

PHARMACOLOGY

TEACHER'S GUIDE SENIOR 4 ASSOCIATE NURSING PROGRAM

First Edition

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FOREWORD

Dear Teacher,

The Rwanda Basic Education Board is pleased to present this Teacher's Guide for the Associate Nursing Program. This guide is designed to support competence-based teaching and ensure consistency in delivering the Pharmacology subject. The Rwandan educational philosophy aims to help student-associate nurses achieve their full potential, preparing them to address community health needs and pursue career opportunities.

To enhance education quality, the government of Rwanda emphasizes the alignment of teaching materials with the syllabus. Effective teaching relies on the relevance of content, pedagogical approaches, assessment strategies, and instructional materials. The guide focuses on activities that promote learning, allowing students to develop ideas and make discoveries.

In a competence-based curriculum, learning involves actively building knowledge and skills through activities, scenarios, and real-life applications. Your role as a teacher includes:

- Planning lessons and preparing teaching materials.
- Organizing group discussions and collaborative learning.
- Engaging students through active learning methods such as inquiry, research, and group work.
- Supporting and facilitating the learning process by valuing student contributions and guiding them towards integrating their findings.

This guide is divided into three parts:

1. Explains the book's structure and provides methodological guidance.
2. Offers sample lesson plans for reference.
3. Provides detailed teaching guidance for each concept in the student book.

Although the guide includes answers to student book activities, please review each question and activity before assessing student responses.

I extend my gratitude to everyone involved in developing this guide, including the Ministry of Health, University of Rwanda, and other institutions. Special thanks go to faculty members, nurses, midwives, teachers, illustrators, designers, Health Workforce development staff/MoH, and REB staff for their dedicated work.

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PART I. GENERAL INTRODUCTION

1.0 About the teacher's guide

This book is a teacher's guide for Pharmacology subject, for senior four in Associate Nursing program. It is designed to accompany student book and intends to help teachers in the implementation of competence based curriculum specifically Pharmacology syllabus.

As the name says, it is a guide that teachers can refer to when preparing their lessons. Teachers may prefer to adopt the guidance provided but they are also expected to be more creative and consider their specific classes' contexts and prepare accordingly.

1.1 The structure of the guide

This section presents the overall structure, the unit and sub-heading structure to help teachers to understand the different sections of this guide and what they will find in each section.

Overall structure

The whole guide has three main parts as follows:

◆ **Part I: General Introduction.**

This part provides general guidance on how to develop the generic competences, how to integrate cross cutting issues, how to cater for students with special educational needs, active methods and Pharmacology and guidance on assessment.

◆ **Part II: Sample lesson plan**

This part provides a sample lesson plan, developed and designed to help the teacher develop their own lesson plans.

◆ **Part III: Unit development**

This is the core part of the guide. Each unit is developed following the structure below. The guide ends with references.

Each unit is made of the following sections:

- **Unit title:** from the syllabus
- **Key unit competence:** from the syllabus
- **Prerequisites (knowledge, skills, attitudes and values)**

This section indicates knowledge, skills and attitudes required for the success of the unit. The competence-based approach calls for connections between units/topics within a subject and interconnections between different subjects.

The teacher will find an indication of those prerequisites and guidance on how to establish connections.

– **Cross-cutting issues to be addressed**

This section suggests cross cutting issues that can be addressed depending on the unit content. It provides guidance on how to come up with the integration of the issue. Note that the issue indicated is a suggestion; teachers are free to take another cross-cutting issue taking into consideration the learning environment.

– **Guidance on the introductory activity**

Each unit starts with an introductory activity in the teacher's book. This section of the teacher's guide provides guidance on how to conduct this activity and related answers. Note that students may not be able to find the right solution but they are invited to predict possible solutions or answers. Solutions are provided by students gradually through discovery activities organized at the beginning of lessons or during the lesson.

– **List of lessons/sub-headings**

This section presents in a table suggestion on the list of lessons, lesson objectives copied or adapted from the syllabus and duration for each lesson. Each lesson / subheading is then developed.

– **End of each unit**

At the end of each unit the teacher provides the following sections:

- Summary of the unit which provides the key points of content developed in the teacher's book.
- Additional information which provides additional content compared to the student book for the teacher to have a deeper understanding of the topic.
- End unit assessment which provides answers to questions of the end unit assessment in the teacher's book and suggests additional questions and related answers to assess the key unit competence.
- Additional activities: (remedial, consolidation and extended activities). The purpose of these activities is to accommodate each student (slow, average and gifted) based on the end of unit assessment results.

Structure of each sub heading

Each lesson/sub-heading is made of the following sections:

Lesson /Sub heading title 1:

– **Prerequisites/Revision/Introduction:**

This section gives a clear instruction to teacher on how to start the lesson.

– **Teaching resources**

This section suggests the teaching aids or other resources needed in line with the activities to achieve the learning objectives. Teachers are encouraged to replace the suggested teaching aids by the available ones in their respective schools and based on learning environment.

– **Learning activities**

This section provides a short description of the methodology and any important aspect to consider. It provides also answers to learning activities with cross reference to student's book.

– **Exercises/application activities**

This provides questions and answers for exercises/ application activities.

1.2 Methodological guidance

1.2.1 Developing competences

Since 2015 Rwanda shifted from a knowledge based to a competence based curriculum for pre-primary, primary and general secondary education. For TTCs, it is in 2019 that the competence based curriculum was embraced. This called for changing the way of learning by shifting from teacher centered to a student centered approach. Teachers are not only responsible for knowledge transfer but also for fostering teacher's learning achievement, and creating safe and supportive learning environment. It implies also that a student has to demonstrate what he/she is able to do using the knowledge, skills, values and attitude acquired in a new or different or given situation.

The competence-based curriculum employs an approach of teaching and learning based on discrete skills rather than dwelling on only knowledge or the cognitive domain of learning. It focuses on what student can do rather than what students know. Students develop basic competences through specific subject unit competences with specific learning objectives broken down into knowledge, skills and attitudes. These competences are developed through learning activities disseminated in student-centered rather than the traditional didactic approach. The students are evaluated against set standards to achieve before moving on. In addition to specific subject competences, students also develop generic competences which are transferable throughout a range of learning areas and situations in life. Below are examples of how generic competences can be developed in Pharmacology:

Generic competence	Examples of activities that develop generic competences
Critical thinking	<ul style="list-style-type: none"> • Describe the relationship and interdependence of sciences • Observe, record, interpret data recorded during experiments • Identify and use pharmacology to solve problems of life and society
Research and Problem solving	<ul style="list-style-type: none"> • Research using internet or books from the library • Design a project for making bioplastics • Design a questionnaire for data collection during field visit
Innovation and creativity	<ul style="list-style-type: none"> • Create an experiment procedure to prove a point • Develop a graph to illustrate information • Design a data collection survey/questionnaire • Conduct experiments with objectives, methodology, observations, results, conclusions • Identify local problems and ways to resolve them
Cooperation, Personal and Interpersonal management and life skills	<ul style="list-style-type: none"> • Work in Pairs • Small group work • Large group work
Communication	<ul style="list-style-type: none"> • Organise and present in writing and verbally a complete and clear report of an experiment • Observe, record, interpret the results of a measurement accurately. • Select and use appropriate formats and presentations, such as tables, graphs and diagrams.
Lifelong learning	<ul style="list-style-type: none"> • Exploit all opportunities available to improve on knowledge and skills. Reading scientific journals to keep updated.

1.2.2. Addressing cross cutting issues

Among the changes in the competence based curriculum is the integration of cross cutting issues as an integral part of the teaching learning process-as they relate to and must be considered within all subjects to be appropriately addressed. The eight cross cutting issues identified in the national curriculum framework are: genocide studies, environment and sustainability, gender, Comprehensive Sexuality Education (CSE), Peace and Values Education, Financial Education, standardization Culture and Inclusive Education.

Some cross cutting issues may seem specific to particular learning areas or subjects but the teacher needs to address all of them whenever an opportunity arises. In addition, student should always be given an opportunity during the learning process to address these cross cutting issues both within and out of the classroom so as to progressively develop related attitudes and values.

Below are examples on how crosscutting issues can be addressed in Pharmacology:

Cross-cutting issues	Examples on how to integrate the cross-cutting issues
Inclusive education	Involve all students in all activities without any bias. E.g.: Allow a student with physical disability (using wheelchair) to take notes or lead the team during an experiment.
Gender	Involve both girls and boys in all activities: No activity is reserved only to girls or boys. Teacher should ensure equal participation of both girls and boys during experiments as well as during cleaning and tidying up related activities after experiments.
Peace and Values Education	During group activities, debates and presentations, the teacher will encourage students to help each other and to respect opinions of colleagues.
Standardization culture	<ul style="list-style-type: none">• Some lessons involve carrying out experiments. Instruction should be clear for students to always check if they are not using expired chemicals or defective apparatus.• In addition, when performing experiments students have to record data accurately.• For tasks involving calculations, they have to always present accurate results.

Environment and sustainability	<ul style="list-style-type: none"> • In order to avoid the environment pollution, before, during or after experiments students avoid throwing away chemicals anywhere; special places or appropriate containers should be used. • Students also have to be aware of the impacts of the use of hydrocarbons as fuels, halogen alkanes, and plastics on the environment.
Financial Education	When performing experiments, students are encouraged to avoid wasting chemicals by using the quantities that are just required. They are required to also avoid spoiling equipment and other materials...

1.2.3. Attention to special educational needs specific to each subject

In the classroom, students learn in different way depending to their learning pace, needs or any other special problem they might have. However, the teacher has the responsibility to know how to adopt his/her methodologies and approaches in order to meet the learning needs of each student in the classroom. Also teacher must understand that students with special needs need to be taught differently or need some accommodations to enhance the learning environment. This will be done depending on the subject and the nature of the lesson.

In order to create a well-rounded learning atmosphere, teacher needs to:

- Remember that students learn in different ways so they have to offer a variety of activities (e.g. role-play, music and singing, word games and quizzes, and outdoor activities).
- Maintain an organized classroom and limits distraction. This will help students with special needs to stay on track during lesson and follow instruction easily.
- Vary the pace of teaching to meet the needs of each student-teacher. Some students process information and learn more slowly than others.
- Break down instructions into smaller, manageable tasks. Students with special needs often have difficulty understanding long-winded or several instructions at once. It is better to use simple, concrete sentences in order to facilitate them understand what you are asking.
- Use clear consistent language to explain the meaning (and demonstrate or show pictures) if you introduce new words or concepts.
- Make full use of facial expressions, gestures and body language.
- Pair a student who has a disability with a friend. Let them do things together and learn from each other. Make sure the friend is not over protective and

does not do everything for the student-teacher. Both students will benefit from this strategy

- Use multi-sensory strategies. As all students learn in different ways, it is important to make every lesson as multi-sensory as possible. Students with learning disabilities might have difficulty in one area, while they might excel in another. For example, use both visual and auditory cues.

Below are general strategies related to each main category of disabilities and how to deal with every situation that may arise in the classroom. However, the list is not exhaustive because each student is unique with different needs and that should be handled differently.

Strategy to help students with developmental impairment:

- Use simple words and sentences when giving instructions.
- Use real objects that the student can feel and handle, rather than just working abstractly with pen and paper.
- Break a task down into small steps or learning objectives. The student should start with an activity that s/he can do already before moving on to something that is more difficult.
- Gradually give the student less help.
- Let the student work in the same group with those without disability.

Strategy to help students with visual impairment:

- Help students to use their other senses (hearing, touch, smell and taste) to play and carry out activities that will promote their learning and development.
- Use simple, clear and consistent language.
- Use tactile objects to help explain a concept.
- If the student has some sight, ask them what they can see. Get information from parents/caregivers on how the student manages their remaining sight at home.
- Make sure the student has a group of friends who are helpful and who allow the students to be as independent as possible.
- Plan activities so that students work in pairs or groups whenever possible.

Strategy to help students with hearing impairment:

- Strategies to help students with hearing disabilities or communication difficulties
- Always get the students attention before you begin to speak.
- Encourage the student to look at your face.
- Use gestures, body language and facial expressions.

- Use pictures and objects as much as possible.
- Ask the parents/caregivers to show you the signs they use at home for communication use the same signs yourself and encourage other students to also use them.
- Keep background noise to a minimum.

Strategies to help children with physical disabilities or mobility difficulties:

- Adapt activities so that student who use wheelchairs or other mobility aids, or other students who have difficulty moving, can participate.
- Ask parents/caregivers to assist with adapting furniture e.g. The height of a table may need to be changed to make it easier for a student to reach it or fit their legs or wheelchair under.
- Encourage peer support friends can help friends.
- Get advice from parents or a health professional about assistive devices.

1.2.4 Guidance on assessment

Each unit in the teacher's guide provides additional activities to help students achieve the key unit competence. Results from assessment inform the teacher which student needs remedial, consolidation or extension activities. These activities are designed to cater for the needs of all categories of students; slow, average and gifted students respectively.

Assessment is an integral part of teaching and learning process. The main purpose of assessment is for improvement. Assessment for learning/ **Continuous/ formative assessment** intends to improve student-teachers' learning and teacher's teaching whereas assessment of learning/summative assessment intends to improve the entire school's performance and education system in general.

Continuous/ formative assessment

It is an ongoing process that arises out of interaction during teaching and learning process. It includes lesson evaluation and end of sub unit assessment. This formative assessment plays a big role in teaching and learning process. The teacher should encourage individual, peer and group evaluation of the work done in the classroom and uses appropriate competence-based assessment approaches and methods.

In Year two textbook, formative assessment principle is applied through application activities that are planned in each lesson to ensure that lesson objectives are achieved before moving on. At the end of each unit, the end unit assessment is formative when it is done to give information on the progress of students and from there decide what adjustments need to be done. Assessment standards are taken into consideration when setting tasks.

Summative assessment

The assessment done at the end of the term, end of year, is considered as summative. The teacher, school and parents are informed on the achievement of educational objectives and think of improvement strategies. There is also end of level/ cycle assessment in form of national examinations.

1.2.5 Student teachers' learning styles and strategies to conduct teaching and learning process

There are different teaching styles and techniques that should be catered for. The selection of teaching method should be done with the greatest care and some of the factors to be considered are: the uniqueness of subjects, the type of lessons, the particular learning objectives to be achieved, the allocated time to achieve the objective, instructional available materials, the physical/sitting arrangement of the classroom, individual student teachers' needs, abilities and learning styles.

There are mainly four different learning styles as explained below:

a) Active and reflective students

Active students tend to retain and understand information best by doing something active with it, discussing or applying it or explaining it to others. Reflective students prefer to think about it quietly first.

b) Sensing and intuitive students

Sensing students tend to like learning facts while intuitive students often prefer discovering possibilities and relationships. Sensors often like solving problems by well-established methods and dislike complications and surprises; intuitive students like innovation and dislike repetition.

c) Visual and verbal students

Visual students remember best what they see (pictures, diagrams, flow charts, time lines, films, demonstrations, etc); verbal students get more out of words (written and spoken explanations).

d) Sequential and global students

Sequential students tend to gain understanding in linear steps, with each step following logically from the previous one. Global students tend to learn in large jumps, absorbing material almost randomly without seeing connections, and then suddenly "getting it."

1.2.6 Teaching methods and techniques that promote the active learning

The different student learning styles mentioned above can be catered for, if the teacher uses active learning whereby students are really engaged in the learning process.

What is Active learning?

Active learning is a pedagogical approach that engages students in doing things and thinking about the things they are doing. In active learning, students are encouraged to bring their own experience and knowledge into the learning process.

The role of the teacher in active learning

- The teacher engages students through active learning methods such as inquiry methods, group discussions, research, investigative activities and group and individual work activities.
- He/she encourages individual, peer and group evaluation of the work done in the classroom and uses appropriate competence-based assessment approaches and methods.
- He provides supervised opportunities for students to develop different competences by giving tasks which enhance critical thinking, problem solving, research, creativity and innovation, communication and cooperation.
- Teacher supports and facilitates the learning process by valuing student-teachers' contributions in the class activities.

The role of students in active learning

Students are key in the active learning process. They are not empty vessels to fill but people with ideas, capacity and skills to build on for effective learning. A student engaged in active learning:

- Communicates and shares relevant information with other students through presentations, discussions, group work and other student-centred activities (role play, case studies, project work, research and investigation)
- Actively participates and takes responsibility for their own learning
- Develops knowledge and skills in active ways
- Carries out research/investigation by consulting print/online documents and resourceful people, and presents their findings
- Ensures the effective contribution of each group member in assigned tasks through clear explanation and arguments, critical thinking, responsibility and confidence in public speaking
- Draws conclusions based on the findings from the learning activities.

Some active techniques that can be used in Pharmacology

The teaching methods strongly emphasised in the competence Based Curriculum (CBC) are active methods. Below are some active techniques that apply in sciences:

A) Practical work/ experiments:

Many of the activities suggested in Pharmacology curriculum as well as in the teacher's book are practical works or experiments.

Practical work is vital in learning pharmacology; this method gives the student the opportunity to implement a series of activities and leads to the development of both cognitive and hands-on skills. The experiments and questions given should target the development of the following skills in student-teachers: observation, recording and report writing, manipulation, measuring, planning and designing.

A practical lesson/Experiment is done in three main stages:

- **Preparation of experiment:** Checking materials to ensure they are available and at good state; try the experiment before the lesson; think of safety rules and give instructions to lab technician if you have any.
- **Performance of experiment:** Sitting or standing arrangement of student-teachers; introduction of the experiment: aims and objectives; setting up the apparatus; performing the experiment; write and record the data.
- **Discussion:** Observations and interpreting data; make generalisations and assignment: writing out the experiment report and further practice and research.

In some cases, demonstration by the teacher is recommended when for example the experiment requires the use of sophisticated materials or very expensive materials or when safety is a major factor like dangerous experiments and it needs specific skills to be learnt first.

In case your school does not have enough laboratory materials and chemicals, experiments can be done in groups but make sure every student participates. You can also make arrangements with the neighbouring science school and take your students there for a number of experiments.

B) Research work

Each student or group of students is given a research topic. They have to gather information from internet, available books in the library or ask experienced people and then the results are presented in verbal or written form and discussed in class.

C) Project work

Pharmacology teachers are encouraged to sample and prepare project works and engage their students in, as many as possible.

Students in groups or individually, are engaged in a self-directed work for an extended period of time to investigate and respond to a complex question, problem, or challenge. The work can be presented to classmates or other people beyond the school. Projects are based on real-world problems that capture students' interest. This technique develops higher order thinking as the students acquire and apply new knowledge in a problem-solving context.

D) Field trip

One of the main aims of teaching Pharmacology in Rwanda is to apply its knowledge for development. To achieve this aim we need to show to students the relationship between classroom science lessons and applied sciences. This helps them see the link between science principles and technological applications.

To be successful, the field visit should be well prepared and well exploited after the visit:

Before the visit, the teacher and student:

- agree on aims and objectives
- gather relevant information prior to visit
- brainstorm on key questions and share responsibilities
- discuss materials needed and other logistical and administrative issues
- discuss and agree on accepted behaviours during the visit
- Visit the area before the trip if possible to familiarise yourself with the place

After the visit

When students come back from trip, the teacher should plan for follow-up. The follow-up should allow students to share experiences and relate them to the prior science knowledge. This can be done in several ways; either: Students write a report individually or in groups and give to the teacher for marking. The teacher then arranges for discussion to explain possible misconceptions and fill gaps. Or students write reports in groups and display them on the class notice board for everyone to read.

Main steps for a lesson in active learning approach

All the principles and characteristics of the active learning process highlighted above are reflected in steps of a lesson as displayed below. Generally, the lesson is divided into three main parts whereby each one is divided into smaller steps to make sure that students are involved in the learning process. Below are those main parts and their small steps:

1) Introduction

Introduction is a part where the teacher makes connection between the current and previous lesson through appropriate technique. The teacher opens short discussions to encourage students to think about the previous learning experience and connect it with the current instructional objective. The teacher reviews the prior knowledge, skills and attitudes which have a link with the new concepts to create good foundation and logical sequencings.

2) Development of the new lesson

The development of a lesson that introduces a new concept will go through the following small steps: discovery activities, presentation of student-teachers' findings, exploitation, synthesis/summary and exercises/application activities, explained below:

◆ Discovery activity

Step 1

- The teacher discusses convincingly with students to take responsibility of their learning
- He/she distributes the task/activity and gives instructions related to the tasks (working in groups, pairs, or individual to instigate collaborative learning, to discover knowledge to be learned)

Step 2

- The teacher let the students work collaboratively on the task.
- During this period the teacher refrains to intervene directly on the knowledge
- He/she then monitors how the students are progressing towards the knowledge to be learned and boost those who are still behind (but without communicating to them the knowledge).

◆ Presentation of student-teachers' productions

- In this episode, the teacher invites representatives of groups to present the student-teachers' productions/findings.
- After three/four or an acceptable number of presentations, the teacher decides to engage the class into exploitation of the student-teachers' productions.

◆ Exploitation of student-teachers' productions

- The teacher asks the students to evaluate the productions: which ones are correct, incomplete or false
- Then the teacher judges the logic of the student-teachers' products, corrects those which are false, completes those which are incomplete, and confirms those which correct.

◆ **Institutionalization (summary/conclusion/ and examples)**

- The teacher summarises the learned knowledge and gives examples which illustrate the learned content.

◆ **Exercises/Application activities**

- Exercises of applying processes and products/objects related to learned unit/sub-unit
- Exercises in real life contexts
- Teacher guides students to make the connection of what they learnt to real life situations. At this level, the role of teacher is to monitor the fixation of process and product/object being learned.

3) Assessment

In this step the teacher asks some questions to assess achievement of instructional objective. During assessment activity, students work individually on the task/activity. The teacher avoids intervening directly. In fact, results from this assessment inform the teacher on next steps for the whole class and individuals. In some cases, the teacher can end with a homework assignment.

PART II SAMPLE LESSON PLAN

Sample lesson

Teacher's Name: School Name:

Term	Date	Subject	Class	Unit No	Lesson No	Duration	Class size
I	18 th October 2021	Pharmacology	S4	1	7 of 19	80 minutes	30 Students
Type of Special Educational Needs and number of students				4 students who have lower vision and hearing problem. They will be encouraged to occupy the front seats in order to see and capture well the content and the gestic will be used for students who have hearing problems			
Topic area		Pharmacology					
Sub-topic area		General Pharmacology					
Unit title		Principles of Pharmacology					
Key Unit Competence		Apply fundamental principles of pharmacology during patient care					
Title of the lesson		Solid drug dosage form					
Plan for this Class (location: in / outside)		In class					
Instructional Objective		Using different images showing different solid drug dosage forms, students S4 will be able to differentiate accurately types of solid dosage forms and their routes of administration.					
Learning Materials		Pharmacology textbooks, a samples of solid drug dosage form, internet connectivity, printed images of drugs, case studies.					
References		Karch (2013). Focus on Nursing Pharmacology, 6th edition. Wolters Kluwer Health Lippincott Williams & Wilkins. Michael Patrick Adams, Leland Norman Holland, Jr, and Carol Quam Urban (2014). Pharmacology for Nurses: A Pathophysiologic Approach. 4th edition. Pearson Education, Inc.					

Timing for each step	Description of teaching and learning activity: The teacher will display different solid dosage forms. The student guided by teacher will observe different solid dosage forms.		Competences and cross cutting issues to be addressed
	Teacher's activities	Student's activities	
1.Introduction: In 5 minutes.	<p>Asking some questions related to solid dosage forms:</p> <ul style="list-style-type: none"> • Ask to the students if they have used medications and the students describe which type of forms they used. • Inform the students that they are learning solid dosage forms. 	<ul style="list-style-type: none"> • Give answers. • Listening how teacher introduce pharmacology and describe solid drug dosage form 	<p>Competences:</p> <ul style="list-style-type: none"> • By differentiating different dosage form and route of administration student will have Critical thinking competence. • Thought responding to the asked questions the student will have Communication competences.
2.Development of the lesson: in 45 minutes			
2.1. Discovery activity	<ul style="list-style-type: none"> • Ask students to form five groups and discuss on the provided image in student textbook (activity 1.7) 	<ul style="list-style-type: none"> • Listen carefully the instructions and share responsibilities. • Students work collaboratively on the task. • Both boys and girls participate actively. 	<p>Competences:</p> <ul style="list-style-type: none"> • cooperation, interpersonal management and life skills: distinguish different types of solid dosage forms; students must share ideas actively in groups.

	<ul style="list-style-type: none"> • Monitor how the students are progressing towards the knowledge, skills and attitudes to be learned and boost those who are still behind (but without communicating to them the knowledge). 		<ul style="list-style-type: none"> • Critical thinking: student differentiate different type of solid dosage form after groups discussion. • Communication: Students discuss collaboratively and share answer questions. • Research and problem solving: Through discussion and research students identify importance of understanding solid drug dosage form.
2.2. Presentation of findings	Invite representatives of groups to presents their findings.	<ul style="list-style-type: none"> • Representatives of groups to presents their findings. • Others follow to the presentation actively and attentively. 	<p>Competence:</p> <ul style="list-style-type: none"> • Communication <p>Cross-cutting issues to be addressed:</p> <ul style="list-style-type: none"> • Gender • Inclusive education
2.3. Exploitation of student's findings	<ul style="list-style-type: none"> • Invite students to evaluate their views: which ones are correct, incomplete or false • Judge the logic of the students' products, corrects those which are false, completes those which are incomplete, and confirms those which correct. 	<ul style="list-style-type: none"> • Give comments on productions. • Follow to the correction of teacher. 	<p>Competence:</p> <ul style="list-style-type: none"> • Through presentation and responding to the questions the students will gain communication competence

			<p>Cross-cutting issues to be addressed:</p> <ul style="list-style-type: none"> • Gender • Inclusive education
<p>3. Conclusion and Assessment: in 30 minutes.</p>	<ul style="list-style-type: none"> • Teacher ask to the students to summarise the learned knowledge and give more clarification on solid dosage forms • Provide the harmonized content • Engage students to work individually on questions of the self-assessment in students' text books 	<ul style="list-style-type: none"> • Participate actively in summarizing the content. • Making short notes. • Do exercises as indicated in students' text books. 	<p>Competences:</p> <ul style="list-style-type: none"> • Through presentation the student gained Listening skills • Through making the note the students gained Writing skills • Through presentation and responding to the questions the students will gain communication competence <p>Competences:</p> <ul style="list-style-type: none"> • Creativity competence will be gained by using different resources to answer to the self-assessment questions. • Lifelong learning competence will be gained during presentation

			<ul style="list-style-type: none"> • Problem solving v competence will be gained during presentation • Critical thinking competence will be gained during presentation
Teacher self-evaluation			

UNIT 1 PRINCIPLES OF PHARMACOLOGY

1.1 Key unit competence

Apply fundamental principles of pharmacology during patient care.

1.2 Prerequisite (knowledge, skills, attitudes and values)

Students were introduced to course of human biology and chemistry. This previously learnt courses will help the students to acquire knowledge and skills related to principles of pharmacology and provide to the students more detailed information to manage patient's conditions.

1.3 Cross-cutting issues to be addressed

a) Inclusive education

This unit involves the need to acquire knowledge and skills to apply the principles of pharmacology and administer drugs according to the standards and special considerations of patient's conditions. To administer the correct prescribed drugs and analysis of each patient's specific condition requires critical thinking, and proper use of the brain. Critical thinking may be challenging for students with mental disabilities, and this requires the teacher to assess the degree of mental disability to the concerned students. Analysis of the teacher will help to assess if the students may be grouped with others who may critically think.

During teaching, ensure that students with special needs are included throughout the course delivery. There may be for example students with visual impairment, hearing impairment or even physical disabilities. For the students with visual impairment, the teacher must ensure that they occupy the front seats in class, and they may be encouraged to report when they can't see well what is written or being presented. In case of class activities, these students may be grouped together with others who have healthy vision, and if there printed activities, ensure to use bigger font sizes. For students with hearing impairment, there is a need to for the teacher to speak loudly, help the students occupy the front seats. The written points help students with visual impairment and speaking aloud helps students with hearing impairment Remember to repeat the main points of the lessons. Finally, for the students with physical disability, the teacher needs to help them occupy the seats that make them comfortable.

b) Gender education

Emphasize to students that anybody irrespective of their gender can present and report during group activities. Give examples of famous people who are successful in real life without considering their gender. Make sure that during different class activities, both boys and girls share and participate equally in all activities. Bear in mind that they all have equal role in the smooth running of the class, and that the leaders of the class or group activities may be of either female or male gender.

c) Environment and sustainability

Students get basic knowledge from the natural sciences, so introductory to biodiversity is essential, and the students should be encouraged to maintain the biodiversity to keep the world safe. They also get skills and attitudes that will enable them in their everyday life to address the environment and climate change issues and to have a sustainable livelihood. Help the students to know maximum skills and attitudes on the environmental sustainability and to be responsible in caring for students' environment.

1.4 Guidance on the introductory activity

This introductory activity is intended to:

- Motivate the students to learn about principles of pharmacology
- Stimulate the students to search more information on drugs
- To rise the curiosity on the content to cover as it relates to principles of pharmacology
- Build on previous knowledge, skills, values, and attitudes to help the teacher to assess the student's prior knowledge and help to link with the new content that is related to principles of pharmacology.

The progress in the learning is gradual. At this point, there are no right or wrong answers as students will gradually get more appropriate answers progressively as they go through the unit.

Teacher's activities:

- Ask the students to form the 5 groups (6 students each group)
- Engage the students with introductory activity and give clear instructions related to the activity (students observe the images and provide the answers to the questions provided in introductory activity)
- Ask any 2 students to present their findings after reading, while others are following, the teacher will be providing the guidance as needed.
- During grouping or pairing, there is a need to ensure that students with different levels of knowledge and understanding are mixed.
- The teacher also has a responsibility to help students with different problems.

Possible answers for the Introductory Activity 1.0: refer to the student's book

1. What do you observe on these images? **The expected Answers are:**
 - A person made in drug taking drug, tablet by oral route
 - A person writing on the paper (medical prescription)
 - A person arranging different form of medication (tablet, capsule, eye drops etc.
 - Nurse and patient, the nurse is counting the drugs/medications and the patient is sitting waiting to receive the medication
 - A person who have head pain receiving drug from someone.
 - A child sleeping and taking oral drug from someone using syringe,
 - A child sitting and the nurse wearing uniform with stethoscope, worn gloves and she have syringe containing medication and is going to give injection to the child.
 - Someone sleeping on the floor with drug in hand and the other on floor (showing that the patient have taken too much medication and become unconscious
2. When you take a drug what is your intention?
3. **The expected Answer:** To become well, to return to school,
4. Based on medicine you have received in hospital; do you think there are no other form of medication are not on these images?
5. **The expected Answer:** yes, syrup, serum (perfusion), cream, powder, aerosols etc.
6. In your family, if someone is sick tell us how patient can take medication?
7. **The expected Answer:** The patient can take the medication by oral route with water, application on the skin, injection, instillation in eye/ears, insertion in anus,
8. What precaution the nurse has to take when is going to administer the medication to the client?
9. **The expected Answer:** The nurse have to ask the patient names, to know the drug, dose, the route of drug administration, time, check well the prescription and ask to the client if he/ she had developed allergy to drug previously, to know if the client is pregnant or not, to know if the drug to administer was not expired.

Students may give different ideas on the expectations from the unit. Get all the answers from some students, and congratulate them for the ideas provided. You then help them to get oriented on the main content to cover in the unit.

1.5 List of lessons

Content/lesson	Learning objectives	Numbers of periods
1. History of pharmacology	<ul style="list-style-type: none"> Identify the key event for history of pharmacology 	2
2. key concept used in Pharmacology	<ul style="list-style-type: none"> Explain the key concepts used in pharmacology Recognize the common terminology used in pharmacology 	1
3. Chemical drug name	<ul style="list-style-type: none"> Identify type of drugs name (chemical, generic and trade names) Describe chemical name 	1
4. Generic drug name	<ul style="list-style-type: none"> Describe generic name 	1
5. Trade drug name	<ul style="list-style-type: none"> Describe trade name 	1
6. Label of drug container	<ul style="list-style-type: none"> Interpret the drug label container before medication use. 	2
7. Solid drug dosage forms	<ul style="list-style-type: none"> Describe solid drug dosage form 	2
8. Semiliquid drug dosage form	<ul style="list-style-type: none"> Describe liquid drug dosage form 	2
9. Liquid drug dosage forms	<ul style="list-style-type: none"> Describe semiliquid drug dosage form 	2
10. Gaseous drug dosage form	<ul style="list-style-type: none"> Describe gaseous drug dosage form 	2
11. Doses and drug regimen <ul style="list-style-type: none"> Loading doses Maintenance doses, 	<ul style="list-style-type: none"> Describe the importance of dose and drug regimen Recognize the importance of loading dose and maintenance dose 	2

12. Fixed dose combination,	• Explain Fixed dose combination	2
	• Recognize the importance of Fixed dose combination	
13. Directly observed therapy	• Explain Directly observed therapy	2
	• Recognize the importance of Directly observed therapy	
14. Therapeutic effects,	• Explain the drug therapy effects	2
15. Sides effect,	• Describe the side effect	2
16. Adverse drug reactions, • Allergic reaction (hypersensitivity)	• Describe adverse drug reactions	2
	• Explain the role of the nurse if the patient develop adverse drug reactions	
17. Antidotes	• Explain the term antidotes in drug therapy	2
18. Responsibilities of nurses regarding safe drug administration	• Understand the roles and responsibilities of nurses in anti-infective drug therapy	2
19. Food and Drug Administration (FDA) pregnancy risk categories during drug therapy for pregnant women	Recognize the Food and Drug Administration (FDA) pregnancy risk categories during drug therapy for pregnant women	2
20. End unit assessment		2

Lesson 1: History of pharmacology

a) Learning objectives:

By the end of the session, the students should be able to:

- Define correctly the terms ‘pharmacology and drug’
- Identify the key events for history of pharmacology

b) Prerequisites/Revision/Introduction:

This is the first lesson of the first unit Principles of pharmacology. In this lesson you will be dealing with **history of pharmacology**. The first thing to do before starting teaching is to remind students that they have learnt about biology, especially introduction to antibiotics and chemistry, and let them discuss the meaning of pharmacology so that they can prepare themselves for this lesson.

Use K-W-L (What students already know-What they want to know-What they have learnt) after the introductory activity to assess how much students already know and what they would be interested in learning about **history of pharmacology**.

c) Teaching resources:

They included: Pharmacology books, S4 pharmacology book guide for students, internet connectivity, projector, markers, chalks, and any other trustworthy and reliable resources to enhance learning.

d) Possible methods:

Pair share, small group discussion, brainstorming, short class presentation, research in the library textbooks or on the internet.

e) Learning activities 1.1 History of pharmacology

Teachers’ activities:

- Ask students to do in small groups, pairs activity 1.1 in their student books.
- Provide to the students the necessary materials or guide them where they can get the materials.
- Move around in silence to monitor if they are having some problems. In case of small groups, ensure that the gender considerations are considered, and none is excluded based on gender.
- Remember to assist those who are weak but without giving them the knowledge.
- Invite randomly some students to present their findings to the rest of students.
- Ask other students to carefully follow the presentations.
- Those who are not acting may have to listen attentively without disturbing and should applaud the actors after.

- Note on chalk board / Manila paper or flip chart the student's ideas.
- Tick the correct findings and correct those ones which are incorrect and try again to complete those which are incomplete.
- Students may still have few things that are not clear. Answer or address any questions or challenges about the activity. Guide them to make notes in their notebooks referring to students' book.
- Harmonize and conclude on the learned knowledge.

Student's role:

- Work in small groups on the activity 1.1 as it appears in the student books.
- Use the materials and resources provided by the teacher to give answers to the activity.
- Attempt all the questions ensuring that participation of each member is obvious.
- Assist one another as they may have different levels of understanding.
- Selected members present the findings of the activity to the rest of students.
- Other students follow carefully the presentation of the findings.
- Those who are not presenting have to listen attentively without disturbing and should applaud their colleagues after presentation.
- Ask for more clarifications from the teacher and take notes in their notebooks.

Answers for learning activity 1.1

1. The major sources of drugs can be grouped into the following: Plant, animal, mineral, marine, synthetic/chemical derivative, Semi-synthetic, Microbiological and Recombinant DNA technology/ Biosynthetic
2. Drugs are substances that are used or intended to be used in the diagnosis, prevention, treatment or cure of disease

Expected answers for self-assessment activity 1.1

1. The exact date on the use of the drug is unknown
2. The sources of medications are: plant, animal, mineral, marine, synthetic/chemical derivative, Semi-synthetic, Microbiological and Recombinant DNA technology/ Biosynthetic sources.
3. It is Frederick Serturmer who first isolated morphine from opium in 1805
4. John Jacob Abel is considered as the father of American pharmacology

Lesson 2: Key concept used in Pharmacology

a) Learning objectives

By the end of this session, the students should be able to:

- Explain the key concepts used in pharmacology
- Recognize the common terminology used in pharmacology

b) Prerequisites/Revision/Introduction

Read the Key unit competence in the syllabus to determine what students will learn and be able to do by the end of the unit. Look at the action verb, concept, and context of each learning objective. This will help you to see the skills, knowledge and attitudes embedded in the learning objective. Remember the learning objectives are linked to the key unit competence.

Use K-W-L (What students already know-What they want to know-What they have learnt) after the previous activity to assess how much students already know and what they would be interested in learning about **key concept used in Pharmacology**.

c) Teaching resources

Basic materials for a class/lesson to be conducted: student's books, internet connectivity, books or magazines, projector, markers, flipchart, chalks, and any other trustworthy and reliable resources to enhance learning.

d) Possible methods

Think-pair-share, small group discussion, brainstorming, short class presentation, research in the library textbooks or on the internet.

Before the lesson, review the learning objective to determine what students will know and be able to do by the end of the lesson. This will help you to see the skills, knowledge, and attitudes embedded in the learning objective and prepare for your lesson appropriately. Remember the learning objectives link to the key unit competence.

Ensure a conducive learning environment and lead a review of the previous lesson on pharmacology history, handle any homework or assignments. Help students link the previous lesson to the current lesson using an appropriate discovery activity.

e) Learning activities 1.2: key concept used in Pharmacology

Teacher's activities:

- Ask students to do individually activity 1.2 in their student books.
- Provide to the students the necessary materials or guide them where they can get the materials.

- Move around in silence to monitor if they are having some problems. In case of small groups, ensure that the gender considerations are considered, and none is excluded based on gender.
- Remember to assist those who are weak but without giving them the knowledge.
- Invite randomly four students to present their findings to the rest of students.
- Ask other students to carefully follow the presentations.
- Those who are not acting may have to listen attentively without disturbing and should applaud the actors after.
- Note on chalk board / Manila paper or flip chart the student's ideas.
- Tick the correct findings and correct those ones which are incorrect and try again to complete those which are incomplete.
- Students may still have few things that are not still clear. Answer or address any questions or challenges about the activity. Guide them to make notes in their books referring to students' book.
- Harmonize and conclude on the learned knowledge.

Student's role:

- Work in small groups on the activity 1.2 as it appears in the student books.
- Use the materials and resources provided by the teacher to give answers to the activity.
- Attempt all the questions ensuring that participation of each member is obvious.
- Assist one another as they may have different levels of understanding.
- Selected members present the findings of the activity to the rest of students.
- Other students follow carefully the presentation of the findings.
- Those who are not presenting have to listen attentively without disturbing and should applaud their colleagues after presentation.
- Ask for more clarifications from the teacher and take notes in their notebooks.

Answers for learning activity 1.2

1. **Pharmacology:** The word pharmacology is derived from two Greek words, “**pharmakon**”, which means **medicine or drug**, and logos, which means study. It is the study of medicines. It includes the study of how drugs are administered and how the body responds (Adams at all 2014). It can be also defined as the study of drugs and their interactions with living systems.
2. **Clinical pharmacology:** is defined as the study of drugs in humans.

- 3. Drugs:** chemicals that are introduced into the body to bring about some sort of change.
- 4. Adverse drug reaction:** Any unexpected, unintended, undesired, or excessive response to a medication given at therapeutic dosages
- 5. Therapeutic effect:** The desired or intended effect of a particular medication.

Answers for Self-assessment 1.2

- 1. Pharmacognosy:** The study of drugs that are obtained from natural plant and animal sources.
- 2. Therapeutic index:** The ratio between the toxic and therapeutic concentrations of a drug.
- 3. Tolerance:** Reduced response to a drug after prolonged use.

Lesson 3: Chemical drug name

a) Learning objectives

By the end of this session, the students should be able to:

- Describe chemical name

b) Prerequisites/Revision/Introduction

Read the Key unit competence in the syllabus to determine what students will learn and be able to do by the end of the unit. Look at the action verb, concept, and context of each learning objective. This will help you to see the skills, knowledge and attitudes embedded in the learning objective. Remember the learning objectives are linked to the key unit competence.

Use K-W-L (What students already know-What they want to know-What they have learnt) after the previous activity to assess how much students already know and what they would be interested in learning about Chemical drug name

c) Teaching resources

Students' textbooks, internet connectivity, books or magazines, projector, markers, flipchart, chalks, and any other trustworthy and reliable resources to enhance learning.

d) Possible methods

Think-pair-share, small group discussion, brainstorming, short class presentation, research in the library textbooks or on the internet.

Before the lesson, review the learning objective to determine what students will know and be able to do by the end of the lesson.

This will help you to see the skills, knowledge, and attitudes embedded in the learning objective and prepare for your lesson appropriately. Remember the learning objectives link to the key unit competence. Ensure a conducive learning environment and lead a review of the previous lesson on key concept used in Pharmacology, handle any homework or assignments. Help students link the previous lesson to the current lesson using an appropriate discovery activity.

e) Learning activities 1.3

Teacher's activities:

- Ask students to do in pairs activity 1.3 in their student books.
- Provide to the students the necessary materials or guide them where they can get the materials.
- Move around in silence to monitor if they are having some problems. In case of small groups, ensure that the gender considerations are considered, and none is excluded based on gender.
- Remember to assist those who are weak but without giving them the knowledge.
- Invite randomly four students to present their findings to the rest of students.
- Ask other students to carefully follow the presentations.
- Those who are not acting may have to listen attentively without disturbing and should applaud the actors after.
- Note on chalk board / Manila paper or flip chart the student's ideas.
- Tick the correct findings and correct those ones which are incorrect and try again to complete those which are incomplete.
- Students may still have few things that are not still clear. Answer or address any questions or challenges about the activity. Guide them to make notes in their books referring to students' book.
- Harmonize and conclude on the learned knowledge.

Student's role:

- Work in pairs on the activity 1.3 as it appears in the student books.
- Use the materials and resources provided by the teacher to give answers to the activity.
- Attempt all the questions ensuring that participation of each member is obvious.
- Assist one another as they may have different levels of understanding.
- Selected members present the findings of the activity to the rest of students.
- Other students follow carefully the presentation of the findings.

- Those who are not presenting have to listen attentively without disturbing and should applaud their colleagues after presentation.
- Ask for more clarifications from the teacher and take notes in their notebooks.

Answers for learning activity 1.3

The chemical names are the scientific names, based on the molecular structure of the drug.

Answers for Self-assessment activity 1.3

1. (A) N-acetyl-p-aminophenol
2. A drug has only one chemical name
3. lithium carbonate, calcium gluconate, and sodium chloride.

Lesson 4: Generic drug name

a) Learning objectives

By the end of this session, the students should be able to describe generic name

b) Prerequisites/Revision/Introduction

Human biology and chemistry, history of pharmacology, and sources of drugs.

Use K-W-L (What students already know-What they want to know-What they have learnt) after the previous activity to assess how much students already know and what they would be interested in learning about **Generic drug name**

c) Teaching resources

Students' books, internet connectivity, books or magazines, projector, markers, flipchart, chalks, and any other trustworthy and reliable resources to enhance learning.

d) Possible methods

Think-pair-share, small group discussion, brainstorming, short class presentation, research in the library textbooks or on the internet.

e) Learning activities 1.4 Generic name

Teacher's activities:

- Ask students to do in small groups, activity 1.4 in their student books.
- Provide to the students the necessary materials or guide them where they can get the materials.

- Move around in silence to monitor if they are having some problems. In case of small groups, ensure that the gender considerations are considered, and none is excluded based on gender.
- Remember to assist those who are weak but without giving them the knowledge.
- Invite randomly four students to present their findings to the rest of students.
- Ask other students to carefully follow the presentations.
- Those who are not acting may have to listen attentively without disturbing and should applaud the actors after.
- Note on chalk board / Manila paper or flip chart the student's ideas.
- Tick the correct findings and correct those ones which are incorrect and try again to complete those which are incomplete.
- Students may still have few things that are not still clear. Answer or address any questions or challenges about the activity. Guide them to make notes in their books referring to students' book.
- Harmonize and conclude on the learned knowledge.

Student's role:

- Work in small groups on the activity 1.4 as it appears in the student books.
- Use the materials and resources provided by the teacher to give answers to the activity.
- Attempt all the questions ensuring that participation of each member is obvious.
- Assist one another as they may have different levels of understanding.
- Selected members present the findings of the activity to the rest of students.
- Other students follow carefully the presentation of the findings.
- Those who are not presenting have to listen attentively without disturbing and should applaud their colleagues after presentation.
- Ask for more clarifications from the teacher and take notes in their notebooks.

Answers for learning activity 1.4

1. The generic name is simpler name, less complicated and easier to remember than chemical names. It may be used in any country and by any manufacturer. The first letter of the generic name is not capitalized.

Answers for Self-assessment 1.4

1. aspirin is a generic name
2. b) ibuprofen
3. a) bioequivalence
4. c) the rate and extend to which the active ingredient is absorbed

Lesson 5: Trade drug name

a) Learning objectives

By the end of this session, the students should be able to describe trade name.

b) Prerequisites/Revision/Introduction

Read the Key unit competence in the syllabus to determine what students will learn and be able to do by the end of the unit. Look at the action verb, concept, and context of each learning objective. This will help you to see the skills, knowledge and attitudes embedded in the learning objective. Remember the learning objectives are linked to the key unit competence.

Use K-W-L (What students already know-What they want to know-What they have learnt) after the previous activity to assess how much students already know and what they would be interested in learning about trade name. The first thing to do before starting teaching is to remind students that they have learnt about generic drug name and make a brief recall about the previous session.

c) Teaching resources

Basic materials for a class/lesson to be conducted: students' books, internet connectivity, books or magazines, projector, markers, flipchart, marker, chalks, and any other trustworthy and reliable resources to enhance learning.

d) Possible methods

Think-pair-share, small group discussion, brainstorming, short class presentation, research in the library textbooks or on the internet.

Before the lesson, review the learning objective to determine what students will know and be able to do by the end of the lesson. This will help you to see the skills, knowledge, and attitudes embedded in the learning objective and prepare for your lesson appropriately. Remember the learning objectives link to the key unit competence. Ensure a conducive learning environment and lead a review of the previous lesson on Generic drug name, handle any homework or assignments. Help students link the previous lesson to the current lesson using an appropriate discovery activity.

e) Learning activities 1.5: Drug Trade name

Teacher's activities:

- Ask students to do in small groups activity 1.5 in their student books.
- Provide to the students the necessary materials or guide them where they can get the materials.
- Move around in silence to monitor if they are having some problems. In case of small groups, ensure that the gender considerations are considered, and none is excluded based on gender.
- Remember to assist those who are weak but without giving them the knowledge.
- Invite randomly four students to present their findings to the rest of students.
- Ask other students to carefully follow the presentations.
- Those who are not acting may have to listen attentively without disturbing and should applaud the actors after.
- Note on chalk board / Manila paper or flip chart the student's ideas.
- Tick the correct findings and correct those ones which are incorrect and try again to complete those which are incomplete.
- Students may still have few things that are not still clear. Answer or address any questions or challenges about the activity. Guide them to make notes in their books referring to students' book.
- Harmonize and conclude on the learned knowledge.

Student's role:

- Work in small groups on the activity 1.5 as it appears in the student books.
- Use the materials and resources provided by the teacher to give answers to the activity.
- Attempt all the questions ensuring that participation of each member is obvious.
- Assist one another as they may have different levels of understanding.
- Selected members present the findings of the activity to the rest of students.
- Other students follow carefully the presentation of the findings.
- Those who are not presenting have to listen attentively without disturbing and should applaud their colleagues after presentation.
- Ask for more clarifications from the teacher and take notes in their notebooks.

Answers for learning activity 1.5

A drug's trade name, sometimes called the proprietary, product, or brand name, is assigned by the pharmaceutical company marketing the drug and it is followed by the symbol ®.

Answers for Self-assessment 1.5

1. B. N-acetyl-p-aminophenol
2. This symbol indicates that the name is registered and that the use of the name is restricted to the owner of the drug, which is usually the manufacturer.

Lesson 6: Label of drug container

a) Learning objectives

By the end of this session, the students should be able to interpret the drug label container before medication use.

b) Prerequisites/Revision/Introduction

Read the Key unit competence in the syllabus to determine what students will learn and be able to do by the end of the unit. Look at the action verb, concept, and context of each learning objective. This will help you to see the skills, knowledge and attitudes embedded in the learning objective. Remember the learning objectives are linked to the key unit competence.

Use K-W-L (What students already know-What they want to know-What they have learnt) after the previous activity to assess how much students already know and what they would be interested in learning about Label of drug container. The first thing to do before starting teaching is to remind students that they have learnt about drug names and make a brief recall about the previous session.

c) Teaching resources

Basic materials for a class/lesson to be conducted: students' books, internet connectivity, books or magazines, projector, markers, flipchart, sample of drug labels container, chalks, and any other trustworthy and reliable resources to enhance learning.

d) Possible methods

Think-pair-share, small group discussion, brainstorming, short class presentation, research in the library textbooks or on the internet.

Before the lesson, review the learning objective to determine what students will know and be able to do by the end of the lesson.

This will help you to see the skills, knowledge, and attitudes embedded in the learning objective and prepare for your lesson appropriately. Remember the learning objectives link to the key unit competence. Ensure a conducive learning environment and lead a review of the previous lesson on drugs names, handle any homework or assignments. Help students link the previous lesson to the current lesson using an appropriate discovery activity.

e) Learning activities 1.6: Label of drug container

Teacher's activities:

- Ask students to do in small groups activity 1.6 in their student books.
- Provide to the students the necessary materials or guide them where they can get the materials.
- Move around in silence to monitor if they are having some problems. In case of small groups, ensure that the gender considerations are considered, and none is excluded based on gender.
- Remember to assist those who are weak but without giving them the knowledge.
- Invite randomly four students to present their findings to the rest of students.
- Ask other students to carefully follow the presentations.
- Those who are not acting may have to listen attentively without disturbing and should applaud the actors after.
- Note on chalk board / Manila paper or flip chart the student's ideas.
- Tick the correct findings and correct those ones which are incorrect and try again to complete those which are incomplete.
- Students may still have few things that are not still clear. Answer or address any questions or challenges about the activity. Guide them to make notes in their books referring to students' book.
- Harmonize and conclude on the learned knowledge.

Student's role:

- Work in small groups on the activity 1.6 as it appears in the student books.
- Use the materials and resources provided by the teacher to give answers to the activity.
- Attempt all the questions ensuring that participation of each member is obvious.
- Assist one another as they may have different levels of understanding.
- Selected members present the findings of the activity to the rest of students.
- Other students follow carefully the presentation of the findings.

- Those who are not presenting have to listen attentively without disturbing and should applaud their colleagues after presentation.
- Ask for more clarifications from the teacher and take notes in their notebooks.

Answers for learning activity 1.6

1. I observe the nurse and patient in pharmacy, the nurse and the patient are reading together information written on the bottle and also there is a box which is labelled outside (TG, General, ibuprofen etc.) and the justifications of each label on the box.
2. It help to know the name and active ingredient of medication, date of expiration, concentration of medication, numbers of content inside the container, Warning information and information showing that the medication is accepted. All this information will help to administer to the client the correct drugs.

Answers for Self-assessment activity 1.6

1. The name and active ingredient of medication, Date of fabrications and expiration, concentration of medication, numbers of content inside the container, Warning information and information showing that the medication is accepted, Manufacturer name.
2. Drug label is a standardized label that appears on all over-the-counter (OTC) medicines approved by the Food and Drug Administration, it have specific information that identifies a specific drug.
3. The nurse will not administer the drug until he/she receive clear information.

Lesson 7: Solid drug dosage forms

a) Learning objectives

By the end of this session, the students should be able to describe solid drug dosage form.

b) Prerequisites/Revision/Introduction

Read the Key unit competence in the syllabus to determine what students will learn and be able to do by the end of the unit. Look at the action verb, concept, and context of each learning objective. This will help you to see the skills, knowledge and attitudes embedded in the learning objective. Remember the learning objectives are linked to the key unit competence.

Use K-W-L (What students already know-What they want to know-What they have learnt) after the previous activity to assess how much students already know and what they would be interested in learning about **solid drug dosage forms**, as one of the drugs forms.

The first thing to do before starting teaching is to remind students that they have learnt about **Label of drug container** and make a brief recall about the previous session.

c) Teaching resources

Basic materials for a class/lesson to be conducted: students' books, internet connectivity, books or magazines, projector, markers, flipchart, sample of the solid drug dosage form, chalks, and any other trustworthy and reliable resources to enhance learning.

d) Possible methods

Think-pair-share, small group discussion, brainstorming, short class presentation, research in the library textbooks or on the internet.

Before the lesson, review the learning objective to determine what students will know and be able to do by the end of the lesson. This will help you to see the skills, knowledge, and attitudes embedded in the learning objective and prepare for your lesson appropriately. Remember the learning objectives link to the key unit competence. Ensure a conducive learning environment and lead a review of the previous lesson on classes of Label of drug container, handle any homework or assignments. Help students link the previous lesson to the current lesson using an appropriate discovery activity.

e) Learning activities 1.7

Teacher's activities:

- Ask students to do individually activity 1.7 in their student books.
- Provide to the students the necessary materials or guide them where they can get the materials.
- Move around in silence to monitor if they are having some problems. In case of small groups, ensure that the gender considerations are considered, and none is excluded based on gender.
- Remember to assist those who are weak but without giving them the knowledge.
- Invite randomly four students to present their findings to the rest of students.
- Ask other students to carefully follow the presentations.
- Those who are not acting may have to listen attentively without disturbing and should applaud the actors after.
- Note on chalk board / Manila paper or flip chart the student's ideas.
- Tick the correct findings and correct those ones which are incorrect and try again to complete those which are incomplete.

- Students may still have few things that are not still clear. Answer or address any questions or challenges about the activity. Guide them to make notes in their books referring to students' book.
- Harmonize and conclude on the learned knowledge.

Student's role:

- Work in small groups on the activity 1.7 as it appears in the student books.
- Use the materials and resources provided by the teacher to give answers to the activity.
- Attempt all the questions ensuring that participation of each member is obvious.
- Assist one another as they may have different levels of understanding.
- Selected members present the findings of the activity to the rest of students.
- Other students follow carefully the presentation of the findings.
- Those who are not presenting have to listen attentively without disturbing and should applaud their colleagues after presentation.
- Ask for more clarifications from the teacher and take notes in their notebooks.

Answers for learning activity 1.7

1. I observe on the image different types of solid dosage within including tablets, capsule, granules etc. These drugs are in different form.
2. Yes, the powder form
3. It important for nurses to know different type of solid drug dosage form as the nurse is the one who administer the drug, knowing different solid dosage form will help the nurse to administer to the patient the correct drug in correct route and also the nurse can predict when effect of drug happen.

Answers for Self-assessment 1.7

1. Tablets, capsules, buccal tablets, sublingual tablets, effervescent tablet, granules, troches, lozenges, solutions, suspension, emulsion, elixir, buccal sprays.
2. C) Effervescent
3. A) gelatine

Lesson 8: Semiliquid drug dosage form

a) Learning objectives

By the end of this session, the students should be able to describe semiliquid drug dosage form.

b) Prerequisites/Revision/Introduction

Read the Key unit competence in the syllabus to determine what students will learn and be able to do by the end of the unit. Look at the action verb, concept, and context of each learning objective. This will help you to see the skills, knowledge and attitudes embedded in the learning objective. Remember the learning objectives are linked to the key unit competence.

Use K-W-L (What students already know-What they want to know-What they have learnt) after the previous activity to assess how much students already know and what they would be interested in learning about Semiliquid drug dosage form, as one of the forms of drugs. The first thing to do before starting teaching is to remind students that they have learnt about solid drug dosage forms, and make a brief recall about the previous session.

c) Teaching resources

Basic materials for a class/lesson to be conducted: students' textbooks, internet connectivity, books or magazines, projector, markers, flipchart, sample of semiliquid drug form, chalks, and any other trustworthy and reliable resources to enhance learning.

d) Possible methods

Think-pair-share, small group discussion, brainstorming, short class presentation, research in the library textbooks or on the internet.

Before the lesson, review the learning objective to determine what students will know and be able to do by the end of the lesson. This will help you to see the skills, knowledge, and attitudes embedded in the learning objective and prepare for your lesson appropriately. Remember the learning objectives link to the key unit competence. Ensure a conducive learning environment and lead a review of the previous lesson on solid drug dosage forms, handle any homework or assignments. Help students link the previous lesson to the current lesson using an appropriate discovery activity.

e) Learning activities 1.8: Semisolid drug dosage form

Teacher's activities:

- Ask students to do individually (or in small groups, pairs) activity 1.8 in their student books.

- Provide to the students the necessary materials or guide them where they can get the materials.
- Move around in silence to monitor if they are having some problems. In case of small groups, ensure that the gender considerations are considered, and none is excluded based on gender.
- Remember to assist those who are weak but without giving them the knowledge.
- Invite randomly four students to present their findings to the rest of students.
- Ask other students to carefully follow the presentations.
- Those who are not acting may have to listen attentively without disturbing and should applaud the actors after.
- Note on chalk board / Manila paper or flip chart the student's ideas.
- Tick the correct findings and correct those ones which are incorrect and try again to complete those which are incomplete.
- Students may still have few things that are not still clear. Answer or address any questions or challenges about the activity. Guide them to make notes in their books referring to students' book.
- Harmonize and conclude on the learned knowledge.

Student's role:

- Work in small groups on the activity 1.8 as it appears in the student books.
- Use the materials and resources provided by the teacher to give answers to the activity.
- Attempt all the questions ensuring that participation of each member is obvious.
- Assist one another as they may have different levels of understanding.
- Selected members present the findings of the activity to the rest of students.
- Other students follow carefully the presentation of the findings.
- Those who are not presenting have to listen attentively without disturbing and should applaud their colleagues after presentation.
- Ask for more clarifications from the teacher and take notes in their notebooks.

Answers for learning activity 1.8

1. I observe image which contain different forms of semisolid drug dosage forms including creams, gels, ointments, pastes, suppository or patch
2. No other form of semisolid dosage form

3. It is important for nurses to know different types of semisolid drug dosage forms as the nurse is the one who administers the drug, knowing different semisolid dosage forms will help the nurse to administer to the patient the correct drug in the correct route and also the nurse can predict when the effect of the drug happens.

Answers for Self-assessment 1.8

1. The semisolid drug dosage forms are: creams, gels, ointments, pastes, suppository or patch
2. d) suspension
3. a) paste

Lesson 9: Liquid drug dosage forms

a) Learning objectives

By the end of this session, the students should be able to describe liquid drug dosage forms.

b) Prerequisites/Revision/Introduction

Read the Key unit competence in the syllabus to determine what students will learn and be able to do by the end of the unit. Look at the action verb, concept, and context of each learning objective. This will help you to see the skills, knowledge and attitudes embedded in the learning objective. Remember the learning objectives are linked to the key unit competence.

Use K-W-L (What students already know-What they want to know-What they have learnt) after the previous activity to assess how much students already know and what they would be interested in learning about **Liquid drug dosage forms**, as one of **drugs forms**. The first thing to do before starting teaching is to remind students that they have learnt about **Semisolid drug dosage forms** and make a brief recall about the previous session.

c) Teaching resources

Basic materials for a class/lesson to be conducted: students' books, internet connectivity, books or magazines, projector, markers, flipchart, sample of liquid drugs, chalks, and any other trustworthy and reliable resources to enhance learning.

d) Possible methods

Think-pair-share, small group discussion, brainstorming, short class presentation, research in the library textbooks or on the internet.

Before the lesson, review the learning objective to determine what students will know and be able to do by the end of the lesson.

This will help you to see the skills, knowledge, and attitudes embedded in the learning objective and prepare for your lesson appropriately. Remember the learning objectives link to the key unit competence. Ensure a conducive learning environment and lead a review of the previous lesson on **semisolid drug dosage forms**, handle any homework or assignments. Help students link the previous lesson to the current lesson using an appropriate discovery activity.

e) Learning activities 1.9:

Teacher's activities:

- Ask students to do individually activity 1.9 in their student books.
- Provide to the students the necessary materials or guide them where they can get the materials.
- Move around in silence to monitor if they are having some problems. In case of small groups, ensure that the gender considerations are considered, and none is excluded based on gender.
- Remember to assist those who are weak but without giving them the knowledge.
- Invite randomly four students to present their findings to the rest of students.
- Ask other students to carefully follow the presentations.
- Those who are not acting may have to listen attentively without disturbing and should applaud the actors after.
- Note on chalk board / Manila paper or flip chart the student's ideas.
- Tick the correct findings and correct those ones which are incorrect and try again to complete those which are incomplete.
- Students may still have few things that are not still clear. Answer or address any questions or challenges about the activity. Guide them to make notes in their books referring to students' book.
- Harmonize and conclude on the learned knowledge.

Student's role:

- Work individually on the activity 1.9 as it appears in the student books.
- Use the materials and resources provided by the teacher to give answers to the activity.
- Attempt all the questions ensuring that participation of each member is obvious.
- Assist one another as they may have different levels of understanding.
- Selected members present the findings of the activity to the rest of students.
- Other students follow carefully the presentation of the findings.

- Those who are not presenting have to listen attentively without disturbing and should applaud their colleagues after presentation.
- Ask for more clarifications from the teacher and take notes in their notebooks.

Answers for learning activity 1.9

1. I observe image which contain different forms of liquid drug dosage forms including Syrup, Suspension, Elixir, Emulsion, Tincture, Eye, Ear and Nose Drops, Mouth washes solution, Enema, Douche solution, Liniment and Medications for injection
2. Perfusion,
3. It important for nurses to know different type of liquid drug dosage form as the nurse is the one who administer the drug, knowing different liquid dosage form will help the nurse to administer to the patient the correct drug in correct route and also the nurse can predict when the effect of drug will happen after administration.

Answers for Self-assessment 1.9

1. Suspension is liquid form of medication that must be shaken well before administration because the medicine particles settle at the bottom of the bottle. The medicine is not evenly dissolved in the liquid (hydrophobic agents) while Emulsion is a pharmaceutical preparation in which two agents of oil and water that cannot ordinarily be combined are mixed.
2. b) liniment
3. c) solute
4. a) solvent

Lesson 10: Gaseous drug dosage form

a) Learning objectives

By the end of this session, the students should be able to describe Gaseous drug dosage form.

b) Prerequisites/Revision/Introduction

Read the Key unit competence in the syllabus to determine what students will learn and be able to do by the end of the unit. Look at the action verb, concept, and context of each learning objective. This will help you to see the skills, knowledge and attitudes embedded in the learning objective. Remember the learning objectives are linked to the key unit competence.

Use K-W-L (What students already know-What they want to know-What they have learnt) after the previous activity to assess how much students already know and what they would be interested in learning about Gaseous drug dosage form, as one of the forms of drugs. The first thing to do before starting teaching is to remind students that they have learnt about Liquid drug dosage forms, and make a brief recall about the previous session.

c) Teaching resources

Basic materials for a class/lesson to be conducted: students' books, internet connectivity, books or magazines, projector, markers, flipchart, sample of Gaseous drug form, chalks, and any other trustworthy and reliable resources to enhance learning.

d) Possible methods

Think-pair-share, small group discussion, brainstorming, short class presentation, research in the library textbooks or on the internet.

Before the lesson, review the learning objective to determine what students will know and be able to do by the end of the lesson. This will help you to see the skills, knowledge, and attitudes embedded in the learning objective and prepare for your lesson appropriately. Remember the learning objectives link to the key unit competence. Ensure a conducive learning environment and lead a review of the previous lesson on liquid drug dosage forms, handle any homework or assignments. Help students link the previous lesson to the current lesson using an appropriate discovery activity.

e) Learning activities 1.10

Teacher's activities:

- Ask students to do in small groups activity 1.10 in their student books.
- Provide to the students the necessary materials or guide them where they can get the materials.
- Move around in silence to monitor if they are having some problems. In case of small groups, ensure that the gender considerations are considered, and none is excluded based on gender.
- Remember to assist those who are weak but without giving them the knowledge.
- Invite randomly four students to present their findings to the rest of students.
- Ask other students to carefully follow the presentations.
- Those who are not acting may have to listen attentively without disturbing and should applaud the actors after.
- Note on chalk board / Manila paper or flip chart the student's ideas.

- Tick the correct findings and correct those ones which are incorrect and try again to complete those which are incomplete.
- Students may still have few things that are not still clear. Answer or address any questions or challenges about the activity. Guide them to make notes in their books referring to students' book.
- Harmonize and conclude on the learned knowledge.

Student's role:

- Work in small groups on the activity 1.10 as it appears in the student books.
- Use the materials and resources provided by the teacher to give answers to the activity.
- Attempt all the questions ensuring that participation of each member is obvious.
- Assist one another as they may have different levels of understanding.
- Selected members present the findings of the activity to the rest of students.
- Other students follow carefully the presentation of the findings.
- Those who are not presenting have to listen attentively without disturbing and should applaud their colleagues after presentation.
- Ask for more clarifications from the teacher and take notes in their notebooks.

Answers for learning activity 1.10

1. I observe a patient taking medication using pump, image showing different parties of pump.
2. Medication for asthma, gas, aerosol, sprays

Answers for Self-assessment 1.10

1. The route of administration of gaseous dosage form are the nose, mouth and the skin.
2. Aerosols are suspension of fine solid or liquid particles with gas used to apply drug to respiratory tract having atomizer within device while Sprays are Gaseous preparations of drugs containing alcohol applied to mucous membrane of nose or throat with atomizer or nebulizer

Lesson 11: Doses and drug regimen

a) Learning objectives

By the end of this session, the students should be able to

- Describe the importance of dose and drug regimen
- Explain loading dose

- Explain maintenance dose
- Differentiate toxic dose and lethal dose

b) Prerequisites/Revision/Introduction

Read the Key unit competence in the syllabus to determine what students will learn and be able to do by the end of the unit. Look at the action verb, concept, and context of each learning objective. This will help you to see the skills, knowledge and attitudes embedded in the learning objective. Remember the learning objectives are linked to the key unit competence.

Use K-W-L (What students already know-What they want to know-What they have learnt) after the previous activity to assess how much students already know and what they would be interested in learning about Doses and drug regimen. The first thing to do before starting teaching is to remind students that they have learnt about drug dosage form and make a brief recall about the previous session.

c) Teaching resources

Basic materials for a class/lesson to be conducted: students' books, internet connectivity, books or magazines, projector, markers, flipchart, sample medical prescription, chalks, and any other trustworthy and reliable resources to enhance learning.

d) Possible methods

Think-pair-share, small group discussion, brainstorming, short class presentation, research in the library textbooks or on the internet.

Before the lesson, review the learning objective to determine what students will know and be able to do by the end of the lesson. This will help you to see the skills, knowledge, and attitudes embedded in the learning objective and prepare for your lesson appropriately. Remember the learning objectives link to the key unit competence. Ensure a conducive learning environment and lead a review of the previous lesson on drug dosage forms, handle any homework or assignments. Help students link the previous lesson to the current lesson using an appropriate discovery activity.

e) Learning activities 1.11: Doses and drug regimen

Teacher's activities:

- Ask students to do in small groups activity 1.11 in their student books.
- Provide to the students the necessary materials or guide them where they can get the materials.
- Move around in silence to monitor if they are having some problems. In case of small groups, ensure that the gender considerations are considered, and none is excluded based on gender.

- Remember to assist those who are weak but without giving them the knowledge.
- Invite randomly four students to present their findings to the rest of students.
- Ask other students to carefully follow the presentations.
- Those who are not acting may have to listen attentively without disturbing and should applaud the actors after.
- Note on chalk board / Manila paper or flip chart the student's ideas.
- Tick the correct findings and correct those ones which are incorrect and try again to complete those which are incomplete.
- Students may still have few things that are not still clear. Answer or address any questions or challenges about the activity. Guide them to make notes in their books referring to students' book.
- Harmonize and conclude on the learned knowledge.

Student's role:

- Work in small groups on the activity 1.11 as it appears in the student books.
- Use the materials and resources provided by the teacher to give answers to the activity.
- Attempt all the questions ensuring that participation of each member is obvious.
- Assist one another as they may have different levels of understanding.
- Selected members present the findings of the activity to the rest of students.
- Other students follow carefully the presentation of the findings.
- Those who are not presenting have to listen attentively without disturbing and should applaud their colleagues after presentation.
- Ask for more clarifications from the teacher and take notes in their notebooks.

Answers for learning activity 1.11

1. I observe students in class, some students are sitting on desks, a table containing different drugs, the nurse is giving drug to the student using the spoon, and another person is recording in register. Sleeping patient receiving drug in one hand from nurse, the other hand holding a cup of water. Patient who have drug in in hand and the health care provider explain to the patient information about the drug.
2. The importance of taking the medication as prescribed help to cure quickly as the concentration of drug in blood will be constant this will read to therapeutic effect.

3. Effective dose is the dose that produces the desired effect in 50 per cent of all who use the drug is called the median dose
4. Based on this image I think I will learn about drug administration, dose, precaution too take if someone take the medications

Answers for Self-assessment 1.11

1. A loading dose is a higher amount of drug, often given only once or twice, that is administered to “prime” the blood-stream with a level sufficient to quickly induce a therapeutic response while maintenance doses are the dose taken to maintain the plasma concentration. During the long-term use of some drugs, it is customary to prescribe fixed doses with virtually identical long intervals between doses.
2. A dose refers to a specified amount of medication taken at one time while the dosage is the prescribed administration of a specific amount, number, and frequency of doses over a specific period of time.
3. The patients have to take the medication every 8 hours because when the patient take the medication after given time the medication will be eliminated and the amount of the drug will be reduced this will affect the effect of the drug if the patient didn't take the medication as prescribed.

Lesson 12: Fixed dose combination

a) Learning objectives

By the end of this session, the students should be able to:

- Explain Fixed dose combination
- Recognize the importance of Fixed dose combination

b) Prerequisites/Revision/Introduction

Read the Key unit competence in the syllabus to determine what students will learn and be able to do by the end of the unit. Look at the action verb, concept, and context of each learning objective. This will help you to see the skills, knowledge and attitudes embedded in the learning objective. Remember the learning objectives are linked to the key unit competence.

Use K-W-L (What students already know-What they want to know-What they have learnt) after the previous activity to assess how much students already know and what they would be interested in learning about Fixed dose combination. The first thing to do before starting teaching is to remind students that they have learnt about dose and drug regimen and make a brief recall about the previous session.

c) Teaching resources

Basic materials for a class/lesson to be conducted: students' books, internet connectivity, books or magazines, projector, markers, flipchart, sample of drugs, chalks, and any other trustworthy and reliable resources to enhance learning.

d) Possible methods

Think-pair-share, small group discussion, brainstorming, short class presentation, research in the library textbooks or on the internet.

Before the lesson, review the learning objective to determine what students will know and be able to do by the end of the lesson. This will help you to see the skills, knowledge, and attitudes embedded in the learning objective and prepare for your lesson appropriately. Remember the learning objectives link to the key unit competence. Ensure a conducive learning environment and lead a review of the previous lesson on dose and drug regimen, handle any homework or assignments. Help students link the previous lesson to the current lesson using an appropriate discovery activity.

e) Learning activities 1.12: Fixed dose combination

Teacher's activities:

- Ask students to do individually 1.12 in their student books.
- Provide to the students the necessary materials or guide them where they can get the materials.
- Move around in silence to monitor if they are having some problems. In case of small groups, ensure that the gender considerations are considered, and none is excluded based on gender.
- Remember to assist those who are weak but without giving them the knowledge.
- Invite randomly four students to present their findings to the rest of students.
- Ask other students to carefully follow the presentations.
- Those who are not acting may have to listen attentively without disturbing and should applaud the actors after.
- Note on chalk board / Manila paper or flip chart the student's ideas.
- Tick the correct findings and correct those ones which are incorrect and try again to complete those which are incomplete.
- Students may still have few things that are not still clear. Answer or address any questions or challenges about the activity. Guide them to make notes in their books referring to students' book.
- Harmonize and conclude on the learned knowledge.

Student's role:

- Work in small groups on the activity 1.12 as it appears in the student books.
- Use the materials and resources provided by the teacher to give answers to the activity.
- Attempt all the questions ensuring that participation of each member is obvious.
- Assist one another as they may have different levels of understanding.
- Selected members present the findings of the activity to the rest of students.
- Other students follow carefully the presentation of the findings.
- Those who are not presenting have to listen attentively without disturbing and should applaud their colleagues after presentation.
- Ask for more clarifications from the teacher and take notes in their notebooks.

Answers for learning activity 1.12

1. I observe a nurse giving tablet to the patient and the patient is going to take one tablet, one hand holding one table and the other holding cup of water and also I observe another patient holding different type of tablets to be taken.
2. Atripla is combination of Efavirenz, Emtricitabine and Tenofovir DF

Answers for Self-assessment 1.12

1. Advantages of taking fixed dose combination are: Decreased pill burden, Better adherence, Prescription errors less likely, Patients unable to take partial regimen, Experience of FDCs with other diseases such as tuberculosis, malaria etc., Practical for management in large programs (improved drug supply systems), Cheaper in generic form
2. Bactrim is a combination of sulfamethoxazole + trimethoprim.

Lesson 13: Directly observed therapy**a) Learning objectives**

By the end of this session, the students should be able to:

- Explain Directly observed therapy
- Recognize the importance of Directly observed therapy

b) Prerequisites/Revision/Introduction

Read the Key unit competence in the syllabus to determine what students will learn and be able to do by the end of the unit. Look at the action verb, concept, and context of each learning objective.

This will help you to see the skills, knowledge and attitudes embedded in the learning objective. Remember the learning objectives are linked to the key unit competence.

Use K-W-L (What students already know-What they want to know-What they have learnt) after the previous activity to assess how much students already know and what they would be interested in learning about Directly observed therapy. The first thing to do before starting teaching is to remind students that they have learnt about Fixed dose combination and make a brief recall about the previous session.

c) Teaching resources

Basic materials for a class/lesson to be conducted: students' books, internet connectivity, books or magazines, projector, markers, flipchart, sample of drugs, chalks, and any other trustworthy and reliable resources to enhance learning.

d) Possible methods

Think-pair-share, small group discussion, brainstorming, short class presentation, research in the library textbooks or on the internet.

Before the lesson, review the learning objective to determine what students will know and be able to do by the end of the lesson. This will help you to see the skills, knowledge, and attitudes embedded in the learning objective and prepare for your lesson appropriately. Remember the learning objectives link to the key unit competence. Ensure a conducive learning environment and lead a review of the previous lesson on fixed dose combination, handle any homework or assignments. Help students link the previous lesson to the current lesson using an appropriate discovery activity.

e) Learning activities 1.13.: Directly observed therapy

Teacher's activities:

- Ask students to do in pairs activity 1.13 in their student books.
- Provide to the students the necessary materials or guide them where they can get the materials.
- Move around in silence to monitor if they are having some problems. In case of small groups, ensure that the gender considerations are considered, and none is excluded based on gender.
- Remember to assist those who are weak but without giving them the knowledge.
- Invite randomly four students to present their findings to the rest of students.
- Ask other students to carefully follow the presentations.
- Those who are not acting may have to listen attentively without disturbing and should applaud the actors after.

- Note on chalk board / Manila paper or flip chart the student's ideas.
- Tick the correct findings and correct those ones which are incorrect and try again to complete those which are incomplete.
- Students may still have few things that are not still clear. Answer or address any questions or challenges about the activity. Guide them to make notes in their books referring to students' book.
- Harmonize and conclude on the learned knowledge.

Student's role:

- Work in pairs on the activity 1.13 as it appears in the student books.
- Use the materials and resources provided by the teacher to give answers to the activity.
- Attempt all the questions ensuring that participation of each member is obvious.
- Assist one another as they may have different levels of understanding.
- Selected members present the findings of the activity to the rest of students.
- Other students follow carefully the presentation of the findings.
- Those who are not presenting have to listen attentively without disturbing and should applaud their colleagues after presentation.
- Ask for more clarifications from the teacher and take notes in their notebooks.

Answers for learning activity 1.13

1. I observe different drugs on the table, 4 person: one dressed nurse with 3 patients, one patient is drinking water, another taking drug from drug container and another is taking the drug. The nurse is observing the patients while taking medications
2. It is necessary to take drug while the nurse is observing to increase the compliance.

Answers for Self-assessment 1.13

1. WHO recommended Direct Observed Therapy (DOT) for patient taking anti-tuberculosis drugs help to monitor and provide treatment support. This increase the adherence and early detection of adverse reactions associated with anti-tuberculosis drugs.

Lesson 14: Therapeutic effects

a) Learning objectives

By the end of this session, the students should be able to explain the drug therapy effects.

b) Prerequisites/Revision/Introduction

Read the Key unit competence in the syllabus to determine what students will learn and be able to do by the end of the unit. Look at the action verb, concept, and context of each learning objective. This will help you to see the skills, knowledge and attitudes embedded in the learning objective. Remember the learning objectives are linked to the key unit competence.

Use K-W-L (What students already know-What they want to know-What they have learnt) after the previous activity to assess how much students already know and what they would be interested in learning about Therapeutic effects. The first thing to do before starting teaching is to remind students that they have learnt about Directly observed therapy and make a brief recall about the previous session.

c) Teaching resources

Students' books, internet connectivity, books or magazines, projector, markers, flipchart, chalks, and any other trustworthy and reliable resources to enhance learning.

d) Possible methods

Think-pair-share, small group discussion, brainstorming, short class presentation, research in the library textbooks or on the internet.

Before the lesson, review the learning objective to determine what students will know and be able to do by the end of the lesson. This will help you to see the skills, knowledge, and attitudes embedded in the learning objective and prepare for your lesson appropriately. Remember the learning objectives link to the key unit competence. Ensure a conducive learning environment and lead a review of the previous lesson on directly observed therapy, handle any homework or assignments. Help students link the previous lesson to the current lesson using an appropriate discovery activity.

e) Learning activities 1.14.: Therapeutic effects

Teacher's activities:

- Ask students to do individually activity 1.14 in their student books.
- Provide to the students the necessary materials or guide them where they can get the materials.

- Move around in silence to monitor if they are having some problems. In case of small groups, ensure that the gender considerations are considered, and none is excluded based on gender.
- Remember to assist those who are weak but without giving them the knowledge.
- Invite randomly four students to present their findings to the rest of students.
- Ask other students to carefully follow the presentations.
- Those who are not acting may have to listen attentively without disturbing and should applaud the actors after.
- Note on chalk board / Manila paper or flip chart the student's ideas.
- Tick the correct findings and correct those ones which are incorrect and try again to complete those which are incomplete.
- Students may still have few things that are not still clear. Answer or address any questions or challenges about the activity. Guide them to make notes in their books referring to students' book.
- Harmonize and conclude on the learned knowledge.

Student's role:

- Work in small groups on the activity 1.14 as it appears in the student books.
- Use the materials and resources provided by the teacher to give answers to the activity.
- Attempt all the questions ensuring that participation of each member is obvious.
- Assist one another as they may have different levels of understanding.
- Selected members present the findings of the activity to the rest of students.
- Other students follow carefully the presentation of the findings.
- Those who are not presenting have to listen attentively without disturbing and should applaud their colleagues after presentation.
- Ask for more clarifications from the teacher and take notes in their notebooks.

Answers for learning activity 1.14

1. I am observing different words: therapeutic effect and the small words (easy, pharmacology, therapeutic, quantification, response, preparation, degree, etc.)
2. The importance of taking the medication as prescribed to achieve the therapeutic effect.

Answers for Self-assessment 1.14

1. Therapeutic effect refers to the response after a treatment of any kind, the results of which are judged to be desirable and beneficial.
2. The factor affecting are nature of the medication, the length of time drugs was received and also vary with client physical condition and interaction other drugs. Others include, Quantity of drug used, Method of drug use, Time taken to consume, Tolerance, Gender, size and amount of muscle, use of other psycho-active drugs, Mood or attitude, Expectation and Setting or environment.

Lesson 15: Side effects

a) Learning objectives

By the end of this session, the students should be able to explain the drug side effects.

b) Prerequisites/Revision/Introduction

Read the Key unit competence in the syllabus to determine what students will learn and be able to do by the end of the unit. Look at the action verb, concept, and context of each learning objective. This will help you to see the skills, knowledge and attitudes embedded in the learning objective. Remember the learning objectives are linked to the key unit competence.

Use K-W-L (What students already know-What they want to know-What they have learnt) after the previous activity to assess how much students already know and what they would be interested in learning about **side effects**. The first thing to do before starting teaching is to remind students that they have learnt about **Therapeutic effects** and make a brief recall about the previous session.

c) Teaching resources

Basic materials for a class/lesson to be conducted: students' books, internet connectivity, books or magazines, projector, markers, flipchart, chalks, and any other trustworthy and reliable resources to enhance learning.

d) Possible methods

Think-pair-share, small group discussion, brainstorming, short class presentation, research in the library textbooks or on the internet.

Before the lesson, review the learning objective to determine what students will know and be able to do by the end of the lesson. This will help you to see the skills, knowledge, and attitudes embedded in the learning objective and prepare for your lesson appropriately. Remember the learning objectives link to the key unit competence.

Ensure a conducive learning environment and lead a review of the previous lesson **Therapeutic effects**, handle any homework or assignments. Help students link the previous lesson to the current lesson using an appropriate discovery activity.

e) Learning activities 1.15: Side effects

Teacher's activities:

- Ask students to do individually activity 1.15 in their student books.
- Provide the students the necessary materials or guide them where they can get the materials.
- Move around in silence to monitor if they are having some problems. In case of small groups, ensure that the gender considerations are considered, and none is excluded based on gender.
- Remember to assist those who are weak but without giving them the knowledge.
- Invite randomly four students to present their findings to the rest of students.
- Ask other students to carefully follow the presentations.
- Those who are not acting may have to listen attentively without disturbing and should applaud the actors after.
- Note on chalk board / Manila paper or flip chart the student's ideas.
- Tick the correct findings and correct those ones which are incorrect and try again to complete those which are incomplete.
- Students may still have few things that are not still clear. Answer or address any questions or challenges about the activity. Guide them to make notes in their books referring to students' book.
- Harmonize and conclude on the learned knowledge.

Student's role:

- Work in small groups on the activity 1.15 as it appears in the student books.
- Use the materials and resources provided by the teacher to give answers to the activity.
- Attempt all the questions ensuring that participation of each member is obvious.
- Assist one another as they may have different levels of understanding.
- Selected members present the findings of the activity to the rest of students.
- Other students follow carefully the presentation of the findings.
- Those who are not presenting have to listen attentively without disturbing and should applaud their colleagues after presentation.
- Ask for more clarifications from the teacher and take notes in their notebooks.

Answers for learning activity 1.15

Side effect is an undesirable secondary effect which occurs in addition to the desired therapeutic effect of a drug or medication.

Answers for Self-assessment 1.15

1. A nurse can explain to the patient about side effect when it not severe and when effects of a drug side are severe, the dosage may be adjusted or a second medication may be prescribed.
2. The use of Benadryl at bedtime when its side effect of drowsiness is beneficial

Lesson 16: Adverse drug reactions

a) Learning objectives

By the end of this session, the students should be able to:

- Describe adverse drug reactions
- Explain the role of the nurse if the patient develops adverse drug reactions

b) Prerequisites/Revision/Introduction

Read the Key unit competence in the syllabus to determine what students will learn and be able to do by the end of the unit. Look at the action verb, concept, and context of each learning objective. This will help you to see the skills, knowledge and attitudes embedded in the learning objective. Remember the learning objectives are linked to the key unit competence.

Use K-W-L (What students already know-What they want to know-What they have learnt) after the previous activity to assess how much students already know and what they would be interested in learning about **Adverse drug reactions**. The first thing to do before starting teaching is to remind students that they have learnt about **side effects** and make a brief recall about the previous session.

c) Teaching resources

Basic materials for a class/lesson to be conducted: students' books, internet connectivity, books or magazines, projector, markers, flipchart, chalks, and any other trustworthy and reliable resources to enhance learning.

d) Possible methods

Think-pair-share, small group discussion, brainstorming, short class presentation, research in the library textbooks or on the internet.

Before the lesson, review the learning objective to determine what students will know and be able to do by the end of the lesson.

This will help you to see the skills, knowledge, and attitudes embedded in the learning objective and prepare for your lesson appropriately. Remember the learning objectives link to the key unit competence. Ensure a conducive learning environment and lead a review of the previous lesson **side effects**, handle any homework or assignments. Help students link the previous lesson to the current lesson using an appropriate discovery activity.

e) Learning activities 1.16.: Adverse drug reactions

Teacher's activities:

- Ask students to do in small groups activity 1.16 in their student books.
- Provide to the students the necessary materials or guide them where they can get the materials.
- Move around in silence to monitor if they are having some problems. In case of small groups, ensure that the gender considerations are considered, and none is excluded based on gender.
- Remember to assist those who are weak but without giving them the knowledge.
- Invite randomly four students to present their findings to the rest of students.
- Ask other students to carefully follow the presentations.
- Those who are not acting may have to listen attentively without disturbing and should applaud the actors after.
- Note on chalk board / Manila paper or flip chart the student's ideas.
- Tick the correct findings and correct those ones which are incorrect and try again to complete those which are incomplete.
- Students may still have few things that are not still clear. Answer or address any questions or challenges about the activity. Guide them to make notes in their books referring to students' book.
- Harmonize and conclude on the learned knowledge.

Student's role:

- Work in small groups on the activity 1.16 as it appears in the student books.
- Use the materials and resources provided by the teacher to give answers to the activity.
- Attempt all the questions ensuring that participation of each member is obvious.
- Assist one another as they may have different levels of understanding.
- Selected members present the findings of the activity to the rest of students.
- Other students carefully follow the presentation of the findings.

- Those who are not presenting must listen attentively without disturbing and should applaud their colleagues after presentation.
- Ask for more clarifications from the teacher and take notes in their notebooks.

Answers for learning activity 1.16

1. I observe the unconscious person sleeping on floor with many capsule some are in hand other are on floor.
2. This person taken many drugs
3. In this situation I can stop the medication, call for help and assess the client.

Answers for Self-assessment 1.16

1. The nurse has to stop the drug, manage the associate complication, explain to the client what happen and educate the patient what to do to avoid the reoccurrence (avoid to take that drug or the drug in the same class).
2. Side effect is an undesirable secondary effect which occurs in addition to the desired therapeutic effect of a drug or medication. Some side effects are expected as part of drug therapy. The occurrence of these expected but undesirable side effects is not a reason to discontinue therapy.

The adverse reactions are more severe than side effects when it happens the patient will discontinue therapy and other measures can be taken.

3. I will explain to the client that the symptom which happen is the side effect associated with taking quinine.
4. Adverse drug reactions are mainly classified into reactions related to the main pharmacological action of the drug (type A) and reactions that are unpredictable and are not dose-related (Type B). Complete the table below, using the key words and phrases provided in the box.

Answer:

	Type A (Augmented) Reactions	Type B (Bizarre) Reactions
Characteristics:	Type A reactions are dose-dependent and predictable based on the drug's pharmacological action.	Type B reactions are dose-independent and unpredictable.
Examples:	Hypoglycemia caused by insulin, bleeding from anticoagulants	Anaphylaxis from penicillin, Stevens-Johnson syndrome from certain medications.

Predictability:	These reactions are predictable because they are directly related to the drug's known pharmacological effects.	These reactions are unpredictable and not related to the known pharmacological effects of the drug
Dose-Dependence:	They are dose-dependent, meaning the severity of the reaction increases with the dose.	They are not dose-dependent, meaning they can occur at any dose, including very small amounts.
Severity:	While some reactions may be mild, such as drowsiness from antihistamines, others can be life-threatening, such as anaphylaxis from penicillin.	Often severe and can be life-threatening. Unlike Type A reactions, their occurrence is not related to the dose or duration of therapy but rather to individual susceptibility, such as genetic differences or immune responses.

Lesson 17: Antidotes

a) Learning objectives

By the end of this session, the students should be able to explain the term antidotes in drug therapy

b) Prerequisites/Revision/Introduction

Read the Key unit competence in the syllabus to determine what students will learn and be able to do by the end of the unit. Look at the action verb, concept, and context of each learning objective. This will help you to see the skills, knowledge and attitudes embedded in the learning objective. Remember the learning objectives are linked to the key unit competence.

Use K-W-L (What students already know-What they want to know-What they have learnt) after the previous activity to assess how much students already know and what they would be interested in learning about Antidotes. The first thing to do before starting teaching is to remind students that they have learnt about Adverse drug reactions and make a brief recall about the previous session.

c) Teaching resources

Basic materials for a class/lesson to be conducted: students' books, internet connectivity, books or magazines, projector, markers, flipchart, chalks, and any other trustworthy and reliable resources to enhance learning.

d) Possible methods

Think-pair-share, small group discussion, brainstorming, short class presentation, research in the library textbooks or on the internet.

Before the lesson, review the learning objective to determine what students will know and be able to do by the end of the lesson. This will help you to see the skills, knowledge, and attitudes embedded in the learning objective and prepare for your lesson appropriately. Remember the learning objectives link to the key unit competence. Ensure a conducive learning environment and lead a review of the previous lesson adverse drug reactions, handle any homework or assignments. Help students link the previous lesson to the current lesson using an appropriate discovery activity.

e) Learning activities 1.17: Antidotes

Teacher's activities:

- Ask students to do in small groups activity 1.17 in their student books.
- Provide to the students the necessary materials or guide them where they can get the materials.
- Move around in silence to monitor if they are having some problems. In case of small groups, ensure that the gender considerations are considered, and none is excluded based on gender.
- Remember to assist those who are weak but without giving them the knowledge.
- Invite randomly four students to present their findings to the rest of students.
- Ask other students to carefully follow the presentations.
- Those who are not acting may have to listen attentively without disturbing and should applaud the actors after.
- Note on chalk board / Manila paper or flip chart the student's ideas.
- Tick the correct findings and correct those ones which are incorrect and try again to complete those which are incomplete.
- Students may still have few things that are not still clear. Answer or address any questions or challenges about the activity. Guide them to make notes in their books referring to students' book.
- Harmonize and conclude on the learned knowledge.

Student's role:

- Work in small groups on the activity 1.17 as it appears in the student books.
- Use the materials and resources provided by the teacher to give answers to the activity.

- Attempt all the questions ensuring that participation of each member is obvious.
- Assist one another as they may have different levels of understanding.
- Selected members present the findings of the activity to the rest of students.
- Other students carefully follow the presentation of the findings.
- Those who are not presenting must listen attentively without disturbing and should applaud their colleagues after presentation.
- Ask for more clarifications from the teacher and take notes in their notebooks.

Answers for learning activity 1.17

An antidote is a drug, chelating substance, or a chemical that counteracts (neutralizes) the effects of another drug or a poison.

Answers for Self-assessment 1.17

1. Antidotes mediate its effect either by preventing the absorption of the toxin, by binding and neutralizing the poison, antagonizing its end-organ effect, or by inhibition of conversion of the toxin to more toxic metabolites.
2. Damage to the liver may be reversible because liver cells can regenerate. However, hearing loss from damage to the eighth cranial nerve caused by toxic reaction to the anti-infective drug streptomycin may be permanent.

Lesson 18: Responsibilities of nurses regarding safe drug administration

a) Learning objectives

By the end of this session, the students should be able to understand the roles and responsibilities of nurses in anti-infective drug therapy

b) Prerequisites/Revision/Introduction

Read the Key unit competence in the syllabus to determine what students will learn and be able to do by the end of the unit. Look at the action verb, concept, and context of each learning objective. This will help you to see the skills, knowledge and attitudes embedded in the learning objective. Remember the learning objectives are linked to the key unit competence.

Use K-W-L (What students already know-What they want to know-What they have learnt) after the previous activity to assess how much students already know and what they would be interested in learning about Responsibilities of nurses regarding safe drug administration. The first thing to do before starting teaching is to remind students that they have learnt about antidotes and make a brief recall about the previous session.

c) Teaching resources

Students' books, internet connectivity, books or magazines, projector, markers, flipchart, chalks, and any other trustworthy and reliable resources to enhance learning.

d) Possible methods

Think-pair-share, small group discussion, brainstorming, short class presentation, research in the library textbooks or on the internet.

Before the lesson, review the learning objective to determine what students will know and be able to do by the end of the lesson. This will help you to see the skills, knowledge, and attitudes embedded in the learning objective and prepare for your lesson appropriately. Remember the learning objectives link to the key unit competence. Ensure a conducive learning environment and lead a review of the previous lesson Antidotes, handle any homework or assignments. Help students link the previous lesson to the current lesson using an appropriate discovery activity.

e) Learning activities 1.18

Teacher's activities:

- Ask students to do in small groups activity 1.18 in their student books.
- Provide to the students the necessary materials or guide them where they can get the materials.
- Move around in silence to monitor if they are having some problems. In case of small groups, ensure that the gender considerations are considered, and none is excluded based on gender.
- Remember to assist those who are weak but without giving them the knowledge.
- Invite randomly four students to present their findings to the rest of students.
- Ask other students to carefully follow the presentations.
- Those who are not acting may have to listen attentively without disturbing and should applaud the actors after.
- Note on chalk board / Manila paper or flip chart the student's ideas.
- Tick the correct findings and correct those ones which are incorrect and try again to complete those which are incomplete.
- Students may still have few things that are not still clear. Answer or address any questions or challenges about the activity. Guide them to make notes in their books referring to students' book.
- Harmonize and conclude on the learned knowledge.

Student's role:

- Work in small groups on the activity 1.18 as it appears in the student books.
- Use the materials and resources provided by the teacher to give answers to the activity.
- Attempt all the questions ensuring that participation of each member is obvious.
- Assist one another as they may have different levels of understanding.
- Selected members present the findings of the activity to the rest of students.
- Other students follow carefully the presentation of the findings.
- Those who are not presenting have to listen attentively without disturbing and should applaud their colleagues after presentation.
- Ask for more clarifications from the teacher and take notes in their notebooks.

Answers for learning activity 1.18

Responsibilities of Nurses Regarding Safe Drug Administration: Nurses have a critical role in the safe administration of medications to patients. Their duties involve multiple aspects aimed at reducing adverse drug reactions and maintaining patient safety. Key responsibilities include: Nurses have a unique and vital role in medication administration, often serving as the final checkpoint to verify that the medication is correctly prescribed and dispensed before it is administered.

1. To Understand the medications
2. To assessment the patient and Monitoring the side effect
3. To Administer the medication
4. To educate the Patient about the medications they are receiving
5. To document and to reporting any adverse drug reactions or medication errorr.
6. To collaborate and to communicate clearly and effectively with patients, their families, and the healthcare team regarding medication regimens, changes in therapy, and any observed reactions or concerns.
7. To ensure that the patient's medication list is accurate and up-to-date, especially during transitions of care and compare the patient's current medication orders with the previous ones to avoid discrepancies and potential drug interactions.
8. To advocate for patient safety by ensuring that medications are prescribed appropriately and questioning orders that appear unsafe or unclear and adhere to legal requirements and institutional policies regarding medication administration and handling.

Answers for Self-assessment 1.18

Question 1: How do you verify that the medication is correctly prescribed?

Answer:

- Review the patient's medical history and current medication list.
- Check the prescription for accuracy, including the drug name, dosage, route, and frequency.
- Confirm that the prescription is appropriate for the patient's condition and does not have any contraindications or potential drug interactions.

Question 2: What steps do you take to ensure the medication is correctly dispensed?

Answer:

- Verify the medication label against the prescription order.
- Check the expiration date and integrity of the medication packaging.
- Ensure the correct dosage form (e.g., tablet, liquid) is dispensed.

Question 3: How do you ensure that you are administering the right medication to the right patient?

Answer:

- Use two patient identifiers (e.g., name and date of birth) to confirm the patient's identity.
- Cross-check the medication order with the patient's identification band.
- Communicate with the patient, asking them to state their name and any known allergies.

Question 4: What protocols do you follow to ensure the correct dosage is administered?

Answer:

- Double-check the dosage calculations.
- Verify the dose with a colleague, especially for high-risk medications.
- Use standardized measurement tools to ensure accuracy.

Question 5: How do you confirm the right route of administration for a medication?

Answer:

- Refer to the prescription order to confirm the route (e.g., oral, intravenous, intramuscular).
- Assess the patient for any contraindications to the specified route.

Prepare the medication using the appropriate technique for the designated route.

Lesson 19: Food and Drug Administration (FDA) pregnancy risk categories

a) Learning objectives

By the end of this session, the students should be able to recognise the Food and Drug Administration (FDA) pregnancy risk categories during drug therapy for pregnant women

b) Prerequisites/Revision/Introduction

Read the Key unit competence in the syllabus to determine what students will learn and be able to do by the end of the unit. Look at the action verb, concept, and context of each learning objective. This will help you to see the skills, knowledge and attitudes embedded in the learning objective. Remember the learning objectives are linked to the key unit competence.

Use K-W-L (What students already know-What they want to know-What they have learnt) after the previous activity to assess how much students already know and what they would be interested in learning about Food and Drug Administration (FDA) pregnancy risk categories during drug therapy for pregnant women. The first thing to do before starting teaching is to remind students that they have learnt about Responsibilities of nurses regarding safe drug administration and make a brief recall about the previous session.

c) Teaching resources

Basic materials for a class/lesson to be conducted: students' books, internet connectivity, books or magazines, projector, markers, flipchart, chalks, and any other trustworthy and reliable resources to enhance learning.

d) Possible methods

Think-pair-share, small group discussion, brainstorming, short class presentation, research in the library textbooks or on the internet.

Before the lesson, review the learning objective to determine what students will know and be able to do by the end of the lesson. This will help you to see the skills, knowledge, and attitudes embedded in the learning objective and prepare for your lesson appropriately. Remember the learning objectives link to the key unit competence. Ensure a conducive learning environment and lead a review of the previous lesson Responsibilities of nurses regarding safe drug administration, handle any homework or assignments. Help students link the previous lesson to the current lesson using an appropriate discovery activity.

e) Learning activities 1.19: Food and Drug Administration (FDA) pregnancy risk categories

Teacher's activities:

- Ask students to do individually activity 1.19 in their student books.
- Provide to the students the necessary materials or guide them where they can get the materials.
- Move around in silence to monitor if they are having some problems. In case of small groups, ensure that the gender considerations are considered, and none is excluded based on gender.
- Remember to assist those who are weak but without giving them the knowledge.
- Invite randomly four students to present their findings to the rest of students.
- Ask other students to carefully follow the presentations.
- Those who are not acting may have to listen attentively without disturbing and should applaud the actors after.
- Note on chalk board / Manila paper or flip chart the student's ideas.
- Tick the correct findings and correct those ones which are incorrect and try again to complete those which are incomplete.
- Students may still have few things that are not still clear. Answer or address any questions or challenges about the activity. Guide them to make notes in their books referring to students' book.
- Harmonize and conclude on the learned knowledge.

Student's role:

- Work individually activity 1.19 as it appears in the student books.
- Use the materials and resources provided by the teacher to give answers to the activity.
- Attempt all the questions ensuring that participation of each member is obvious.
- Assist one another as they may have different levels of understanding.
- Selected members present the findings of the activity to the rest of students.
- Other students follow carefully the presentation of the findings.
- Those who are not presenting have to listen attentively without disturbing and should applaud their colleagues after presentation.
- Ask for more clarifications from the teacher and take notes in their notebooks.

Answers for learning activity 1.19

Because the drugs used by pregnant women may reach the fetus through the placenta and lead to effects on the development, intellectual ability, birth defects, miscarriage and stillbirth

Answers for Self-assessment 1.19

Category A: Adequate and well-controlled studies have failed to demonstrate a risk to the fetus in the first trimester of pregnancy (and there is no evidence of risk in later trimesters). Example drugs or substances: levothyroxine, folic acid, liothyronine

Category B: Animal reproduction studies have failed to demonstrate a risk to the fetus and there are no adequate and well-controlled studies in pregnant women. Example drugs: metformin, hydrochlorothiazide, cyclobenzaprine, amoxicillin

Category C: Animal reproduction studies have shown an adverse effect on the fetus and there are no adequate and well-controlled studies in humans, but potential benefits may warrant use of the drug in pregnant women despite potential risks. Example drugs: gabapentin, amlodipine, trazodone

Category D: There is positive evidence of human fetal risk based on adverse reaction data from investigational or marketing experience or studies in humans, but potential benefits may warrant use of the drug in pregnant women despite potential risks. Example drugs: losartan

Category X: Studies in animals or humans have demonstrated fetal abnormalities and/or there is positive evidence of human fetal risk based on adverse reaction data from investigational or marketing experience, and the risks involved in use of the drug in pregnant women clearly outweigh potential benefits. Example drugs: atorvastatin, simvastatin, methotrexate, finasteride.

1.6 Summary of the unit

The word pharmacology is derived from two Greek words, “**pharmakon**”, which means **medicine or drug**, and logos, which means study. The story of pharmacology is rich and exciting, filled with accidental discoveries and landmark events. Its history likely **began when a human first used a plant to relieve symptoms of disease**. One of the oldest forms of health care, **herbal medicine** has been practiced in virtually every culture dating to antiquity.

The major sources of drugs can be grouped into the following: Plant, animal, mineral, marine, synthetic/chemical derivative, Semi-synthetic, Microbiological and Recombinant DNA technology/ Biosynthetic sources. **Drugs are chemicals**

that are introduced into the body to bring about some sort of change. The drugs have several names, which may cause confusion. Each drug has three names: **a chemical name, a generic name, trade name and a brand name.**

Drug Administration has specific information that identifies a specific drug. It is important to obtain thorough and accurate information from the drug containers regarding their labelling, as they can often provide valuable information. **The Drug label** is a standardized label that appears on all over-the-counter (OTC) medicines approved by the Food and Drug Administration, it has specific information that identifies a specific drug. It is designed to tell the purpose of the medicine, who should take the medicine and how to take it safely.

Drugs are presented in various forms including Solid, Semisolid, and Liquid Gaseous drug dosage forms. The patient diagnosed with disease has to take the medications as prescribed by the authorised health professional. To avoid and to achieve desirable therapeutic effect, the patient has to take the correct dose.

A dose refers to a specified amount of medication taken at one time while the dosage is the prescribed administration of a specific amount, number, and frequency of doses over a specific period of time. A dosage guides a drug regimen.

Directly observed therapy (DOT) is used to ensure the person receives and takes all medications as prescribed and to monitor response to treatment. DOT is widely used to manage tuberculosis (TB) disease. In HIV treatment, DOT is sometimes called directly administered antiretroviral therapy (DAART).

Good adherence to medication is one of the cornerstones of successful management of chronic diseases. There are many causes and many possible **reasons for patient noncompliance**: the patient suffers adverse effects, the patient does not think the drug is effective, the patient forgets to take the drug, the patient believes the disease is cured because the symptoms have abated, the patient has misunderstood the user instructions, the patient has run out of the drug, the patient does not master the administration technique, e.g. inhalation, the drug formulation is unsuitable, the drug is unacceptable, e.g. unpleasant taste, the patient uses many drugs simultaneously (polypharmacy), frequent dosages and the patient has other objections towards the use of a certain drug.

The main purpose of taking the medication is to achieve the therapeutic effect. **Therapeutic effect** refers to the response after a treatment of any kind, the results of which are judged to be desirable and beneficial.

An undesirable secondary effect which occurs in addition to the desired therapeutic effect of a drug or medication is called **side effect**. It may vary for each individual depending on the person's disease state, age, weight, gender, ethnicity and general health. All drugs have desirable or undesirable side effects.

When the patient is taking the medications he/she can develop some effect which is not desirable and severe which is called **adverse effects**. The adverse effects can be classified into dose-related and non-dose-related effects. **Non-Dose-Related Adverse Effects:** In principle, all effects of drugs depend on the dose that is taken (with a zero dose, there are no effects or adverse effects). **Adverse reactions** are more severe than side effects because are not are not directly related to the drug's pharmacological activities while **Dose-related adverse effects** are associated with the drug's known pharmacological effects and occur when drugs are used in therapeutic doses. **Toxic effects, or toxicity** is also an adverse drug reaction caused by excessive dosing. **Allergic Reaction** is an immune response.

For an allergic reaction to occur there must be prior sensitization of the immune system. Once the immune system has been sensitized to a drug, re-exposure to that drug can trigger an allergic response. Iatrogenic Disease is a disease that occurs as the result of medical care or treatment. The term iatrogenic disease is also used to denote a disease produced by drugs. Teratogenic Effect is a drug and other chemicals capable of causing birth defects.

The patient can experience any unusual reaction which can be reversed by administering another drug that acts as an **antidote**. **An antidote is a drug, chelating substance, or a chemical that counteracts (neutralizes) the effects of another drug or a poison.** Nurses have a unique role and responsibility in medication administration, in that they are frequently the final person to check to see that the medication is correctly prescribed and dispensed before administration. It is standard during nursing education to receive instruction on a guide to clinical medication administration and upholding patient safety known as the 'Nine rights' or 'Nine R's' of medication administration (**Right Patient, Right Reason or Indication, Right drug, Right dose, Right Route and form, Right Time, Right Documentation, Right Response and Right to Refuse**). These 'rights' came into being during an era in medicine in which the precedent was that an error committed by a provider was that provider's sole responsibility and patients did not have as much involvement in their own care.

An associate nurses should remember the **Way to prevent medication administration errors:**

- **Read** the medication labels carefully many products come in similar containers, colors and shapes.
- **Be aware** of medications with similar names many medication names sound alike.
- **When new** or unfamiliar medication is ordered, consult resource if prescriber is also unfamiliar with drug, there is greater risk of inaccurate dosages being ordered.

- Do not administer medication ordered by nickname or unofficial abbreviation know client with same last names.
- Do not confuse equivalents.
- Client should be educated regarding the self-administration of drugs while getting discharged.

In addition, more attention should be taken with Food and drug administration (FDA) pregnancy risk categories. Drugs used by pregnant women may reach the fetus through the placenta and lead to effects on the development, intellectual ability, birth defects, miscarriage and stillbirth. **Therefore, regardless of the pregnancy stage, no drug should be administered during pregnancy unless it is clearly needed.**

1.7. Additional information for Teachers

The students are required to come in class prepared, and they need to consult the textbooks of pharmacology available in the library. The students are requested to work on the homework given to them, and consider self-learning as an important component in their learning.

Pharmacology course equips the students with necessary knowledge and skills to administer drugs to patients and monitor their effects. In that context, all the students are required to be curious and creative when they meet the drugs they do know, and try to look for information pertaining to these drugs.

They are allowed to ask questions for clarifications about the content of pharmacology they didn't get well, and if required, they may even contact the teachers remotely via the email for example.

DRUG EVALUATION

After a chemical that might have therapeutic value is identified, it must undergo a series of scientific tests to evaluate its actual therapeutic and toxic effects. This process is tightly controlled by the U.S. **Food and Drug Administration (FDA)**, an agency of the U.S. Department of Health and Human Services that regulates the development and sale of drugs. FDA-regulated tests are designed to ensure the safety and reliability of any drug approved in this country. For every 100,000 chemicals that are identified as being potential drugs, only about five end up being marketed. Before receiving final FDA approval to be marketed to the public, drugs must pass through several stages of development. These include preclinical trials and phase I, II, and III studies. The drugs listed in this book have been through rigorous testing and are approved for sale to the public, either with or without a prescription from a health care provider.

Preclinical Trials

In **preclinical trials**, chemicals that may have therapeutic value are tested on laboratory animals for two main purposes: (1) to determine whether they have the presumed effects in living tissue and (2) to evaluate any adverse effects.

Animal testing is important because unique biological differences can cause very different reactions to the chemical. These differences can be found only in living organisms, so computer-generated models alone are often inadequate. At the end of the preclinical trials, some chemicals are discarded for the following reasons:

- The chemical lacks therapeutic activity when used with living animals.
- The chemical is too toxic to living animals to be worth the risk of developing into a drug.
- The chemical is highly **teratogenic** (causing adverse effects to the fetus).
- The safety margins are so small that the chemical would not be useful in the clinical setting.

Some chemicals, however, are found to have therapeutic effects and reasonable safety margins. This means that the chemicals are therapeutic at doses that are reasonably different from doses that cause toxic effects. Such chemicals will pass the preclinical trials and advance to phase I studies.

Phase I Studies

A **phase I study** uses human volunteers to test the drugs. These studies are more tightly controlled than preclinical trials and are performed by specially trained clinical investigators. The volunteers are fully informed of possible risks and may be paid for their participation. Usually, the volunteers are healthy, young men.

Women are not good candidates for phase I studies because the chemicals may exert unknown and harmful effects on a woman's ova, and too much risk is involved in taking a drug that might destroy or alter the ova. Women do not make new ova after birth. Men produce sperm daily, so there is less potential for complete destruction or alteration of the sperm. Women who elect to participate in phase 1 studies have to be informed of the potential risk and must sign a consent outlining the possible effects. Some chemicals are therapeutic in other animals but have no effects in humans. Investigators in phase I studies scrutinize the drugs being tested for effects in humans. They also look for adverse effects and toxicity. At the end of phase I studies, many chemicals are dropped from the process for the following reasons:

- They lack therapeutic effect in humans.
- They cause unacceptable adverse effects.
- They are highly teratogenic.

- They are too toxic.

Some chemicals move to the next stage of testing despite undesirable effects. For example, the antihypertensive drug minoxidil (Loniten) was found to effectively treat malignant hypertension, but it caused unusual hair growth on the palms and other body areas. However, because it was so much more effective for treating malignant hypertension at the time of its development than any other antihypertensive drug, it proceeded to phase II studies. (Now, its hair-growing effect has been channeled for therapeutic use into various hair-growth preparations such as Rogaine.)

Phase II Studies

A **phase II study** allows clinical investigators to try out the drug in patients who have the disease that the drug is designed to treat. Patients are told about the possible benefits of the drug and are invited to participate in the study. Those who consent to participate are fully informed about possible risks and are monitored very closely, often at no charge to them, to evaluate the drug's effects. Usually, phase II studies are performed at various sites across the country—in hospitals, clinics, and doctors' offices—and are monitored by representatives of the pharmaceutical company studying the drug. At the end of phase II studies, a drug may be removed from further investigation for the following reasons:

- It is less effective than anticipated.
- It is too toxic when used with patients.
- It produces unacceptable adverse effects.
- It has a low benefit-to-risk ratio, meaning that the therapeutic benefit it provides does not outweigh the risk of potential adverse effects that it causes.
- It is no more effective than other drugs already on the market, making the cost of continued research and production less attractive to the drug company.

A drug that continues to show promise as a therapeutic agent receives additional scrutiny in phase III studies.

Phase III Studies

A **phase III study** involves use of the drug in a vast clinical market. Prescribers are informed of all the known reactions to the drug and precautions required for its safe use. Prescribers observe patients very closely, monitoring them for any adverse effects. Often, prescribers ask patients to keep journals and record any symptoms they experience. Prescribers then evaluate the reported effects to determine whether they are caused by the disease or by the drug. This information is collected by the drug company that is developing the drug and is shared with the FDA. When a drug is used widely, totally unexpected responses may occur. A drug that produces unacceptable adverse effects or unforeseen reactions is usually removed from further study by the drug company. In some cases, the FDA may

have to request that a drug be removed from the market.

Drug Dosage Calculations

Drug dosage calculations are required when the amount of medication ordered (or desired) is different from what is available on hand for the nurse to administer.

Formula:

$\frac{\text{Amount DESIRED (D)}}{\text{Amount on HAND(H)}} \times \text{QUANTITY (Q)} = Y \text{ (Tablets Required)}$
--

Note: When medication is given in tablets, the QUANTITY = 1 since the amount of medication available is specified per (one) tablet.

Example 1: Toprol XL, 50 mg PO, is ordered. Toprol XL is available as 100 mg per tablets. How many tablets would the nurse administer?

Step 1: Determine your givens.	Amount desired (D) = 50mg Amount on hand (H) = 100mg Quantity = 1
Step 2: Plug in what you know into the formula and simplify.	$\frac{50mg}{100mg} \times 1 = 0.5 \text{ tablets}$

Therefore, the nurse would administer 0.5 of a tablet.

Example 2: 1200 mg of Klor-Con is ordered. This medication is only available as 600 mg per tablet. How many tablets should the nurse give?

Step 1: Determine your givens.	Amount desired (D) = 1200 mg Amount on hand (H) = 600 mg Quantity = 1
Step 2: Plug in what you know into the formula and simplify.	$\frac{12000mg}{600mg} \times 1 = 2 \text{ tablets}$

Therefore, the nurse should give 2 tablets.

The same formula can be used for dosage calculations where the medication is available as amount per certain volume. In these types of calculations, the volume available on hand is the QUANTITY.

Example 3: Dilantin-125 is available as 125 mg/5 mL. Dilantin-125, 0.3 g PO, is

ordered. How much should the nurse administer to the patient?

Step 1: Determine your givens.	Amount desired (D) = 0.3 g Amount on hand (H) = 125 mg Quantity = 5 mL
Step 2: Convert 0.3 g to mg (since the ordered dose is in grams but the drug is available on hand in milligrams)	$0.3 \text{ g} \times 1,000 \text{ mg/g} = 300 \text{ mg}$
Step 3: Plug in what you know into the formula and simplify.	$\frac{300\text{mg}}{125\text{mg}} \times 5\text{mL} = 12\text{mL}$

Therefore, the nurse would administer 12 mL.

Example 4: Furosemide is available as 40 mg in 1 mL. 10 mg is ordered to be administered through an IV. What amount of furosemide should the nurse administer?

Step 1: Determine your givens.	Amount desired (D) = 10 mg Amount on hand (H) = 40 mg Quantity = 1 mL
Step 2: Plug in what you know into the formula and simplify.	$\frac{10\text{mg}}{40\text{mg}} \times 1\text{mL} = 0.4\text{mL}$

Therefore, the nurse should administer 0.4 mL of furosemide.

Dosage Calculations based on Body Weight

Dosage calculations based on body weight are required when the dosage ordered and administered is dependent on the weight of the patient. For example, many pediatric drugs are ordered and given per weight (usually in kg). Dosage calculations based on body weight are calculated in two main stages.

Stage 1: Using the formula below, calculate the total required dosage based on given the body weight.

Weight (kg) x Dosage Ordered (per kg) = Y (Required Dosage)

Stage 2: Apply the **D/H** x Q formula to calculate the actual amount of medication to be administered.

Example 1: Medrol 4 mg/kg is ordered for a child weighing 64.8 lb. Medrol is available

as 500 mg/4mL. How many milliliters of medication must the nurse administer?

Step 1: Determine your givens.	Weight: 64.8 lb Dosage ordered: 4mg/kg Available on hand: 500 mg/4mL
Step 2: Convert 64.5 lb to kg since the infant's weight is given in pounds (lb) but the dosage ordered is in mg per kilogram	$64.8 \text{ lb} \div 2.2 \text{ lb/kg} = 29.45 \text{ kg}$ Therefore, the infant's weight is 29.45 kg.
Step 3: Calculate the required dosage (mg) of medication based on the child's weight.	Weight (kg) x Dosage Ordered (per kg) = Y (Required dosage) $29.45 \times 4 \text{ mg/kg} = 117.8 \text{ mg}$ Therefore, the required dosage of medication is 117.8 mg.
Step 4: Calculate the volume of medication (mL) to be administered based on what's available on hand.	$\frac{\text{Amount Desired}}{\text{Amount on Hand}} \times \text{Quantity} = Y$ $\frac{117.8 \text{ mg}}{500 \text{ mg}} \times 4 \text{ mL} = 0.942 \text{ mL}$ Therefore, the nurse must administer 0.942 mL of medication.

1.8 Additional activities

1.8.1 Remedial Activities

1. Describes the factors affecting therapeutic effect of drug?

Answer: Therapeutic effect vary with the nature of the medication, the length of time drugs was received and also vary with client physical condition and interaction other drugs. Others include, Quantity of drug used, Method of drug use, Time taken to consume, Tolerance, Gender, size and amount of muscle, Use of other psycho-active drugs, Mood or attitude, Expectation and Setting or environment.

2. The nurse is preparing to give an oral dose of acetaminophen (Tylenol) to a child who weighs 12 kg. The dose is 15 mg/kg. How many milligrams will the nurse administer for this dose?

Answer: 180 mg

3. A genetically determined abnormal or unusual response to a drug is.....
 - a. **Idiosyncrasy**
 - b. Tolerance
 - c. Genetic polymorphism
 - d. Salicylism
4. Liniments must not be applied on theskin
 - a. Swelled
 - b. **Broken**
 - c. Painful
 - d. Normal
5. The patient who are taking the medications to reduce blood pressure want to normalize the blood pressure quickly by taking too much medication. The Associate nurse is correct when explain to the patient that a toxic dose is:
 - a. The amount of substance to produce the minimal biological effect
 - b. **The amount of substance to produce effects hazardous for an organism**
 - c. The amount of substance to produce the necessary effect in most of patients
 - d. The amount of substance to fast creation of high concentration of medicine in an organism

1.8.2 Consolidation activities

1. During a busy shift, the nurse notes that the medical record of a newly admitted patient has a few orders for various medications and diagnostic tests that were taken by telephone by another nurse. The nurse is on the way to the patient's room to do an assessment when the unit secretary tells the nurse that one of the orders reads as follows: "Lasix, 20 mg, stat." What is the priority action by the nurse? How does the nurse go about giving this drug? Explain the best action to take in this situation.

Answer: Nurses are responsible for safe and prudent decision-making in the nursing care of their patients, including the provision of drug therapy; in accomplishing this task, they attend to the Nine Rights and adhere to legal and ethical standards related to medication administration and documentation. There are additional rights related to drug administration. These rights deserve worthy consideration before initiation of the medication administration process. Observance of all of these rights enhances patient safety and helps avoid medication errors.

2. The correct definition of therapeutic dose is that:
 - a. The amount of a substance to produce the minimal biological effect
 - b. The amount of a substance to produce effects hazardous for an organism

- c. The amount of a substance to produce the required effect in most patients**
- d. The amount of a substance to accelerate an increase of concentration of medicine in an organism
3. A teratogenic action is:
- a. Toxic action on the liver
- b. Negative action on the foetus causing fatal malformation**
- c. Toxic action on blood system
- d. Toxic action on kidneys
4. Every dosage form is a combination of drug and different kind of non-drug components called.....
- a. Additives**
- b. Non-Additives
- c. New chemical entity
- d. All of these
5. Simple syrup is a saturated solution of...
- a. Sucrose**
- b. Fructose
- c. Dextrose
- d. None of these
6. Capsules in which powders are enclosed are made up of
- a. Gelatine**
- b. Rice flour
- c. Fructose
- d. Dextrose
7. In females, the drug should be given very carefully in which stage.....
- a. Menstruation
- b. Lactation
- c. Pregnancy
- d. All of these**
8. The component present in solution in small quantity is known as.....
- a. Solvent
- b. Solution
- c. Solute**
- d. Liquid

9. The component present in solution in large quantity is known as.
- Solvent**
 - Solution
 - Solute
 - Liquid
10. Which of the following is not monophasic liquid dosage form.....
- Solution
 - Gargles
 - Suspension
 - Enemas
11. The part of the prescription called inscription contains
- Name and quantity of ingredients**
 - Name, Age
 - Signature, Address
 - Registration number and Patient information
12. Which one of the following oral liquid formulations would be considered as an oropharyngeal formulation?
- Syrup
 - Elixir
 - Mouthwash**
 - Linctus
13. Which of the following formulations would not be applicable to ocular administration?
- Solution
 - Liniment**
 - Suspension
 - Ointment
14. Capsules normally fall into two main categories. Which are they?
- Hard gelatine capsules and soft gelatine capsules**
 - Hard gelatine capsules and layered capsules
 - Soft gelatine capsules and compressed capsules
 - Compressed and layered capsules
15. Which of the following dosage forms delivers the API to the GI tract?
- Rectal suppositories**
 - Nasal sprays

- c. Vaginal pessaries
- d. Eye drops

1.8.3 Extended activities

1. Pick out the correct definition of a toxic dose:
 - a. The amount of substance to produce the minimal biological effect
 - b. The amount of substance to produce effects hazardous for an organism**
 - c. The amount of substance to produce the necessary effect in most of patients
 - d. The amount of substance to fast creation of high concentration of medicine in an organism
2. Characteristic unwanted reaction which isn't related to a dose or to a pharmacodynamics property of a drug is called:
 - a. Idiosyncrasy
 - b. Hypersensitivity**
 - c. Tolerance
 - d. Teratogenic action
3. A teratogenic action is:
 - a. Toxic action on the liver
 - b. Negative action on the fetus causing fetal malformation**
 - c. Toxic action on blood system
 - d. Toxic action on kidneys

ANSWERS OF END UNIT ASSESSMENT 1

1. Pharmacology: The word pharmacology is derived from two Greek words, "pharmakon", which means medicine or drug, and logos, which means study. It is the study of medicines. It includes the study of how drugs are administered and how the body responds. It can be also defined as the study of drugs and their interactions with living systems.
2. Solid dosage forms, semi-solid dosage forms, liquid dosage forms and gaseous dosage forms
3. The sources of drug are Plant, animal, mineral, marine, synthetic/chemical derivative, Semi-synthetic, Microbiological and Recombinant DNA technology/ Biosynthetic sources.
4. A loading dose is a higher amount of drug, often given only once or twice, that is administered to "prime" the blood-stream with a level sufficient to quickly induce a therapeutic response while the maintenance doses are the dose taken to maintain the plasma concentration. During the long-term use of some drugs, it is customary to prescribe fixed doses with virtually identical long intervals between doses.

5. Generic name
6. Direct Observed Therapy help to monitor and provide treatment support. This increase the adherence and early detection of adverse reactions associated with drugs.
7. Fixed dose combination in patient care
 - Decreased pill burden
 - Better adherence
 - Prescription errors less likely
 - Patients unable to take partial regimen
 - Experience of FDCs with other diseases such as tuberculosis, malaria etc.
 - Practical for management in large programs (improved drug supply systems)
 - Cheaper in generic form
8. The ways to prevent medial errors:
 - Read the medication labels carefully many products come in similar containers, colors and shapes.
 - Be aware of medications with similar names many medication names sound alike.
 - When new or unfamiliar medication is ordered, consult resource if prescriber is also unfamiliar with drug, there is greater risk of inaccurate dosages being ordered.
 - Do not administer medication ordered by nickname or unofficial abbreviation know client with same last names.
 - Do not confuse equivalentents.
 - Client should be educated regarding the self-administration of drugs while getting discharged.

9. The responsibilities of the nurse during drug administration are:

Responsibilities of Nurses Regarding Safe Drug Administration: Nurses have a critical role in the safe administration of medications to patients. Their duties involve multiple aspects aimed at reducing adverse drug reactions and maintaining patient safety. Key responsibilities include: Nurses have a unique and vital role in medication administration, often serving as the final checkpoint to verify that the medication is correctly prescribed and dispensed before it is administered.

1. To Understand the medications
2. To assessment the patient and Monitoring the side effect
3. To Administer the medication

4. To educate the Patient about the medications they are receiving
 5. To document and to reporting any adverse drug reactions or medication errorr.
 6. To collaborate and to communicate clearly and effectively with patients, their families, and the healthcare team regarding medication regimens, changes in therapy, and any observed reactions or concerns.
 7. To ensure that the patient's medication list is accurate and up-to-date, especially during transitions of care and compare the patient's current medication orders with the previous ones to avoid discrepancies and potential drug interactions.
 8. To advocate for patient safety by ensuring that medications are prescribed appropriately and questioning orders that appear unsafe or unclear and adhere to legal requirements and institutional policies regarding medication administration and handling.
10. b) Drugs used to treat, prevent, or diagnose disease.
 11. c) The original name assigned to the drug at the beginning of the evaluation process.
 12. a) Indicate a drug's potential or actual teratogenic effects.
 13. c) The amount of a substance to produce the required effect in most patients
 14. b) The amount of substance to produce effects hazardous for an organism
 15. d) Enteral and systemic
 16. a) Solution
 17. a) Rectum
 18. c) Pessaries
 19. b) Eye drops for inflammation
 20. c) Ask the patient's wife to bring his medications to the hospital in their original containers
 21. d) If a patient expresses a concern about a drug, stop, listen, and investigate the concerns.
 22. d) The nurse contacts the prescriber to clarify the dosage route

2.1 Key unit competence

At the end of this unit, the student will be able to explain the application of pharmacokinetics and pharmacodynamics during clinical practice

2.2 Prerequisites

To succeed well this unit, and complete it confidently, the students need to have been introduced to basic pharmacological concepts. They should have been introduced to the key principles of pharmacology including drug names, the meaning of pharmacology, factors influencing drug prescription, drug dosage forms, and ways of drug administration. The students also need to have been introduced to human biology, and basic chemical reactions.

You then assess how much students already know and what they would be interested in learning about pharmacokinetics and pharmacodynamics.

2.3. Cross cutting issues to be addressed

a) Inclusive education

This unit involves the need to use drugs appropriately, and expect the potential results of these drugs on the client. This requires critical thinking for the students in order to administer drugs bearing in mind they need to exert effects while causing no or less harm to the patient.

During teaching, ensure that students with special needs are included throughout the course delivery. There may be for example students with visual impairment, hearing impairment or even physical disabilities. For the students with visual impairment, the teacher must ensure that they occupy the front seats in class, and they may be encouraged to report when they can't see well what is written or being presented. In case of class activities, these students may be grouped together with others who have healthy vision, and if there are printed activities, ensure to use bigger font sizes. For students with hearing impairment, these students must be included in the learning process. In this context, there is a need to for the teacher to speak loudly, help the students occupy the front seats.

The written points help students with visual impairment and speaking aloud helps students with hearing impairment. Remember to repeat the main points of the lessons.

It is the responsibility of the teacher and teaching team to ensure that all students with a diversity of disabilities are included in the learning process, and special considerations will be considered for each category of students with special needs.

b) Gender

Emphasize to students that anybody irrespective of their gender can present and report during group activities. Give examples of famous people who are successful in real life irrespective of their gender differences. Make sure that during different class activities, both boys and girls share and participate equally in all activities. Bear in mind that they all have equal role in the smooth running of the class, and that the leaders of the class or group activities may be of either female or male gender.

c) Environment and sustainability

Students get basic knowledge from the natural sciences, so introduction to biodiversity is essential, and the students should be encouraged to maintain the biodiversity in order to keep the world safe. They also get skills and attitudes that will enable them in their everyday life to address the environment and climate change issues and to have a sustainable livelihood. Help the students to know maximum skills and attitudes on the environmental sustainability and to be responsible in caring for students' environment.

2.4 Guidance on introductory activity 2.0

This introductory activity is intended to:

- Motivate the students to learn about key principles of pharmacokinetics and pharmacodynamics.
- Stimulate the students to search more information pertaining to of pharmacokinetics and pharmacodynamics.
- To rise the curiosity on the content to cover as it relates to pharmacokinetics and pharmacodynamics of antibiotics.
- Build on previous knowledge, skills, values and attitudes to help the teacher to assess the student's prior knowledge and help to link with the new content that is related to pharmacokinetics and pharmacodynamics.

The progress in the learning is gradual. At this point, there are no right or wrong answers as students will gradually get more appropriate answers progressively as they go through the unit. You may even ask the students to guess what will be covered in the unit.

Teacher's activities:

- The teachers are encouraged to promote learning in small groups of students and provide students with Unit 2 introductory activity, give clear instructions to the activity.
- Ask a determined number of students to present their findings after reading, while others are following, the teacher will be providing the guidance as needed.
- During grouping or pairing, there is a need to ensure that students with different levels of knowledge and understanding are mixed.
- The teacher also has a responsibility to help students with different problems.

Possible answers for the Introductory Activity 2.0: refer to the student's book

1. Students may give diverse answers. Just briefly introduce the aspects of pharmacokinetics and pharmacodynamics as indicated by the arrows.
2. Answers may vary.

2.5 List of lessons/sub-headings including assessments

SN	Lesson title	Learning objectives (from the syllabus including knowledge, skills and attitudes)	Number of Periods
1	Introduction to Pharmacokinetics	<ul style="list-style-type: none">• Define the drugs Pharmacokinetics• Apply pharmacokinetic principles in clinical decision making	1
2	Absorption of drugs	Explain absorption and distribution of drugs within the human body	1
3	Distribution of drugs	<ul style="list-style-type: none">• Explain mechanisms by which drugs cross plasma membranes• recognize the factors affecting absorption and distribution of drugs	2
4	Metabolism of drugs	<ul style="list-style-type: none">• Explain the metabolism of drugs	1
5	Excretion of Drugs	<ul style="list-style-type: none">• Explain the excretion of drugs	1
6	Factors influencing drug effects	<ul style="list-style-type: none">• Identify all the factors influencing drug effects in the human body	2
7	Drug-drug interactions	<ul style="list-style-type: none">• Define drug-drug interaction and related implications to the human body	1

8	Drug-food/beverage interactions	Define drug-food/beverage interaction	1
9	Time-Response Relationships: Drug Plasma Levels	<ul style="list-style-type: none"> • Understand drug plasma levels • Describe how plasma proteins affect drug distribution. 	1
10	Introduction to pharmacodynamics	<ul style="list-style-type: none"> • Understand the pharmacodynamics principles and related concepts • Describe the relationship between receptors and drug action. 	1
11	Drug Agonists	Explain drug agonists	1
12	Drug Antagonists	Explain drug antagonists	1
13	Pharmacokinetics in special population	<ul style="list-style-type: none"> • Identify the pharmacokinetics concerns for special population • Compare and contrast pharmacokinetic principles in neonates, infant, and child. 	2
14	Pharmacodynamics in Special population	<ul style="list-style-type: none"> • Identify Pharmacodynamics concerns in special population • Compare and contrast pharmacodynamics principles in neonates, infant, and child 	1
15	Dose-Response relationship	Understand dose-response relationships	1
16	Potency	Explain the term potency for drugs	1
17	Efficacy	<ul style="list-style-type: none"> • Explain the term efficacy for drugs • compare and contrast the terms potency and efficacy. 	2
18	Therapeutic Index	Explain drug therapeutic index	1
19	Interpatient Variability	Explain inter patient variability during drug usage	1
20	End unit assessment	Explain the application of pharmacokinetics and pharmacodynamics during clinical practice	1

Lesson 1: Introduction to Pharmacokinetics

a) Learning objectives:

By the end of the session, the students should be able to explain confidently the pharmacokinetics.

b) Prerequisites/Revision/Introduction:

To understand well this lesson, and complete it successfully, the students need to have been introduced to basic pharmacological concepts. They should have been introduced to the key principles of pharmacology including drug names, the meaning of pharmacology, factors influencing drug prescription, drug dosage forms, and ways of drug administration. The students also need to have been introduced to human biology, and basic chemical reactions.

You then assess how much students already know and what they would be interested in learning about the introduction to pharmacokinetics.

c) Teaching resources:

They include: Students' books, internet connectivity, printed copies of case studies, projector, markers, chalks, any other trustworthy and reliable resources to enhance learning.

d) Possible methods:

Pair share, small group discussion, brainstorming, short class presentation, research in the library textbooks or on the internet.

e) Learning activity 2.1. Introduction to pharmacokinetics

Teachers' activities:

- Ask students to do individually (or in small groups, pairs) activity 1.1 in their student books.
- Provide to the students the necessary materials or guide them where they can get the materials.
- Move around in silence to monitor if they are having some problems. In case of small groups, ensure that the gender considerations are taken into account, and none is excluded based on gender.
- Remember to assist those who are weak but without giving them the knowledge.
- Invite randomly some students to present their findings to the rest of students.
- Ask other students to follow carefully the presentations.
- Those who are not acting may have to listen attentively without disturbing and should applaud the actors after.

- Note on chalk board / Manila paper or flip chart the student's ideas.
- Tick the correct findings and correct those ones which are incorrect and try again to complete those which are incomplete.
- Students may still have few things that are not clear. Answer or address any questions or challenges about the activity. Guide them to make notes in their notebooks referring to students' book.
- Harmonize and conclude on the learned knowledge.

Answers for learning activity 2.1

1. Pharmacokinetics, sometimes described as what the body does to a drug, refers to the movement of drug into, through, and out of the body.
2. Four phases/processes of pharmacokinetics are:
 - Absorption
 - Distribution
 - Biotransformation (metabolism)
 - Excretion

Answers for Self-assessment 2.1

1. FALSE (a loading dose is rather recommended, and not a maintenance dose).
2. (A) Absorption, Distribution, Biotransformation and Excretion

Lesson 2: Absorption of drugs

a) Learning objectives:

At the completion of this lesson, the student will be able to explain appropriately absorption of drugs within the human body.

b) Prerequisites/Revision/Introduction:

To master well this lesson, and complete successfully, the students need to have been introduced to basic pharmacological concepts. They should have been introduced to the key principles of pharmacology including drug names, the meaning of pharmacology, factors influencing drug prescription, drug dosage forms, and ways of drug administration. The students also need to have been introduced to human biology, and basic chemical reactions.

You then assess how much students already know and what they would be interested in learning about the first pharmacokinetic process, which is absorption. Remind the students that they have been introduced to pharmacokinetics in the previous session.

c) Teaching resources:

These consist of: Students' books, internet connectivity, printed copies of case studies, projector, markers, chalks, any other trustworthy and reliable resources to enhance learning.

d) Possible methods:

Pair share, small group discussion, brainstorming, short class presentation, research in the library textbooks or on the internet.

e) Learning activities 2.2. Absorption of drugs

Teacher's activities:

- Ask students to do in small groups activity 2.2 in their student books.
- Provide the to the students the necessary materials or guide them where they can get the materials.
- Move around in silence to monitor if they are having some problems. In making small groups, ensure that the gender considerations are taken into account, and none is excluded based on gender.
- Guide the students, including those who are weak, without giving them the answers immediately.
- Invite randomly four students to present their findings to the rest of students.
- Ask other students to follow carefully the presentations.
- Those who are not acting may have to listen attentively without disturbing and should applaud the actors after.
- Note on chalk board / Manila paper or flip chart the student's ideas.
- Tick the correct findings and correct those ones which are incorrect and try again to complete those which are incomplete.
- Students may still have few things that are not still clear. Answer or address any questions or challenges about the activity. Guide them to make notes in their books referring to students' book.
- Harmonize and conclude on the learned knowledge.

Student's role:

- Work in small groups on the activity 2.2 as it appears in the student books.
- Use the materials and resources provided by the teacher to give answers to the activity.
- Attempt all the questions ensuring that participation of each member is obvious.
- Assist one another as they may have different levels of understanding.

- Selected members present the findings of the activity to the rest of students.
- Other students follow carefully the presentation of the findings.
- Those who are not presenting have to listen attentively without disturbing and should applaud their colleagues after presentation.
- Ask for more clarifications from the teacher and take notes in their notebooks.

Answers for learning activity 2.2

1. The nurse preferred to administer the injectable medication for this specific patient with severe respiratory disease, because a rapid effect was needed. It has been approved that drugs given parentally are absorbed more quickly than those given by oral route. Of the parenteral routes, drugs administered IV (intravenously) are absorbed the fastest.
2. There are many factors that can affect drug absorption administered by oral route and they include:
 - Acidity of stomach
 - Length of time in stomach
 - Blood flow to gastrointestinal tract
 - Presence of interacting foods or drugs

Answers for Self-assessment 2.2

1. **(A)** Active transport is a process that uses energy to actively move a molecule across a cell membrane.
2.
 - A. The factors affecting the absorption of the drugs administered by IM routes:
 1. Perfusion or blood flow to the muscle
 2. Fat content of the muscle
 3. Temperature of the muscle: cold causes vasoconstriction and decreases absorption; heat causes vasodilation and increases absorption
 - B. The factors affecting the absorption of the drugs administered by SC routes:
 1. Perfusion or blood flow to the tissue
 2. Fat content of the tissue
 3. Temperature of the tissue: cold causes vasoconstriction and decreases absorption; heat causes vasodilation and increases absorption
 - C. The factors affecting the absorption of the drugs administered by Iv routes:

ANSWER: None. The drug directly enters into the venous system.

Lesson 3: Distribution of drugs

a) Learning objectives:

By the end of this lesson, the student will be able to:

- Discuss correctly how drugs are distributed throughout the body.
- Describe appropriately how plasma proteins affect drug distribution.

b) Prerequisites/Revision/Introduction:

To understand well this lesson, and complete it successfully, the students need to have been introduced to basic pharmacological concepts. They should have been introduced to the key principles of pharmacology including drug names, the meaning of pharmacology, factors influencing drug prescription, drug dosage forms, and ways of drug administration. The students also need to have been introduced to human biology, and basic chemical reactions.

You then assess how much students already know and what they would be interested in learning about the second pharmacokinetic process, which is distribution. Make a brief recall about the previous session on absorption of drugs.

c) Teaching resources:

Basic materials for a class/lesson to be conducted include: Students' books, internet connectivity, case studies, projector, markers, chalks, and any other trustworthy and reliable resources to enhance learning.

d) Possible methods:

Pair share, small group discussion, brainstorming, short class presentation, research in the library textbooks or on the internet.

e) Learning activities 2.3. Drug distribution

- Ask students to do in small groups activity 2.3 in their student books.
- Provide to the students the necessary materials or guide them where they can get the materials.
- Move around in silence to monitor if they are having some problems. In making small groups, ensure that the gender considerations are taken into account, and none is excluded based on gender.
- Guide the students, including those who are weak, without giving them the answers immediately.
- Invite randomly some students to present their findings to the rest of students.
- Ask other students to follow carefully the presentations.
- Those who are not acting may have to listen attentively without disturbing and should applaud the actors after.

- Note on chalk board / Manila paper or flip chart the student's ideas.
- Tick the correct findings and correct those ones which are incorrect and try again to complete those which are incomplete.
- Students may still have few things that are not clear. Answer or address any questions or challenges about the activity. Guide them to make notes in their notebooks referring to students' book.
- Harmonize and conclude on the learned knowledge.

Student's role:

- Work in small groups on the activity 2.3 as it appears in the student books.
- Use the materials and resources provided by the teacher to give answers to the activity.
- Attempt all the questions ensuring that participation of each member is obvious.
- Assist one another as they may have different levels of understanding.
- Selected members present the findings of the activity to the rest of students.
- Other students follow carefully the presentation of the findings.
- Those who are not presenting have to listen attentively without disturbing and should applaud their colleagues after presentation.
- Ask for more clarifications from the teacher and take notes in their notebooks.

Answers for learning activity 2.3

1. The nurse was advised to administer the drugs that act topically because the drugs that act systemically cannot be well distributed in the leg because of impaired perfusion. This diabetic patient has developed circulatory complications of the lower limbs, which impacts negatively on the tissue.
2. The organs with high blood flow are the first accumulate drugs which are administered systemically, and they include brain, heart, liver, and kidneys among others.

Answers for Self-assessment 2.3

1. **(C)** Distribution
2. **(A)** Proteins in blood

Lesson 4: Metabolism of drugs

a) Learning objectives:

By the end of this lesson, the student will be able to:

- Explain correctly the metabolism of drugs and its applications to pharmacotherapy.
- Describe appropriately the role of the liver in metabolism.

b) Prerequisites/Revision/Introduction:

To understand well this lesson, and complete it successfully, the students need to have been introduced to basic pharmacological concepts. They should have been introduced to the key principles of pharmacology including drug names, the meaning of pharmacology, factors influencing drug prescription, drug dosage forms, and ways of drug administration. The students also need to have been introduced to human biology, and basic chemical reactions.

You then assess how much students already know and what they would be interested in learning about the third pharmacokinetic process, which is metabolism or biotransformation. Make a brief recall about the previous session on distribution of drugs.

c) Teaching resources:

Students' books, internet connectivity, case studies, projector, markers, chalks, and any other trustworthy and reliable resources to enhance learning.

d) Possible methods:

Pair share, small group discussion, brainstorming, short class presentation, research in the library textbooks or on the internet.

e) Learning activities 2.4. Metabolism of drugs

Teacher's activities:

- Ask students to do individually activity 2.4 in their student books.
- Provide to the students the necessary materials or guide them where they can get the materials.
- Move around in silence to monitor if they are having some problems. In making small groups, ensure that the gender considerations are taken into account, and none is excluded based on gender.
- Guide the students, including those who are weak, without giving them the answers immediately.
- Invite randomly some students to present their findings to the rest of students.
- Ask other students to follow carefully the presentations.

- Those who are not acting may have to listen attentively without disturbing and should applaud the actors after.
- Note on chalk board / Manila paper or flip chart the student's ideas.
- Tick the correct findings and correct those ones which are incorrect and try again to complete those which are incomplete.
- Students may still have few things that are not clear. Answer or address any questions or challenges about the activity. Guide them to make notes in their notebooks referring to students' book.
- Harmonize and conclude on the learned knowledge.

Student's role:

- Work individually the activity 2.4 as it appears in the student books.
- Use the materials and resources provided by the teacher to give answers to the activity.
- Attempt all the questions ensuring that participation of each member is obvious.
- Assist one another as they may have different levels of understanding.
- Selected members present the findings of the activity to the rest of students.
- Other students follow carefully the presentation of the findings.
- Those who are not presenting have to listen attentively without disturbing and should applaud their colleagues after presentation.
- Ask for more clarifications from the teacher and take notes in their notebooks.

Answers for learning activity 2.4

1. The associate nurse student advised the nurse to adjust the dose and follow the client up because it is an old client (aged 85), and more specifically with chronic liver disease. This may impair the drug metabolism because the liver is not functioning properly. **Note:** *The students may answer differently, but the key is to recognize impact of chronic liver disease and ageing on drug metabolism.*
2. The main organ that is involved in metabolism of drugs is the LIVER.

Answers for Self-assessment 2.4

1. **(B)** Advanced age (elderly)
2. **(A)** Oral

Lesson 5: Excretion of drugs

a) Learning objectives:

At the completion of this lesson, the student will be able to explain confidently the excretion of drugs.

b) Prerequisites/Revision/Introduction:

To understand well this lesson, and complete it successfully, the students need to have been introduced to basic pharmacological concepts. They should have been introduced to the key principles of pharmacology including drug names, the meaning of pharmacology, factors influencing drug prescription, drug dosage forms, and ways of drug administration. The students also need to have been introduced to human biology, and basic chemical reactions.

You then assess how much students already know and what they would be interested in learning about the fourth pharmacokinetic process, which is excretion. Make a brief recall about the previous session on metabolism of drugs.

c) Teaching resources:

Basic materials for a class/ lesson to be conducted include: Students' books, internet connectivity, case studies, projector, markers, chalks, urinary system image or model and any other trustworthy and reliable resources to enhance learning.

d) Possible methods:

Pair share, small group discussion, brainstorming, short class presentation, research in the library textbooks or on the internet.

e) Learning activities 2.5. Excretion of drugs

Teacher's activities:

- Ask students to do in small groups activity 2.5 in their student books.
- Provide the to the students the necessary materials or guide them where they can get the materials.
- Move around in silence to monitor if they are having some problems. In making small groups, ensure that the gender considerations are taken into account, and none is excluded based on gender.
- Guide the students, including those who are weak, without giving them the answers immediately.
- Invite randomly four students to present their findings to the rest of students.
- Ask other students to follow carefully the presentations.
- Those who are not acting may have to listen attentively without disturbing and should applaud the actors after.

- Note on chalk board / Manila paper or flip chart the student's ideas.
- Tick the correct findings and correct those ones which are incorrect and try again to complete those which are incomplete.
- Students may still have few things that are not still clear. Answer or address any questions or challenges about the activity. Guide them to make notes in their books referring to students' book.
- Harmonize and conclude on the learned knowledge.

Student's role:

- Work in small groups on the activity 2.5 as it appears in the student books.
- Use the materials and resources provided by the teacher to give answers to the activity.
- Attempt all the questions ensuring that participation of each member is obvious.
- Assist one another as they may have different levels of understanding.
- Selected members present the findings of the activity to the rest of students.
- Other students follow carefully the presentation of the findings.
- Those who are not presenting have to listen attentively without disturbing and should applaud their colleagues after presentation.
- Ask for more clarifications from the teacher and take notes in their notebooks.

Answers for learning activity 2.5

It is always important to consider the patient's kidney function and urine acidity before administering a drug. Kidney dysfunction can lead to toxic levels of a drug in the body because the drug cannot be excreted adequately, and this leads to drug accumulation which causes toxicity.

Answers for Self-assessment 2.5

1. **(C)** The patient took 50 mg of drug with half-life of 2 hours at 8h00 AM. We know a half of drug is eliminated after 2 hours means at 10.00 AM, 25 mg will be remaining and after other 2 hours, the half of the remaining drug will be eliminated. Therefore, at 12.00 PM, 12.5 mg will remain in the body.
2. **Definition of half-life:** The half-life of a drug is the time it takes for the amount of drug in the body to decrease to one half of the peak level it previously achieved.
3. **(D).** Excretion is the removal of a drug from the body. The skin, saliva, lungs, bile, and feces are some of the routes used to excrete drugs. The kidneys, however, play the most important role in drug excretion.

Lesson 6: Factors influencing drug effects

a) Learning objectives:

By the end of this lesson, the student will be able to:

- Explain correctly factors influencing drug effects

b) Prerequisites/Revision/Introduction:

To understand well this lesson, and complete it successfully, the students need to have been introduced to basic pharmacological concepts. They should have been introduced to the key principles of pharmacology including drug names, the meaning of pharmacology, factors influencing drug prescription, drug dosage forms, and ways of drug administration. The students also need to have been introduced to human biology, and basic chemical reactions.

You then assess how much students already know and what they would be interested in learning about the factors influencing drug effects. Make a brief recall about the previous sessions of pharmacokinetic processes.

c) Teaching resources:

These include: Students' books, internet connectivity, case studies, projector, markers, chalks, and any other trustworthy and reliable resources to enhance learning.

d) Possible methods:

Pair share, small group discussion, brainstorming, short class presentation, research in the library textbooks or on the internet.

e) Learning activities 2.6. Factors influencing drug effects

Teacher's activities:

- Ask students to do individually activity 2.4 in their student books.
- Provide to the students the necessary materials or guide them where they can get the materials.
- Move around in silence to monitor if they are having some problems. In making small groups, ensure that the gender considerations are taken into account, and none is excluded based on gender.
- Guide the students, including those who are weak, without giving them the answers immediately.
- Invite randomly some students to present their findings to the rest of students.
- Ask other students to follow carefully the presentations.
- Those who are not acting may have to listen attentively without disturbing and should applaud the actors after.

- Note on chalk board / Manila paper or flip chart the student's ideas.
- Tick the correct findings and correct those ones which are incorrect and try again to complete those which are incomplete.
- Students may still have few things that are not clear. Answer or address any questions or challenges about the activity. Guide them to make notes in their notebooks referring to students' book.
- Harmonize and conclude on the learned knowledge.

Student's role:

- Work individually on the activity 2.6 as it appears in the student books.
- Use the materials and resources provided by the teacher to give answers to the activity.
- Attempt all the questions ensuring that participation of each member is obvious.
- Assist one another as they may have different levels of understanding.
- Selected members present the findings of the activity to the rest of students.
- Other students follow carefully the presentation of the findings.
- Those who are not presenting have to listen attentively without disturbing and should applaud their colleagues after presentation.
- Ask for more clarifications from the teacher and take notes in their notebooks.

Answers for learning activity 2.6

1. The factors to consider are:
 - Age (It is a pediatric patient aged 12 months)
 - Stunting (nutritional/ disease state)
2. Yes. It is very necessary to consider the factors that influence drug effects because they impact (negatively or positively) on the outcome from the prescribed drugs.

Answers for Self-assessment 2.6

1. Five (5) factors that influence drug effects are:
 - Weight
 - Age
 - Gender
 - Physiological Factors
 - Pathological Factors
 - Genetic Factors

- Immunological Factors
- Psychological Factors
- Environmental Factors
- Tolerance
- Interactions

2. The ideal weight to consider for an adult is around 70 kilos

Lesson 7: Drug-drug interactions

a) Learning objectives:

By the end of this lesson, the student will be able to discuss confidently the drug-drug interactions

b) Prerequisites/Revision/Introduction:

To successfully understand and complete well this lesson, the students need to have been introduced to basic pharmacological concepts. They should have been introduced to the key principles of pharmacology including drug names, the meaning of pharmacology, factors influencing drug prescription, drug dosage forms, and ways of drug administration. The students also need to have been introduced to human biology, and basic chemical reactions.

You then assess how much students already know and what they would be interested in learning about the drug-drug interactions. Make a brief recall about the previous sessions of pharmacokinetic processes.

c) Teaching resources:

The teaching resources include students' books, internet connectivity, case studies, projector, markers, chalks, and any other trustworthy and reliable resources to enhance learning.

d) Possible methods:

Pair share, small group discussion, brainstorming, short class presentation, research in the library textbooks or on the internet.

e) Learning activities 2.7. Drug-drug interactions

Teacher's activities:

- Ask students to do individually activity 2.7 in their student books.
- Provide to the students the necessary materials or guide them where they can get the materials.

- Move around in silence to monitor if they are having some problems. In making small groups, ensure that the gender considerations are taken into account, and none is excluded based on gender.
- Guide the students, including those who are weak, without giving them the answers immediately.
- Invite randomly some students to present their findings to the rest of students.
- Ask other students to follow carefully the presentations.
- Those who are not acting may have to listen attentively without disturbing and should applaud the actors after.
- Note on chalk board / Manila paper or flip chart the student's ideas.
- Tick the correct findings and correct those ones which are incorrect and try again to complete those which are incomplete.
- Students may still have few things that are not clear. Answer or address any questions or challenges about the activity. Guide them to make notes in their notebooks referring to students' book.
- Harmonize and conclude on the learned knowledge

Student's role:

- Work individually on the activity 2.7 as it appears in the student books.
- Use the materials and resources provided by the teacher to give answers to the activity.
- Attempt all the questions ensuring that participation of each member is obvious.
- Assist one another as they may have different levels of understanding.
- Selected members present the findings of the activity to the rest of students.
- Other students follow carefully the presentation of the findings.
- Those who are not presenting have to listen attentively without disturbing and should applaud their colleagues after presentation.
- Ask for more clarifications from the teacher and take notes in their notebooks.

Answers for learning activity 2.7

1. There was a drug-drug interaction which made penicillin G to be less effective, and there was a need to increase its dose to have the expected effect.

When penicillin G and tetracyclines are taken concurrently, the effectiveness of penicillin G decreases. If this combination is used, the dose of the penicillin should be increased.

Answers for Self-assessment 2.7

1. The stages/sites at which drug-drug interactions may happen are:
 - At the site of absorption:
 - During distribution:
 - During biotransformation:
 - During excretion:
 - At the site of action
2. Drug-nonprescription treatment interaction refers the reaction between a drug and a nonprescription treatment. These include over-the-counter (OTC) medications, herbs, vitamins, or other supplements.

Lesson 8: Drug-food/beverage interactions

a) Learning objectives:

At the completion of this lesson the student will be able to explain confidently drug-food/beverage interactions.

b) Prerequisites/Revision/Introduction:

To successfully understand and complete well this lesson, the students need to have been introduced to basic pharmacological concepts. They should have been introduced to the key principles of pharmacology including drug names, the meaning of pharmacology, factors influencing drug prescription, drug dosage forms, and ways of drug administration. The students also need to have been introduced to human biology, and basic chemical reactions.

You then assess how much students already know and what they would be interested in learning about the drug-food/beverage interactions. Make a brief recall about the previous sessions of pharmacokinetic processes, and factors influencing drug effects as well as introduction to drug-drug interactions.

c) Teaching resources:

Pair share, small group discussion, brainstorming, short class presentation, research in the library textbooks or on the internet.

d) Possible methods:

Pair share, small group discussion, brainstorming, short class presentation, research in the library textbooks or on the internet.

e) Learning activities 2.8 Drug-food/beverage interactions

Teacher's activities:

- Ask students to do individually the activity 2.8 in their student books.

- Provide the to the students the necessary materials or guide them where they can get the materials.
- Move around in silence to monitor if they are having some problems. In making small groups, ensure that the gender considerations are taken into account, and none is excluded based on gender.
- Guide the students, including those who are weak, without giving them the answers immediately.
- Invite randomly four students to present their findings to the rest of students.
- Ask other students to follow carefully the presentations.
- Those who are not acting may have to listen attentively without disturbing and should applaud the actors after.
- Note on chalk board / Manila paper or flip chart the student's ideas.
- Tick the correct findings and correct those ones which are incorrect and try again to complete those which are incomplete.
- Students may still have few things that are not still clear. Answer or address any questions or challenges about the activity. Guide them to make notes in their books referring to students' book.
- Harmonize and conclude on the learned knowledge.

Student's role:

- Work individually on the activity 2.8 as it appears in the student books.
- Use the materials and resources provided by the teacher to give answers to the activity.
- Attempt all the questions ensuring that participation of each member is obvious.
- Assist one another as they may have different levels of understanding.
- Selected members present the findings of the activity to the rest of students.
- Other students follow carefully the presentation of the findings.
- Those who are not presenting have to listen attentively without disturbing and should applaud their colleagues after presentation.
- Ask for more clarifications from the teacher and take notes in their notebooks.

Answers for learning activity 2.8

1. Grapefruit juice has been found to affect liver enzyme systems for up to 48 hours after it has been ingested. This can result in increased or decreased serum levels of certain drugs. Therefore, the sister was requested to avoid taking the grapefruit juice when she was taking drug because that kind of drug may have interaction with the grapefruit juice and it has been evidenced

that this kind of drug-food interaction does not take place in the stomach, so the grapefruit juice needs to be avoided the entire time the drug is being used, not just while the drug is in the stomach.

2. **FALSE.** Drug-food/beverage interactions may result in either increased or decreased serum levels of the drugs.

Answers for Self-assessment 2.8

1. Taking drugs on empty stomach is advisable because the food in the stomach can interact with the drug and affect the absorption and distribution of the drug in the body.
2. **FALSE.** Drug-food/beverage interactions may occur any time the drug is in the body, including after absorption.

Lesson 9: Time-Response Relationships: Drug Plasma Levels

a) Learning objectives:

At the completion of this lesson the student will be able to explain confidently Time-Response Relationships: Drug Plasma Levels.

b) Prerequisites/Revision/Introduction:

This lesson is linked to the previous lessons and subjects. Therefore, to successfully understand this lesson, the students need to have been introduced to basic pharmacological concepts. They should have been introduced to the key principles of pharmacology including drug names, the meaning of pharmacology, factors influencing drug prescription, drug dosage forms, and ways of drug administration. The students also need to have been introduced to human biology, and basic chemical reactions.

You then assess how much students already know and what they would be interested in learning about the time-response relationships, with focus on drug plasma levels. Make a brief recall about the previous sessions of pharmacokinetic processes.

c) Teaching resources:

Pair share, small group discussion, brainstorming, short class presentation, research in the library textbooks or on the internet.

d) Possible methods:

Pair share, small group discussion, brainstorming, short class presentation, research in the library textbooks or on the internet.

e) Learning activities 2.9 Time-Response Relationships: Drug Plasma Levels

Teacher's activities:

- Ask students to do in small groups the activity 2.9 in their student books.
- Provide the to the students the necessary materials or guide them where they can get the materials.
- Move around in silence to monitor if they are having some problems. In making small groups, ensure that the gender considerations are taken into account, and none is excluded based on gender.
- Guide the students, including those who are weak, without giving them the answers immediately.
- Invite randomly four students to present their findings to the rest of students.
- Ask other students to follow carefully the presentations.
- Those who are not acting may have to listen attentively without disturbing and should applaud the actors after.
- Note on chalk board / Manila paper or flip chart the student's ideas.
- Tick the correct findings and correct those ones which are incorrect and try again to complete those which are incomplete.
- Students may still have few things that are not still clear. Answer or address any questions or challenges about the activity. Guide them to make notes in their books referring to students' book.
- Harmonize and conclude on the learned knowledge.

Student's role:

- Work in small groups on the activity 2.9 as it appears in the student books.
- Use the materials and resources provided by the teacher to give answers to the activity.
- Attempt all the questions ensuring that participation of each member is obvious.
- Assist one another as they may have different levels of understanding.
- Selected members present the findings of the activity to the rest of students.
- Other students follow carefully the presentation of the findings.
- Those who are not presenting have to listen attentively without disturbing and should applaud their colleagues after presentation.
- Ask for more clarifications from the teacher and take notes in their notebooks.

Answers for learning activity 2.9

1. The importance of respecting the interval of taking drugs: When a drug dose is given repeatedly over a given period, a steady state is eventually reached, at which point the amount of drug absorbed is in equilibrium with that eliminated from the body. This avoids toxicity and increases the drug effect. Otherwise, taking the amount of drug meant for 2 doses at the same time may cause toxicity.
2. Loading dose: The loading dose is one or a series of doses that may be given at the onset of therapy with the aim of achieving the target concentration rapidly. Whereas the maintenance dose helps to maintain the chosen steady-state or target concentration, and at this time, the rate of drug administration is adjusted such that the rate of input equals to rate of loss.

Answers for Self-assessment 2.9

1. Steady state plasma concentration: When a drug dose is given repeatedly over a given period, a steady state is eventually reached, at which point the amount of drug absorbed is in equilibrium with that eliminated from the body.
2. Zero order kinetic: It is independent of the amount of drug present at the particular sites of drug absorption or elimination.
3. First order kinetic: Refer to the rate at which absorption, distribution, metabolism and excretion occur are proportional to the concentration of drugs.

Lesson 10: Introduction to pharmacodynamics

a) Learning objectives:

At the completion of this lesson the student will be able to:

- Understand correctly the pharmacodynamics principles and related concepts
- Describe the relationship between receptors and drug action.

b) Prerequisites/Revision/Introduction:

This lesson is linked to the previous lessons and subjects. Therefore, to successfully understand this lesson, the students need to have been introduced to basic pharmacological concepts. They should have been introduced to the key principles of pharmacology including drug names, the meaning of pharmacology, factors influencing drug prescription, drug dosage forms, and ways of drug administration. The students also need to have been introduced to human biology, and basic chemical reactions.

You then assess how much students already know and what they would be interested in learning about the fourth pharmacokinetic process, which is excretion. Make a brief recall about the previous sessions of pharmacokinetics.

c) Teaching resources:

Pair share, small group discussion, brainstorming, short class presentation, research in the library textbooks or on the internet.

d) Possible methods:

Pair share, small group discussion, brainstorming, short class presentation, research in the library textbooks or on the internet.

e) Learning activities 2.10 Introduction to pharmacodynamics

Teacher's activities:

- Ask students to do in small groups the activity 2.10 in their student books.
- Provide the to the students the necessary materials or guide them where they can get the materials.
- Move around in silence to monitor if they are having some problems. In making small groups, ensure that the gender considerations are taken into account, and none is excluded based on gender.
- Guide the students, including those who are weak, without giving them the answers immediately.
- Invite randomly four students to present their findings to the rest of students.
- Ask other students to follow carefully the presentations.
- Those who are not acting may have to listen attentively without disturbing and should applaud the actors after.
- Note on chalk board / Manila paper or flip chart the student's ideas.
- Tick the correct findings and correct those ones which are incorrect and try again to complete those which are incomplete.
- Students may still have few things that are not still clear. Answer or address any questions or challenges about the activity. Guide them to make notes in their books referring to students' book.
- Harmonize and conclude on the learned knowledge.

Student's role:

- Work in small groups on the activity 2.10 as it appears in the student books.
- Use the materials and resources provided by the teacher to give answers to the activity.

- Attempt all the questions ensuring that participation of each member is obvious.
- Assist one another as they may have different levels of understanding.
- Selected members present the findings of the activity to the rest of students.
- Other students follow carefully the presentation of the findings.
- Those who are not presenting have to listen attentively without disturbing and should applaud their colleagues after presentation.
- Ask for more clarifications from the teacher and take notes in their notebooks.

Answers for learning activity 2.10

1. Selective toxicity: Ideally, all chemotherapeutic agents would act only on enzyme systems that are essential for the life of a pathogen or neoplastic cell and would not affect healthy cells. The ability of a drug to attack only those systems found in foreign cells is known as selective toxicity
2. They are called Receptor Sites

Answers for Self-assessment 2.10

1. These ways are:
 - To replace or act as substitutes for missing chemicals
 - To increase or stimulate certain cellular activities
 - To depress or slow cellular activities
 - To interfere with the functioning of foreign cells, such as invading microorganisms or neoplasms
2. **FALSE** (Drugs may harm the human cells unintentionally)

Lesson 11: Drug Agonists

a) Learning objectives:

At the end of this lesson the student will be able to explain confidently drug agonists.

b) Prerequisites/Revision/Introduction:

Read the Key unit competence in the syllabus to determine what students will learn and be able to do by the end of the unit. Look at the action verb, concept and context of each learning objective. This will help you see the skills, knowledge and attitudes embedded in the learning objective. Remember the learning objectives are linked to the key unit competence.

Use K-W-L (What students already know-What they want to know-What they have learnt) after the sessions they previously had on introduction to pharmacokinetics, and drug absorption. The students need to have covered enzymes and receptors

in human biology and key principles of pharmacology including drug names, the meaning of pharmacology, factors influencing drug prescription, drug dosage forms, and ways of drug administration. The students also need to have been introduced to human biology, and basic chemical reactions.

You then assess how much students already know and what they would be interested in learning about drug agonist.

c) Teaching aids

Students' books, computer, internet if needed, flipchart, projectors, case studies, sample of different forms of antipyretic drugs and any other trustworthy and reliable resources to enhance learning.

d) Possible methods:

Choose possible methods among the following: Pair share, small group discussion, brainstorming and short class presentation

e) Learning Activity on agonist drugs

Students are given a topic to be discussed on in a group of 3 to 6 students, or in pairs and come with ideas that may help them understand the agonist drug. Refer students to the textbook of pharmacology in library, indicate the pages they will read, and then instruct them that after 20 minutes they will bring their findings or answers to be presented in classroom. Harmonize their findings; help them to draw conclusion on agonist drug.

Harmonize and conclude on the learned knowledge and still engage students in making that conclusion

Teacher' activities

- Splits students into groups
- Provide the necessary guidance for library searching materials.
- Indicate them when to come back for classroom presentation
- Invites any three students to present their findings to the rest of students.
- Ask other students to follow carefully the presentations
- Note on chalk board / Manila paper the student's ideas.
- Tick the correct findings and correct those ones which are incorrect and try again to complete those which are incomplete.
- Harmonize and conclude on the learned knowledge and still engage students in making that conclusion

Student's Role

- Students form groups as instructed
- Go to Library to search information as the teacher guided them materials.
- Ask questions where it seems not clear
- Request assistant if necessary.
- Being ready to present their findings to the other students.
- To follow carefully the presentations and ask questions if any.
- Note on chalk board / Manila paper the student's ideas.
- Follow the teacher when ticking the correct findings and correcting those ones which are incorrect

Answers for learning activity 2.11

1. The associate nurse in the scenario would explain to the woman that the insulin work as agonists drugs. The insulin interacts directly with receptor sites to cause the same activity that natural chemicals (insulin produced by pancreas) would cause at that the receptor.

Answers for Self-assessment 2.11

1. Agonist drugs is a drug that interacts directly with receptor sites to cause the same activity that natural chemicals would cause at that site.
2. Full agonists are drugs when administered at concentrations sufficient to saturate the receptor pool, can activate their receptor-effector systems to the maximum extent of which the system is capable and this causes a shift of almost all of the receptor pool. Whereas Partial agonists describe a medication that produces a weaker, or less efficacious, response than an agonist. It binds to the same receptors and activate them in the same way but do not evoke as great a response, no matter how high the concentration.

Lesson 12: Drug Antagonists

a) Learning objectives:

At the completion of this lesson the student will be able to explain drug antagonists

b) Prerequisites/Revision/Introduction:

Read the Key unit competence in the syllabus to determine what students will learn and be able to do by the end of the unit. Look at the action verb, concept and context of each learning objective. This will help you see the skills, knowledge and attitudes embedded in the learning objective. Remember the learning objectives are linked to the key unit competence.

Use K-W-L (What students already know-What they want to know-What they have learnt) after the sessions they previously had on introduction to pharmacokinetics, and drug absorption. The students need to have covered enzymes and receptors in human biology and key principles of pharmacology including drug names, the meaning of pharmacology, factors influencing drug prescription, drug dosage forms, and ways of drug administration. The students also need to have been introduced to human biology, and basic chemical reactions.

You then assess how much students already know and what they would be interested in learning about drug antagonist.

c) Teaching aids

Basic materials for a class/ lesson to be conducted include: Students books, computer, internet if needed, flipchart, projectors, case studies, sample of different forms of antipyretic drugs and any other trustworthy and reliable resources to enhance learning.

d) Possible methods:

Small group discussion, brainstorming

e) Learning Activity on agonist drugs

Students are given a topic to be discussed on in a group of 5 to 6 students, or in pairs and come with ideas that may help them understand the antagonist drug. Refer students to the textbook of pharmacology in library, indicate the pages they will read, then instruct them that after 20 minutes they will bring their findings or answers to be presented in classroom. Harmonize their findings; help them to draw conclusion on agonist drug.

Teacher's activities

- Splits students into groups
- Provide the necessary guidance for library searching materials.
- Indicate them when to come back for classroom presentation
- Invite two student students in each group to present their findings to the rest of students.
- Ask other students to follow carefully the presentations
- Note on chalk board / Manila paper the student's ideas.
- Tick the correct findings and correct those ones which are incorrect and try again to complete those which are incomplete.
- Harmonize and conclude on the learned knowledge and still engage students in making that conclusion

Student's Role

- Students form groups as instructed
- Go to Library to search information as the teacher guided them materials.
- Ask questions where it seems not clear
- Request assistant if necessary.
- Being ready to present their findings to the other students.
- To follow carefully the presentations and ask questions if any.
- Note on chalk board / Manila paper the student's ideas.
- Follow the teacher when ticking the correct findings and correcting those ones which are incorrect
- Take the note of while teacher is harmonizing the content

Answers for learning activity 2.12

1. Students may come with different solutions for given activity. But the content may lead to the common understanding that: Antagonist is a drug that may block or reduce the effectiveness of one or more of the drugs. An antagonist is a medication that typically binds to a receptor without activating them, but instead, decreases the receptors ability to be activated by other agonist.

Answers for Self-assessment 2.12

1. An antagonist medication is a medication that binds to a receptor without activating them, but instead, decreases the receptors ability to be activated by other drugs.
2. A **competitive antagonist** drug is a drug that binds to the same receptor sites as another drug and prevents it from binding. On the other hand, a **noncompetitive antagonist** is a drug that binds to different receptor sites from another drug but still prevents that drug from binding.

Lesson 13: Pharmacokinetics in special population

a) Learning objectives:

At the end of this lesson the student should be able:

1. Identify correctly the pharmacokinetics concerns for special population
2. Compare and contrast appropriately pharmacokinetic principles in neonates, infant, and child

b) Prerequisites/Revision/Introduction:

Read the Key unit competence in the syllabus to determine what students will learn and be able to do by the end of the unit.

Look at the action verb, concept and context of each learning objective. This will help you see the skills, knowledge and attitudes embedded in the learning objective. Remember the learning objectives are linked to the key unit competence.

Use K-W-L (What students already know-What they want to know-What they have learnt) after the sessions they previously had on introduction to pharmacokinetics, and drug absorption. The students need to have covered key principles of pharmacology, pharmacokinetics and pharmacodynamics lessons. The students also need to have been introduced to human biology. The teacher assesses how much students already know and what they would be interested in learning about pharmacokinetics in special population.

c) Teaching resources:

Basic materials for a class/ lesson to be conducted include: Students' books, internet connectivity, case studies, projector, markers, chalks, flip chart, posters and any other reliable resources to enhance learning.

d) Possible methods:

Pair share, small group discussion, brainstorming, short class presentation, research in the library textbooks or on the internet.

e) Learning activities 2.13: Pharmacokinetics in special population

Teachers' activities:

- Ask students in individually (or in small groups, pairs) activity to consult library text books.
- Provide to the students the necessary materials or guide them where they can get the materials.
- Move around in silence to monitor if they are having some problems. In case of small groups, ensure that the gender considerations are taken into account, and none is excluded based on gender.
- Remember to assist those who are weak but without giving them the knowledge.
- Invite randomly some students to present their findings to the rest of students.
- Ask other students to follow carefully the presentations.
- Those who are not acting may have to listen attentively without disturbing and should applaud the actors after.
- Note on chalk board / Manila paper or flip chart the student's ideas.
- Tick the correct findings and correct those ones which are incorrect and try again to complete those which are incomplete.

- Students may still have few things that are not clear. Answer or address any questions or challenges about the activity. Guide them to make notes in their notebooks referring to students' book.
- Harmonize and conclude on the learned knowledge.

Students' activities:

- Students form groups as instructed
- Go to Library to search information as the teacher guided them materials.
- Ask questions where it seems not clear
- Request assistant if necessary.
- Being ready to present their findings to the other students.
- To follow carefully the presentations and ask questions if any.
- Note on chalk board / Manila paper the student's ideas.
- Follow the teacher when ticking the correct findings and correcting those ones which are incorrect
- Take the note of while teacher is harmonizing the content

Answers for learning activity 2.13

1. On this activity the students may bring different views.

Possible answer should be that to providing safe and effective medications, pediatric drug therapy represents a great challenge to the health professionals.

Children often require different doses of drugs than adults because children's bodies often handle drugs very differently from adults' bodies. In some cases, a pediatric dose is suggested, but in many cases it will need to be calculated based on the weight and the age of the child.

Answers for Self-assessment 2.13

1. Special considerations in case of pharmacokinetics during drug administration are Women, Geriatric, Neonates, Pediatrics, and Pregnant women
2. Drug toxicity may rise because with advanced age, liver enzyme decreases blood supply especially to liver consequently the absorption decreases. As result some drugs may therefore be more slowly broken down and their blood concentration may rise to toxic levels.

Lesson 14: Pharmacodynamics in special population

a) Learning objectives:

At the end of this lesson the student should be able:

1. Identify the pharmacokinetics concerns for special population
2. Compare and contrast pharmacokinetic principles in neonates, infant, and child

b) Prerequisites/Revision/Introduction:

Read the Key unit competence in the syllabus to determine what students will learn and be able to do by the end of the unit. Look at the action verb, concept and context of each learning objective. This will help you see the skills, knowledge and attitudes embedded in the learning objective. Remember the learning objectives are linked to the key unit competence.

Use K-W-L (What students already know-What they want to know-What they have learnt) after the sessions they previously had on introduction to pharmacokinetics, and drug absorption. The students need to have covered key principles of pharmacology, pharmacokinetics and pharmacodynamics lessons. The students also need to have been introduced to human biology. The teacher assesses how much students already know and what they would be interested in learning pharmacodynamics in special population.

c) Teaching resources:

Basic materials for a class/ lesson to be conducted include: Students' books, internet connectivity, case studies, projector, markers, chalks, flip chart, posters and any other reliable resources to enhance learning.

d) Possible methods:

Pair share, small group discussion, brainstorming, short class presentation, research in the library textbooks or on the internet.

e) Learning activities 2.14: Pharmacokinetics in special population

Teachers' activities:

- Ask students in individually (or in small groups, pairs) activity to consult library text books.
- Provide to the students the necessary materials or guide them where they can get the materials.
- Move around in silence to monitor if they are having some problems. In case of small groups, ensure that the gender considerations are taken into account, and none is excluded based on gender.

- Remember to assist those who are weak but without giving them the knowledge.
- Invite randomly some students to present their findings to the rest of students.
- Ask other students to follow carefully the presentations.
- Those who are not acting may have to listen attentively without disturbing and should applaud the actors after.
- Note on chalk board / Manila paper or flip chart the student's ideas.
- Tick the correct findings and correct those ones which are incorrect and try again to complete those which are incomplete.
- Students may still have few things that are not clear. Answer or address any questions or challenges about the activity. Guide them to make notes in their notebooks referring to students' book.
- Harmonize and conclude on the learned knowledge.

Student's Role

- Students form groups as instructed
- Go to Library to search information as the teacher guided them materials.
- Ask questions where it seems not clear
- Request assistant if necessary.
- Being ready to present their findings to the other students.
- To follow carefully the presentations and ask questions if any.
- Note on chalk board / Manila paper the student's ideas.
- Follow the teacher when ticking the correct findings and correcting those ones which are incorrect
- Take the note of while teacher is harmonizing the content

Answers for learning activity 2.14

1. On this activity the students may bring different views.

Possible answers: Medications can affect the fetus either by interfering with some important function in the mother which indirectly damages the fetus or by pass across the placenta or acting directly on the fetus.

Answers for Self-assessment 2.14

1. To avoid the possible effects of drug on pregnant woman a nurse should be sure that every female he/she attempt to give medication is pregnant or not, read drug risk category before administration of any drug to a pregnant female.

Lesson 15: Dose-response relationships

a) Learning objectives:

At the end of this lesson the student should be able:

- To define dose-response relationships

b) Prerequisites/Revision/Introduction:

Read the Key unit competence in the syllabus to determine what students will learn and be able to do by the end of the unit. Look at the action verb, concept and context of each learning objective. This will help you see the skills, knowledge and attitudes embedded in the learning objective. Remember the learning objectives are linked to the key unit competence.

Use K-W-L (What students already know-What they want to know-What they have learnt) after the sessions they previously had on introduction to pharmacokinetics, and drug absorption. The students need to have covered key principles of pharmacology, pharmacokinetics and pharmacodynamics lessons. The students also need to have been introduced to human biology. The teacher assess how much students already know and what they would be interested in learning about drug distribution.

c) Teaching resources:

Basic materials for a class/ lesson to be conducted include: Students' books, internet connectivity, case studies, projector, markers, chalks, flip chart, posters and any other reliable resources to enhance learning.

d) Possible methods:

Pair share, small group discussion, brainstorming, short class presentation, research in the library textbooks or on the internet.

e) Learning activities: Pharmacokinetics in special population

Teachers' activities:

- Ask students in individually activity to consult library text books.
- Provide to the students the necessary materials or guide them where they can get the materials.
- Move around in silence to monitor if they are having some problems. In case of small groups, ensure that the gender considerations are taken into account, and none is excluded based on gender.
- Remember to assist those who are weak but without giving them the knowledge.
- Invite randomly some students to present their findings to the rest of students.

- Ask other students to follow carefully the presentations.
- Those who are not acting may have to listen attentively without disturbing and should applaud the actors after.
- Note on chalk board / Manila paper or flip chart the student's ideas.
- Tick the correct findings and correct those ones which are incorrect and try again to complete those which are incomplete.
- Students may still have few things that are not clear. Answer or address any questions or challenges about the activity. Guide them to make notes in their notebooks referring to students' book.
- Harmonize and conclude on the learned knowledge.

Student's Role

- Students form groups as instructed
- Go to Library to search information as the teacher guided them materials.
- Ask questions where it seems not clear
- Request assistant if necessary.
- Being ready to present their findings to the other students.
- To follow carefully the presentations and ask questions if any.
- Note on chalk board / Manila paper the student's ideas.
- Follow the teacher when ticking the correct findings and correcting those ones which are incorrect
- Take the note of while teacher is harmonizing the content

Answers for learning activity 2.15

On the activity 2.15 the students may bring different views.

The possible answer should be that the drug was increased from 5 mg to 8 mg because 5 mg did not give desirable effect. That mean 5 mg was low dose. But 8mg dose was the most desirable range of doses for pharmacotherapeutics. In brief in proportionately more effect; a lower drug dose gives less effect.

Answers for Self-assessment 2.15

1. Dose – response relationship, describes the magnitude of the response of an organism, as a function of exposure (or doses) to a stimulus or stressor (usually a chemical) after a certain exposure time.

Lesson 16: Potency of drug

a) Learning objectives:

By the end of this session, the students should be able to apply the term potency for drug.

b) Prerequisites/Revision/Introduction:

Read the Key unit competence in the syllabus to determine what students will learn and be able to do by the end of the unit. Look at the action verb, concept and context of each learning objective. This will help you see the skills, knowledge and attitudes embedded in the learning objective. Remember the learning objectives are linked to the key unit competence.

Use K-W-L (What students already know-What they want to know-What they have learnt) after the sessions they previously had on introduction to pharmacokinetics and drug pharmacodynamics. The students need to have covered key principles of pharmacology including drug names, the meaning of pharmacology, factors influencing drug prescription, drug dosage forms, and ways of drug administration. You then assess how much students already know and what they would be interested in learning about potency for drug.

c) Teaching resources:

Basic materials for a class/ lesson to be conducted include: flipchart, Students' books, internet connectivity, case studies, projector, markers, chalks and any other trustworthy and reliable resources to enhance learning.

d) Possible methods:

Think-pair-share, small group discussion, brainstorming, short class presentation, research in the library textbooks or on the internet.

Before the lesson, review the learning objective to determine what students will know and be able to do by the end of the lesson. This will help you to see the skills, knowledge, and attitudes embedded in the learning objective and prepare for your lesson appropriately. Remember the learning objectives link to the key unit competence. Ensure a conducive learning environment and lead a review of the previous lesson on pharmacology history, handle any homework or assignments. Help students link the previous lesson to the current lesson using an appropriate discovery activity.

e) Learning activities 2.16 Potency of drug

Teachers' activities:

- Ask students to do individually activity 2.16 in their student books.

- Provide to the students the necessary materials or guide them where they can get the materials.
- Move around in silence to monitor if they are having some problems. In case of small groups, ensure that the gender considerations are taken into account, and none is excluded based on gender.
- Remember to assist those who are weak but without giving them the knowledge.
- Invite randomly some students to present their findings to the rest of students.
- Ask other students to follow carefully the presentations.
- Those who are not acting may have to listen attentively without disturbing and should applaud the actors after.
- Note on chalk board / Manila paper or flip chart the student's ideas.
- Tick the correct findings and correct those ones which are incorrect and try again to complete those which are incomplete.
- Students may still have few things that are not clear. Answer or address any questions or challenges about the activity. Guide them to make notes in their notebooks referring to student's book.
- Harmonize and conclude on the learned knowledge.

Student's Role

- Students form groups as instructed
- Go to Library to search information as the teacher guided them materials.
- Ask questions where it seems not clear
- Request assistant if necessary.
- Being ready to present their findings to the other students.
- To follow carefully the presentations and ask questions if any.
- Note on chalk board / Manila paper the student's ideas.
- Follow the teacher when ticking the correct findings and correcting those ones which are incorrect
- Take the note of while teacher is harmonizing the content

Answers for learning activity 2.16

1. The concept of potency is first fundamental ways to compare medications within therapeutic and pharmacologic classes. Pharmacologic potency can largely determine the administered dose of the chosen drug. For therapeutic purposes, the potency of a drug should be stated in dosage units, usually in terms of a particular therapeutic end point may be used in comparing one drug with another.

Potency is an index of how much drug must be administered to elicit a desired response. A drug that is more potent will produce its therapeutic effect at a lower dose, compared to another drug in the same class.

Answers for Self-assessment 2.16

Students analyze the given questions in the application, which relates to Potency of drug, either in groups or in pairs and come with ideas that may result in opportunities to get introduced to the Potency of drug, and their intent.

This activity may be given as a research activity or homework. Depending on the purpose of the application activity, choose an appropriate method to assess students' findings, answers or responses. Depending on the performance or results, you may decide to give remedial or extension activities.

Answer: 1. (D) An index of how much drug must be administered to elicit a desired response.

Lesson 17: Efficacy of drug

a) Learning objectives

By the end of this session, the students should be able to apply the term efficacy for drugs.

b) Prerequisites/Revision/Introduction:

Read the Key unit competence in the syllabus to determine what students will learn and be able to do by the end of the unit. Look at the action verb, concept and context of each learning objective. This will help you see the skills, knowledge and attitudes embedded in the learning objective. Remember the learning objectives are linked to the key unit competence.

Use K-W-L (What students already know-What they want to know-What they have learnt) after the sessions they previously had on introduction to pharmacokinetics, and drug absorption. The students need to have covered key principles of pharmacology including drug names, the meaning of pharmacology, factors influencing drug prescription, drug dosage forms, and ways of drug administration. You then assess how much students already know and what they would be interested in learning about drug distribution.

c) Teaching resources:

Students' books, internet connectivity, case studies, projector, markers, chalks, different antibiotic drug forms and any other trustworthy and reliable resources to enhance learning.

d) Possible methods:

Pair share, small group discussion, brainstorming, short class presentation, research in the library textbooks or on the internet.

e) Learning activities 2.17 Efficacy of drug

Teachers' activities:

- Ask students to do in small groups activity 2.17 in their student books.
- Provide to the students the necessary materials or guide them where they can get the materials.
- Move around in silence to monitor if they are having some problems. In case of small groups, ensure that the gender considerations are taken into account, and none is excluded based on gender.
- Remember to assist those who are weak but without giving them the knowledge.
- Invite randomly some students to present their findings to the rest of students.
- Ask other students to follow carefully the presentations.
- Those who are not acting may have to listen attentively without disturbing and should applaud the actors after.
- Note on chalk board / Manila paper or flip chart the student's ideas.
- Tick the correct findings and correct those ones which are incorrect and try again to complete those which are incomplete.
- Students may still have few things that are not clear. Answer or address any questions or challenges about the activity. Guide them to make notes in their notebooks referring to students' book.
- Harmonize and conclude on the learned knowledge.

Answers for learning activity 2.17

1. The concept of Efficacy is a second fundamental ways to compare medications within therapeutic and pharmacologic classes, which is defined as the greatest maximal response that can be produced from a particular drug or defined as the largest effect that a drug can produce. Maximal efficacy is indicated by the height of the dose-response curve. The maximal efficacy of a drug is obviously crucial for making clinical decisions when a large response is needed. It may be determined by the drug's mode of interactions with receptors (as with partial agonists, described above) or by characteristics of the receptor-effector system involved.

Answers for Self-assessment 2.17

1. (C) The greatest maximal response that can be produced from a particular drug or defined as the largest effect that a drug can produce.

Lesson 18: Therapeutic Index

a) Learning objectives

By the end of this lesson, the student should be able to explain drug therapeutic index.

b) Prerequisites/Revision/Introduction:

The students need to have covered key principles of pharmacology including drug names, the meaning of pharmacology, factors influencing drug prescription, drug dosage forms, and ways of drug administration. The students also need to have been introduced to human biology, and basic chemical reactions. You then assess how much students already know and what they would be interested in learning about Therapeutic index.

c) Teaching resources:

Basic materials for a class/ lesson to be conducted include: internet connectivity, case studies, projector, markers, chalks, and any other trustworthy and reliable resources to enhance learning.

d) Possible methods:

Pair share, small group discussion, brainstorming, short class presentation, research in the library textbooks or on the internet.

e) Learning activities 2.18. Therapeutic Index

Teachers' activities:

- Ask students to do in small groups the activity 2.18 in their student books.
- Provide to the students the necessary materials or guide them where they can get the materials.
- Move around in silence to monitor if they are having some problems. In case of small groups, ensure that the gender considerations are taken into account, and none is excluded based on gender.
- Remember to assist those who are weak but without giving them the knowledge.
- Invite randomly some students to present their findings to the rest of students.
- Ask other students to follow carefully the presentations.

- Those who are not acting may have to listen attentively without disturbing and should applaud the actors after.
- Note on chalk board / Manila paper or flip chart the student's ideas.
- Tick the correct findings and correct those ones which are incorrect and try again to complete those which are incomplete.
- Students may still have few things that are not clear. Answer or address any questions or challenges about the activity. Guide them to make notes in their notebooks referring to students' book.
- Harmonize and conclude on the learned knowledge.

Student's role

- The students will organize in group
- Read the books of pharmacology
- Make short note of therapeutic index
- The representatives of the groups present their findings

Answers for learning activity 2.18

The therapeutic index (TI; also referred to as therapeutic ratio) is a quantitative measurement of the relative safety of a drug. It is a comparison of the amount of a therapeutic agent that causes the therapeutic effect to the amount that causes toxicity. The related terms therapeutic window or safety window refer to a range of doses which optimize between efficacy and toxicity, achieving the greatest therapeutic benefit without resulting in unacceptable side-effects or toxicity.

Answers for Self-assessment 2.18

1. The therapeutic index (TI, also referred to as therapeutic ratio) is a quantitative measurement of the relative safety of a drug. It is a comparison of the amount of a therapeutic agent that causes the therapeutic effect to the amount that causes toxicity.
2. Before administration the nurse must respect 9 RIGHTS of drug administration and check the dose carefully. After administration the nurse have to monitor the person receiving the drug closely for any signs of drug toxicity.
3. **(A)** Efficacy and toxicity

Lesson 19: Inter patient Variability

a) Learning objectives

By the end of this lesson, the student will be able to explain inter patient variability during drug usage.

b) Prerequisites/Revision/Introduction:

The students need to have covered key principles of pharmacology including drug names, the meaning of pharmacology, factors influencing drug prescription, drug dosage forms, and ways of drug administration. The students also need to have been introduced to human biology, and basic chemical reactions. You then assess how much students already know and what they would be interested in learning about Therapeutic index.

c) Teaching resources:

Basic materials for a class/ lesson to be conducted include: Students' books, internet connectivity, case studies, projector, markers, chalks, and any other trustworthy and reliable resources to enhance learning.

d) Possible methods:

Pair share, small group discussion, brainstorming, short class presentation, research in the library textbooks or on the internet.

e) Learning activities 2.19. Inter patient Variability

Teachers' activities:

- Ask students to do individually (or in small groups, pairs) activity 2.19 in their student books.
- Provide to the students the necessary materials or guide them where they can get the materials.
- Move around in silence to monitor if they are having some problems. In case of small groups, ensure that the gender considerations are taken into account, and none is excluded based on gender.
- Remember to assist those who are weak but without giving them the knowledge.
- Invite randomly some students to present their findings to the rest of students.
- Ask other students to follow carefully the presentations.
- Those who are not acting may have to listen attentively without disturbing and should applaud the actors after.
- Note on chalk board / Manila paper or flip chart the student's ideas.

- Tick the correct findings and correct those ones which are incorrect and try again to complete those which are incomplete.
- Students may still have few things that are not clear. Answer or address any questions or challenges about the activity. Guide them to make notes in their notebooks referring to students' book.
- Harmonize and conclude on the learned knowledge.

Students' role

- The students will organize in group
- Read the books of pharmacology
- Make short note of therapeutic index
- The representatives of the groups present their finding

Answers for learning activity 2.19

The reasons behind patient difference in responsiveness to a given dose of a drug are many. They include genetics, disease, age, gender, body weight, drugs given concomitantly, and various behavioral and environmental factors.

Answers for Self-assessment 2.19

Gender is linked with differences in hormonal balance, body composition, and activity of certain enzymes manifest themselves in differences in both pharmacokinetics and responsiveness, but overall, the effect of gender is small.

2.6 Summary of the unit

Pharmacodynamics is the study of the way that drugs affect the body. Most drugs work by replacing natural chemicals, by stimulating normal cell activity, or by depressing normal cell activity. Chemotherapeutic agents work by interfering with normal cell functioning, causing cell death. The most desirable chemotherapeutic agents are those with selective toxicity to foreign cells and foreign cell activities. Drugs frequently act at specific receptor sites on cell membranes to stimulate enzyme systems within the cell and to alter the cell's activities.

Pharmacokinetics—the study of the way the body deals with drugs—includes absorption, distribution, biotransformation, and excretion of drugs. The goal of established dosing schedules is to achieve a critical concentration of the drug in the body. This critical concentration is the amount of the drug necessary to achieve the drug's therapeutic effects. Arriving at a critical concentration involves a dynamic equilibrium among the processes of drug absorption, distribution, metabolism or biotransformation, and excretion. Absorption involves moving a drug into the body for circulation.

Oral drugs are absorbed from the small intestine, undergo many changes, and are affected by many things in the process. IV drugs are injected directly into the circulation and do not need additional absorption.

Drugs are distributed to various tissues throughout the body depending on their solubility and ionization. Most drugs are bound to plasma proteins for transport to reactive tissues. Drugs are metabolized or biotransformed into less toxic chemicals by various enzyme systems in the body. The liver is the primary site of drug metabolism or biotransformation.

The first-pass effect is the breakdown of oral drugs in the liver immediately after absorption. Drugs given by other routes often reach reactive tissues before passing through the liver for biotransformation. Drug excretion is removal of the drug from the body. This occurs mainly through the kidneys.

The half-life of a drug is the period of time it takes for an amount of drug in the body to decrease to one half of the peak level it previously achieved.

The half-life is affected by all aspects of pharmacokinetics. Knowing the half-life of a drug helps in predicting dosing schedules and duration of effects. The actual effects of a drug are determined by its pharmacokinetics, its pharmacodynamics, and many human factors that can change the drug's effectiveness. To provide the safest and most effective drug therapy, the nurse must consider all of the possible factors that influence drug concentration and effectiveness.

2.7 Additional information for teachers

Drug-Laboratory Test Interactions

As explained in the components of drug-drug interactions and drug-food/beverage interactions, the body works through a series of chemical reactions. Because of this, administration of a particular drug may alter results of tests that are done on various chemical levels or reactions as part of a diagnostic study. This drug–laboratory test interaction is caused by the drug being given and not necessarily by a change in the body's responses or actions.

Keep these interactions in mind when evaluating a patient's diagnostic tests. If one test result is altered and does not fit in with the clinical picture or other test results, consider the possibility of a drug–laboratory test interference. For example, dalteparin (Fragmin), a low-molecular weight heparin used to prevent deep vein thrombosis after abdominal surgery, may cause increased levels of the liver enzymes aspartate aminotransferase and alanine aminotransferase with no injury to liver cells or hepatitis.

Answers to end unit assessment 2

1. (D) The ability of the anti-infectious agent to affect the infectious agent's cell without affecting the host (human) cell
2. (C) Pharmacokinetics
3. (C) The drug that can cause congenital malformation
4. (B) A decreased response to a drug, requiring an increase in dosage to achieve the desired effect
5. (D) The ED₅₀ is a measure of drug's efficacy
6. (B) Drug biotransformation in the organism
7. (B) Mechanisms of drug action
8. (A) Partial agonist
9. 1B. Competitive antagonist, 2C. Agonist, 3A. Partial agonist, 4E. Non-competitive antagonist, 5D. Antagonist

2.8 Additional activities

2.8.1 Remedial Activities

1. Half-life ($t_{1/2}$) is the time required to:
 - A. Change the amount of a drug in plasma by half during elimination
 - B. Metabolize a half of an introduced drug into the active metabolite
 - C. Absorb a half of an introduced drug
 - D. Bind a half of an introduced drug to plasma proteins
2. If an agonist can produce maximal effects and has high efficacy it's called:
 - A. Partial agonist
 - B. Antagonist
 - C. Agonist-antagonist
 - D. Full agonist
3. A competitive antagonist is a substance that:
 - A. Interacts with receptors and produces submaximal effect
 - B. Binds to the same receptor site and progressively inhibits the agonist response
 - C. Binds to the nonspecific sites of tissue
 - D. Binds to one receptor subtype as an agonist and to another as an antagonist
4. What does "pharmacokinetics" include?
 - A. Localization of drug action
 - B. Mechanisms of drug action

- C. Excretion of substances
- A. Interaction of substances

Answers for Remedial activities

1. (A) Change the amount of a drug in plasma by half during elimination
2. (D) Full agonist
3. (B) Binds to the same receptor site and progressively inhibits the agonist response
4. (C) Excretion of substances

2.8.2 Consolidation activities

1. Discuss how the pathological factors may influence drug effects.
2. Mention at least 4 components of time-response relationships that determine the drug plasma levels.

Answers for consolidation activities

1. Drugs are usually used to treat disease or pathology. However, the disease that the drug is intended to treat can change the functioning of the chemical reactions within the body and thus change the response to the drug. Other pathological conditions can change the basic pharmacokinetics of a drug. For example, GI disorders can affect the absorption of many oral drugs. Vascular diseases and low blood pressure alter the distribution of drug, preventing it from being delivered to the reactive tissue, thus rendering the drug nontherapeutic. Liver or kidney diseases affect the way that a drug is biotransformed and excreted and can lead to toxic reactions when the usual dose is given.
2. Four components of time-response relationships
 - First order kinetic
 - Zero order kinetic
 - Steady state plasma concentration
 - Loading dose
 - Maintenance dose

2.8.3 Extended activities

1. Half-life ($t_{1/2}$) doesn't depend on:
 - A. Biotransformation
 - B. Time of drug absorption
 - C. Concentration of a drug in plasma

D. Rate of drug elimination

2. Pharmacodynamics involves the study of following **EXCEPT**:

- A. Biological and therapeutic effects of drugs
- B. Mechanisms of drug action
- C. Absorption and distribution of drugs
- D. Drug interactions

3. An antagonist is a substance that:

- A. Binds to the receptors and initiates changes in cell function, producing maximal effect
- B. Binds to the receptors and initiates changes in cell function, producing submaximal effect
- C. Interacts with plasma proteins and doesn't produce any effect
- D. Binds to the receptors without directly altering their functions

4. Elimination is expressed as follows:

- A. Rate of renal tubular reabsorption
- B. Clearance speed of some volume of blood from substance
- C. Time required to decrease the amount of drug in plasma by one-half
- D. Clearance of an organism from a xenobiotic

5. Differentiate the drug's potency from its efficacy

Answers for extended activities

- 1. **(B)** Time of drug absorption
- 2. **(C)** Absorption and distribution of drugs
- 3. **(D)** Binds to the receptors without directly altering their functions
- 4. **(D)** Clearance of an organism from a xenobiotic
- 5. The potency is first fundamental ways to compare medications within therapeutic and pharmacologic classes. Pharmacologic potency can largely determine the administered dose of the chosen drug.

The Efficacy is a second fundamental ways to compare medications within therapeutic and pharmacologic classes, which is defined as the greatest maximal response that can be produced from a particular drug or defined as the largest effect that a drug can produce. Efficacy is almost always more important than potency.

3.1.Key Unit competence

Administer safely medications to the patients.

3.2 Prerequisites (knowledge, skills, attitudes and values)

Students were introduced to course of human biology, chemistry, introduction to ways of drug administration, and principles of pharmacokinetics as well as pharmacodynamics. Students have also been introduced to the fundamentals of nursing that provide guidance on different ways of medication administration. These previously learnt courses will help the students to acquire knowledge and skills related to principles of drug administration and provide to the students more detailed information to manage patient's conditions.

3.3 Cross-cutting issues to be addressed

a) Inclusive education

This unit involves the need to acquire knowledge and skills to apply the principles of pharmacology and administer drugs according to the standards and special considerations of patient's conditions. To administer the correct prescribed drugs and analysis of each patient's specific condition requires critical thinking, and proper use of the brain. Critical thinking may be challenging for students with mental disabilities, and this requires the teacher to assess the degree of mental disability to the concerned students. Analysis of the teacher will help to assess if the students may be grouped with others who may critically think.

During teaching, ensure that students with special needs are included throughout the course delivery. There may be for example students with visual impairment, hearing impairment or even physical disabilities. For the students with visual impairment, the teacher must ensure that they occupy the front seats in class, and they may be encouraged to report when they can't see well what is written or being presented. In case of class activities, these students may be grouped together with others who have healthy vision, and if there printed activities, ensure to use bigger font sizes. For students with hearing impairment, there is a need to for the teacher to speak loudly, help the students occupy the front seats. The written points help students with visual impairment and speaking aloud helps students with hearing impairment Remember to repeat the main points of the lessons. Finally, for the students with physical disability, the teacher needs to help them occupy the seats that make them comfortable.

b) Gender

Emphasize to students that anybody irrespective of their gender can present and report during group activities. Give examples of famous people who are successful in real life irrespective of their gender differences. Make sure that during different class activities, both boys and girls share and participate equally in all activities. Bear in mind that they all have equal role in the smooth running of the class, and that the leaders of the class or group activities may be of either female or male gender.

c) Environment and sustainability

Students get basic knowledge from the natural sciences, so introduction to biodiversity is essential, and the students should be encouraged to maintain the biodiversity in order to keep the world safe. They also get skills and attitudes that will enable them in their everyday life to address the environment and climate change issues and to have a sustainable livelihood. Help the students to know maximum skills and attitudes on the environmental sustainability and to be responsible in caring for students' environment.

3.4 Guidance on the introductory activity 3.0

This introductory activity is intended to:

- Motivate the students to learn about different principles of drug administration
- Stimulate the students to search more information on the aspects to consider before administering medications via different routes
- To rise the curiosity on the content to cover as it relates to principles of drug administration
- Build on previous knowledge, skills, values and attitudes to help the teacher to assess the students' prior knowledge and help to link with the new content that is related to principles of drug administration.

The progress in the learning is usually progressive. At this point, there are no right or wrong answers as students will gradually get more appropriate answers progressively as they go through the unit.

Teacher's activities:

- The tutors are encouraged to promote learning in small groups of students and provide students with Unit 3 introductory activity, give clear instructions to the activity.
- Ask any three students to present their findings after reading, while others are following, the teacher will be providing the guidance as needed.
- During grouping or pairing, there is a need to ensure that students with different levels of knowledge and understanding are mixed.

- The teacher also has a responsibility to help students with different problems.

Possible answers for the Introductory Activity 3.0: refer to the student's book

Students may have different answers according to their observation. They do not necessarily need to provide the right answers, but they need to provide information related to the principles of drug administration.

1. **Image A:** The healthcare provider (nurse) is withdrawing a drug from the vial. She is then checking well the graduations on the syringe to ensure that she applies one of the RIGHTS of drug administration (Right dose). She needs to be careful in order to administer a right dose to the patient, and minimize the risks that may be associated with a wrong dose.

Image B: The nurse is verifying the prescription and the drug to administer. During this step, the nurse needs to verify different RIGHTS of drug administration: she/can be checking the right dose, right drug, right route, right patient and right time. This needs to be well checked before any drug administration.

Image C: Nurses are discussing on the prescription of drugs to ensure that right drugs are prescribed for right medical conditions at the right doses, and these medications need to be administered on right time through right routes. This will prevent some of the errors in medication administration or prescription.

Image D: The nurse is giving clear instructions to the patient in order to ensure that the patient complies with prescription. The nurse and patient are holding interesting discussions to come up with a way that will increase medication compliance and adherence. In this discussion, the nurse may identify areas that need more details to ensure that the patient understands well the benefits of properly using the medication, and the risks that may be associated with drugs that are taken inappropriately.

Image E: It shows that different medication errors may occur, and the errors may come from the prescriber's side, dispenser's side, and the client's side or relatives. In the image, the patient is hesitating on the drugs to take, and he may be mixing the drugs on undue time.

Image F: The drug dosage is being calculated. The patient was prescribed a drug dose that will first need to make calculation to exactly know the amount of drug to administer according to the dosage form.

3.5 List of lessons/sub-headings including assessments

No of lessons	Lesson title	Learning objectives (from the syllabus including knowledge, skills and attitudes)	Number of Periods
1	The rights of drug administration	<ul style="list-style-type: none"> • Explain how the rights of drug administration affect client safety. • Relate the importance of dosing schedules to successful pharmacological therapeutic outcomes • Safely administer drug in the appropriate routes 	2
2	Compliance/ adherence to drug regimen	<ul style="list-style-type: none"> • Outline a plan for improving patient adherence to the medication regimen. • Discuss the factors affecting patient compliance to the drug regimen • Provide patient complete instructions about the use of medication to promote adherence to the drug regimen • Appreciate the importance of compliance to drug regimen in patient management 	2
3	Drug storage	<ul style="list-style-type: none"> • Describe how the storage of drugs can affect their effectiveness. 	2
4	Routes of drug administration: enteral routes	<ul style="list-style-type: none"> • Explain the proper methods of administering enteral drugs • Compare and contrast the advantages and disadvantages of each route of drug administration. • Compare and contrast enteral, topical, and parenteral drug administration. • Safely administer drug in the appropriate routes 	2

5	Routes of drug administration: parenteral routes	<ul style="list-style-type: none"> • Explain the proper methods of administering parenteral drugs • Compare and contrast the advantages and disadvantages of each route of drug administration. • Compare and contrast enteral, topical, and parenteral drug administration. • Safely administer drug in the appropriate routes. 	2
6	Routes of drug administration: topical routes	<ul style="list-style-type: none"> • Explain the proper methods of drugs • Compare and contrast the advantages and disadvantages of each route of drug administration. • Compare and contrast enteral, topical, and parenteral drug administration. • Safely administer drug in the appropriate routes 	2
7	Introduction to medication errors and classification of medication errors	<ul style="list-style-type: none"> • Explain how medication reconciliation can lead to a reduction in medication errors. • Respect rules, policies, and procedures to help in prevention of medication errors 	2
8	Actions to take in case of medication errors, and use of high alert medications	<ul style="list-style-type: none"> • Explain the importance of properly documenting medication administration. • Describe procedures for reporting and documenting medication errors and incidents. • List of strategies that the nurse can implement to reduce medication errors. • Respect rules, policies, and procedures to help in prevention of medication errors 	2
9	Systems of measurement used in pharmacology	<ul style="list-style-type: none"> • Convert between different measuring systems when given drug orders • Compare and contrast the three systems of measurement used in pharmacology 	2

10	Characteristics of a well written medical prescription	<ul style="list-style-type: none"> Identify the elements of a well written medical prescription Interpret drug orders that contain abbreviations Respect a well written medical prescription during drug administration 	2
11	Calculation of drug dosage: tablets, syrup, vials, powder forms.	<ul style="list-style-type: none"> Differentiate reconstitution and dilution of medication Calculate the correct dose of a drug for different drug dosage forms 	2
12	End Unit Assessment		2

Lesson 1: The RIGHTS of drug administration

a) Learning objectives:

By the end of the session, the students should be able to explain correctly the 10 RIGHTS of medication administration

b) Prerequisites/Revision/Introduction:

Read the Key unit competence in the syllabus to determine what students will learn and be able to do by the end of the unit. Look at the action verb, concept and context of each learning objective. This will help you see the skills, knowledge and attitudes embedded in the learning objective. Remember the learning objectives are linked to the key unit competence.

Use K-W-L (What students already know-What they want to know-What they have learnt) after the introductory activity to assess how much students already know and what they would be interested in learning RIGHTS of medication administration. Remind the students that this session is linked to other subjects, and the components related to this session include ways of drug administration; and principles of pharmacokinetics as well as pharmacodynamics.

c) Teaching resources:

Basic materials for a class/ lesson to be conducted include: Students' books, internet connectivity, case studies, projector, markers, chalks, and any other trustworthy and reliable resources to enhance learning.

d) Possible methods:

Pair share, small group discussion, brainstorming, short class presentation, research in the library textbooks or on the internet are the key teaching methods to use.

e) Learning activities 3.1. RIGHTS of drug administration

Teacher's activities:

- Ask students to form small groups of 6 students each and do the activity 3.1 in their student books.
- Provide to the students the necessary materials or guide them where they can get the materials.
- Move around in silence to monitor if they are having some problems. In making small groups, ensure that the gender considerations are taken into account, and none is excluded based on gender.
- Guide the students, including those who are weak, without giving them the answers immediately.
- Invite randomly some students to present their findings to the rest of students.
- Ask other students to follow carefully the presentations.
- Those who are not acting may have to listen attentively without disturbing and should applaud the actors after.
- Note on chalk board or flip chart the students' ideas.
- Tick the correct findings and correct the ones which are incorrect and try again to complete those which are incomplete.
- Students may still have few things that are not clear. Answer or address any questions or challenges about the activity. Guide them to make notes in their notebooks referring to students' book.
- Harmonize and conclude on the learned knowledge.

Student's role:

- Work in small groups on the activity 3.1 as it appears in the student books.
- Use the materials and resources provided by the teacher to give answers to the activity.
- Attempt all the questions ensuring that participation of each member is obvious.
- Assist one another as they may have different levels of understanding.
- Selected members present the findings of the activity to the rest of students.
- Other students follow carefully the presentation of the findings.
- Those who are not presenting have to listen attentively without disturbing and should applaud their colleagues after presentation.
- Ask for more clarifications from the teacher and take notes in their notebooks.

Answers for learning activity 3.1

1. Ten RIGHTS of drug administration that need to be considered before medication administration.
 - Right Patient
 - Right Reason or Indication
 - Right medication or drug
 - Right Route and form
 - Right time
 - Right dose
 - Right Documentation
 - Right Response
 - Right to Refuse
 - Right evaluation
2. In which category of RIGHTS of drug administration would checking the expiry date belong?
The expiry date belongs to the right drug.

Answers for Self-assessment 3.2

1. Visual methods, and verbal methods
2. If refusal of a medication occurs, always respect the patient's right (to refuse), determine the reason, and take appropriate action, including notifying the prescriber. Do not force! Document the refusal and a concise description of the reason for refusal. Document any further actions you take at this time, such as vital signs and/or system assessment. If a consequence to the patient's condition and/or as hospital policy dictates, the prescriber is to be contacted immediately. Never return unwrapped medication to a container, and discard medication dose according to agency policy. If the wrapper remains intact, return the medication to the automated medication-dispensing system. Revise the nursing care plan as needed.
3. (A) Right indication
4. (C) Three

Lesson 2: Compliance/Adherence to drug regimen

a) Learning objectives

By the end of this session, the students should be able to:

- Describe adequately the compliance/adherence to drug regimen, and factors that contribute to poor drug adherence.

b) Prerequisites/Revision/Introduction

In order to understand well this lesson, the students must have been introduced to principles of pharmacokinetics and pharmacodynamics, the RIGHTS of drug administration, and fundamentals of nursing.

Use K-W-L (What students already know-What they want to know-What they have learnt) to assess how much students already know and what they would be interested in learning about adherence/compliance to drug regimen. Remind the students that the current session needs to be linked to the first session that was about the RIGHTS of drug administration.

c) Teaching resources

Students' books, internet connectivity, books or magazines, projector, markers, chalks, and any other trustworthy and reliable resources to enhance learning.

d) Possible methods

Think-pair-share, small group discussion, brainstorming, short class presentation, research in the library textbooks or on the internet are the main teaching methods that may be used.

Before the lesson, review the learning objective to determine what students will know and be able to do by the end of the lesson. This will help you to see the skills, knowledge, and attitudes embedded in the learning objective and prepare for your lesson appropriately. Remember the learning objectives link to the key unit competence. Ensure a conducive learning environment and lead a review of the previous lesson on RIGHTS of drug administration, handle any homework or assignments. Help students link the previous lesson to the current lesson using an appropriate discovery activity.

e) Learning activities 3.2: Compliance/Adherence to drug regimen

Teacher's activities:

- Ask students to do individually activity 3.2 in their student books.
- Provide the to the students the necessary materials or guide them where they can get the materials.
- Move around in silence to monitor if they are having some problems.

- Guide the students, including those who are weak, without giving them the answers immediately.
- Invite randomly two students to present their findings to the rest of students.
- Ask other students to follow carefully the presentations.
- Those who are not acting may have to listen attentively without disturbing and should applaud the actors after.
- Note on chalk board / Manila paper or flip chart the students' ideas.
- Tick the correct findings and correct those ones which are incorrect and try again to complete those which are incomplete.
- Students may still have few things that are not still clear. Answer or address any questions or challenges about the activity. Guide them to make notes in their books referring to students' book.
- Harmonize and conclude on the learned knowledge.

Student's role:

- Work individually on the activity 3.2 as it appears in the student books.
- Use the materials and resources provided by the teacher to give answers to the activity.
- Attempt all the questions ensuring that participation of each member is obvious.
- Assist one another as they may have different levels of understanding.
- Selected members present the findings of the activity to the rest of students.
- Other students follow carefully the presentation of the findings.
- Those who are not presenting have to listen attentively without disturbing and should applaud their colleagues after presentation.
- Ask for more clarifications from the teacher and take notes in their notebooks.

Answers for learning activity 3.2

1. Adherence describes how a patient follows a medical regime recommended by a healthcare provider
2. These factors are:
 - Social/economic factors
 - Provider-patient/health care system factors
 - Condition-related factors
 - Therapy-related factors
 - Patient-related factors

Answers for Self-assessment 3.2

1. Enumerate patient-related factors affecting adherence to medications.

◆ **Physical Factors**

- Visual impairment
- Hearing impairment
- Cognitive impairment
- Impaired mobility or dexterity
- Swallowing problems

◆ **Psychological/Behavioral Factors**

- Knowledge about disease
 - Perceived risk/susceptibility to disease
 - Understanding reason medication is needed
 - Expectations or attitudes toward treatment
 - Perceived benefit of treatment
 - Confidence in ability to follow treatment regimen
 - Motivation
 - Fear of possible adverse effects
 - Fear of dependence
 - Feeling stigmatized by the disease
 - Frustration with health care providers
 - Psychosocial stress, anxiety, anger
 - Alcohol or substance abuse
2. FALSE. Compliance has negative connotations as it requests a submissive and obedient patient. Adherence is rather more preferable these days than compliance.
3. FALSE. Compliance implies an authoritarian, asymmetric physician-patient relationship, in which the doctor has the exclusive decisional power. Concordance places the patient in the centre of the decision-making process. It focuses less on compliance and more on overall success of treatment as a shared goal.

Lesson 3: Drug storage

a) Learning objectives

By the end of this session, the students should be able to:

- Describe adequately how the storage of drugs can affect their effectiveness.

b) Prerequisites/Revision/Introduction

In order to understand well this lesson, the students must have been introduced to principles of pharmacokinetics and pharmacodynamics, the RIGHTS of drug administration, drugs names, drug dosage forms, and fundamentals of nursing.

Use K-W-L (What students already know-What they want to know-What they have learnt) to assess how much students already know and what they would be interested in learning about drug storage. Remind the students that the current session needs to be linked to the previous sessions.

c) Teaching resources

Students' books, internet connectivity, books or magazines, projector, markers, chalks, and any other trustworthy and reliable resources to enhance learning.

d) Possible methods

Think-pair-share, small group discussion, brainstorming, short class presentation, research in the library textbooks or on the internet are the main teaching methods that may be used.

Before the lesson, review the learning objective to determine what students will know and be able to do by the end of the lesson. This will help you to see the skills, knowledge, and attitudes embedded in the learning objective and prepare for your lesson appropriately. Remember the learning objectives link to the key unit competence. Ensure a conducive learning environment and lead a review of the previous lesson on adherence/compliance to drug regimen, handle any homework or assignments. Help students link the previous lesson to the current lesson using an appropriate discovery activity.

e) Learning activities 3.3: Storage of drugs

Teacher's activities:

- Ask students to do in small groups activity 3.3 in their student books.
- Provide the to the students the necessary materials or guide them where they can get the materials.
- Move around in silence to monitor if they are having some problems.

- Guide the students, including those who are weak, without giving them the answers immediately.
- Invite randomly two students to present their findings to the rest of students.
- Ask other students to follow carefully the presentations.
- Those who are not acting may have to listen attentively without disturbing and should applaud the actors after.
- Note on chalk board or flip chart the students' ideas.
- Tick the correct findings and correct those ones which are incorrect and try again to complete those which are incomplete.
- Students may still have few things that are not still clear. Answer or address any questions or challenges about the activity. Guide them to make notes in their books referring to students' book.
- Harmonize and conclude on the learned knowledge.

Student's role:

- Work in small groups on the activity 3.3 as it appears in the student books.
- Use the materials and resources provided by the teacher to give answers to the activity.
- Attempt all the questions ensuring that participation of each member is obvious.
- Assist one another as they may have different levels of understanding.
- Selected members present the findings of the activity to the rest of students.
- Other students follow carefully the presentation of the findings.
- Those who are not presenting have to listen attentively without disturbing and should applaud their colleagues after presentation.
- Ask for more clarifications from the teacher and take notes in their notebooks.

Answers for learning activity 3.3

1. The nurse in image A is checking the drugs that have been stored in the shelves. Some of them might have the closer expiry date than the others. It is then the responsibility of the healthcare providers to ensure that drugs are stored properly, and used in an appropriate manner. Those that are about to expire for example may be used first. Those that have expired must be discarded.

The nurse in image B is getting the drugs from the fridge where they have been stored.

2. Drugs stored in the medicines refrigerator include: vaccines; insulin; chemotherapy drugs; topical preparations, such as some types of eye drops; and other treatments such as glucagon, which is used to manage severe hypoglycaemia.

Answers for Self-assessment 3.3

1. The factors that govern the storage of drugs are:
 - 1) Proper drug storage
 - 2) Storage Environment
 - 3) Arrangement of drugs on shelves
 - 4) The storeroom
 - 5) The dispensary
2. (C) Eight stacks
3. To have access to drugs with shorter expiration dates, put these in front of the shelves. Those with longer expiration dates should be placed behind those with shorter dates.
4. The characteristics of drug storage environment are:
 - Adequate temperature,
 - sufficient lighting,
 - clean conditions,
 - humidity control,
 - cold storage facilities, and
 - adequate shelving to ensure integrity of the stored drugs.

Lesson 4: Enteral routes of drug administration

a) Learning objectives

By the end of this session, the students should be able to:

- Explain correctly and confidently the enteral routes of drug administration

b) Prerequisites/Revision/Introduction

In order to understand well this lesson, the students must have been introduced to principles of pharmacokinetics and pharmacodynamics, drugs names, drug dosage forms, and fundamentals of nursing.

Use K-W-L (What students already know-What they want to know-What they have learnt) to assess how much students already know and what they would be interested in learning about enteral routes of drug administration. Remind the students that the current session needs to be linked to the previous sessions.

c) Teaching resources

Students' books, internet connectivity, books or magazines, projector, markers, chalks, and any other trustworthy and reliable resources to enhance learning.

d) Possible methods

Think-pair-share, small group discussion, brainstorming, short class presentation, research in the library textbooks or on the internet are the main teaching methods that may be used.

Before the lesson, review the learning objective to determine what students will know and be able to do by the end of the lesson. This will help you to see the skills, knowledge, and attitudes embedded in the learning objective and prepare for your lesson appropriately. Remember the learning objectives link to the key unit competence. Ensure a conducive learning environment and lead a review of the previous lesson on drug storage, handle any homework or assignments. Help students link the previous lesson to the current lesson using an appropriate discovery activity.

e) Learning activities 3.4: Enteral routes of drug administration

Teacher's activities:

- Ask students to do individually activity 3.4 in their student books.
- Provide the to the students the necessary materials or guide them where they can get the materials.
- Move around in silence to monitor if they are having some problems.
- Guide the students, including those who are weak, without giving them the answers immediately.
- Invite randomly two students to present their findings to the rest of students.
- Ask other students to follow carefully the presentations.
- Those who are not acting may have to listen attentively without disturbing and should applaud the actors after.
- Note on chalk board / Manila paper or flip chart the students' ideas.
- Tick the correct findings and correct those ones which are incorrect and try again to complete those which are incomplete.
- Students may still have few things that are not still clear. Answer or address any questions or challenges about the activity. Guide them to make notes in their books referring to students' book.
- Harmonize and conclude on the learned knowledge.

Student's role:

- Work individually on the activity 3.4 as it appears in the student books.

- Use the materials and resources provided by the teacher to give answers to the activity.
- Attempt all the questions ensuring that participation of each member is obvious.
- Assist one another as they may have different levels of understanding.
- Selected members present the findings of the activity to the rest of students.
- Other students follow carefully the presentation of the findings.
- Those who are not presenting have to listen attentively without disturbing and should applaud their colleagues after presentation.
- Ask for more clarifications from the teacher and take notes in their notebooks.

Answers for learning activity 3.4

A. How can you define an enteral route of drug administration to your colleague?

Enteral route may be defined as a medium through which drugs are introduced in the body involving the gastrointestinal tract.

B. Types of enteral routes of drug administration are:

- Oral Administration (Oral route)
- Buccal or Sublingual Administration (Sublingual route)
- Rectal route

C. The enteral route that poses a greater risk of first-pass effect is oral route

Answers for Self-assessment 3.4

1. (A) It is easily self-administered method;
2. (D) Drugs are subject to first-pass metabolism.
3. (A) Rectal
4. FALSE (The oral route of drug administration is not suitable for an emergency as the onset of action is slow).

Lesson 5: Parenteral routes of drug administration

a) Learning objectives

By the end of this session, the students should be able to:

- Explain correctly and confidently the parenteral routes of drug administration

b) Prerequisites/Revision/Introduction

In order to understand well this lesson, the students must have been introduced to principles of pharmacokinetics and pharmacodynamics, drugs names, drug dosage forms, and fundamentals of nursing.

The tutor needs to assess how much students already know and what they would be interested in learning about parenteral routes of drug administration. Remind the students that the current session needs to be linked to the previous sessions.

c) Teaching resources

Students' books, internet connectivity, books or magazines, projector, markers, chalks, and any other trustworthy and reliable resources to enhance learning.

d) Possible methods

Think-pair-share, small group discussion, brainstorming, short class presentation, research in the library textbooks or on the internet are the main teaching methods that may be used.

Before the lesson, review the learning objective to determine what students will know and be able to do by the end of the lesson. This will help you to see the skills, knowledge, and attitudes embedded in the learning objective and prepare for your lesson appropriately. Remember the learning objectives link to the key unit competence. Ensure a conducive learning environment and lead a review of the previous lesson on enteral routes of drug administration, handle any homework or assignments. Help students link the previous lesson to the current lesson using an appropriate discovery activity.

e) Learning activities 3.5: Parenteral routes of drug administration

Teacher's activities:

- Ask students to do in small groups activity 3.5 in their student books.
- Provide the to the students the necessary materials or guide them where they can get the materials.
- Move around in silence to monitor if they are having some problems.
- Guide the students, including those who are weak, without giving them the answers immediately.
- Invite randomly two students to present their findings to the rest of students.
- Ask other students to follow carefully the presentations.
- Those who are not acting may have to listen attentively without disturbing and should applaud the actors after.
- Note on chalk board / Manila paper or flip chart the students' ideas.
- Tick the correct findings and correct those ones which are incorrect and try again to complete those which are incomplete.
- Students may still have few things that are not still clear. Answer or address any questions or challenges about the activity. Guide them to make notes in their books referring to students' book.

- Harmonize and conclude on the learned knowledge.

Student's role:

- Work in small groups on the activity 3.5 as it appears in the student books.
- Use the materials and resources provided by the teacher to give answers to the activity.
- Attempt all the questions ensuring that participation of each member is obvious.
- Assist one another as they may have different levels of understanding.
- Selected members present the findings of the activity to the rest of students.
- Other students follow carefully the presentation of the findings.
- Those who are not presenting have to listen attentively without disturbing and should applaud their colleagues after presentation.
- Ask for more clarifications from the teacher and take notes in their notebooks.

Answers for learning activity 3.5

1. I would advise the nurse to shift to parenteral routes (those that involve injections) because the patient is vomiting. The main parenteral routes are intramuscular route, intravenous route, intradermal route, and subcutaneous route. The choice may depend on patient's status, and the drug being given.
2. The following angles need to be used in parenteral routes (injections):
 - Intramuscular route: 90 degrees
 - Subcutaneous route: 45 degrees
 - Intravenous route: 25 degrees
 - Intradermal route: 10-15 degrees

Answers for Self-assessment 3.5

1. (A) Intravenous, intramuscular, subcutaneous
2. (D) Drugs undergo first-pass metabolism in the liver
3. (C) 90%
4. (A) The drug is delivered in the upper layer of the skin to the dermis, where the absorption is low

Lesson 6: Topical routes of drug administration

a) Learning objectives

By the end of this session, the students should be able to:

- Explain appropriately the topical route of drug administration

b) Prerequisites/Revision/Introduction

In order to understand well this lesson, the students must have been introduced to principles of pharmacokinetics and pharmacodynamics, drugs names, drug dosage forms, and fundamentals of nursing.

The tutor needs to assess how much students already know and what they would be interested in learning about topical routes of drug administration. Remind the students that the current session needs to be linked to the previous sessions.

c) Teaching resources

Students' books, internet connectivity, books or magazines, projector, markers, chalks, and any other trustworthy and reliable resources to enhance learning.

d) Possible methods

Think-pair-share, small group discussion, brainstorming, short class presentation, research in the library textbooks or on the internet are the main teaching methods that may be used.

Before the lesson, review the learning objective to determine what students will know and be able to do by the end of the lesson. This will help you to see the skills, knowledge, and attitudes embedded in the learning objective and prepare for your lesson appropriately. Remember the learning objectives link to the key unit competence. Ensure a conducive learning environment and lead a review of the previous lesson on parenteral routes of drug administration, handle any homework or assignments. Help students link the previous lesson to the current lesson using an appropriate discovery activity.

e) Learning activities 3.6: Topical route of drug administration

Teacher's activities:

- Ask students to do individually activity 3.6 in their student books.
- Provide the to the students the necessary materials or guide them where they can get the materials.
- Move around in silence to monitor if they are having some problems.
- Guide the students, including those who are weak, without giving them the answers immediately.
- Invite randomly two students to present their findings to the rest of students.

- Ask other students to follow carefully the presentations.
- Those who are not acting may have to listen attentively without disturbing and should applaud the actors after.
- Note on chalk board / Manila paper or flip chart the students' ideas.
- Tick the correct findings and correct those ones which are incorrect and try again to complete those which are incomplete.
- Students may still have few things that are not still clear. Answer or address any questions or challenges about the activity. Guide them to make notes in their books referring to students' book.
- Harmonize and conclude on the learned knowledge.

Student's role:

- Work individually on the activity 3.6 as it appears in the student books.
- Use the materials and resources provided by the teacher to give answers to the activity.
- Attempt all the questions ensuring that participation of each member is obvious.
- Assist one another as they may have different levels of understanding.
- Selected members present the findings of the activity to the rest of students.
- Other students follow carefully the presentation of the findings.
- Those who are not presenting have to listen attentively without disturbing and should applaud their colleagues after presentation.
- Ask for more clarifications from the teacher and take notes in their notebooks.

Answers for learning activity 3.6

1. In all the images, the drugs are being administered topically. In image A, the drug (drops) is being administered in the nose (intranasal route).

For the image B, the drug (cream) is being administered on the skin for a topical effect/

In the image C, a patch has been placed to administer the drug transdermally. The drug may be used for both local and systemic effects.

In the image D, the drug (drops) is being administered in the eyes.

2. Benefits of topical route:
 - Alternative to oral administration
 - Fewer risks of gastrointestinal difficulties
 - Fewer risks of abuse

- Easy to administer
- Reduced hospital congestion

Answers for Self-assessment 3.6

1. Advantages of administering the drugs by the inhalational route:
May be used for local or systemic effects.
2. Disadvantages of administering the drugs by the inhalational route:
 - Particle size of drugs determines anatomic placement in the respiratory tract.
 - May stimulate cough reflex.
 - Some drugs may be swallowed.
3. FALSE: Transdermal administration is a route wherein active ingredients are delivered across the skin for systemic distribution of the drug
4. Advantages of administering the drugs by the transdermal route:
 - The transdermal delivery system (patch) is easy to use and withdraw.
 - Continuous release of the drug is observed for a specified period of time.
 - It is used for lipid-soluble drugs with a low dose and low molecular weight.
 - Low pre-systemic metabolism.

Lesson 7: Introduction to medications errors and classification of medication errors

a) Learning objectives

By the end of this session, the students should be able to:

- Explain appropriately the main categories of medication errors

b) Prerequisites/Revision/Introduction

In order to understand well this lesson, the students must have been introduced to principles of pharmacokinetics and pharmacodynamics, drugs names, drug dosage forms, and fundamentals of nursing.

The tutor needs to assess how much students already know and what they would be interested in learning about medication errors. Remind the students that the current session needs to be linked to the previous sessions.

c) Teaching resources

Students' books, internet connectivity, books or magazines, projector, markers, chalks, and any other trustworthy and reliable resources to enhance learning.

d) Possible methods

Think-pair-share, small group discussion, brainstorming, short class presentation, research in the library textbooks or on the internet are the main teaching methods that may be used.

Before the lesson, review the learning objective to determine what students will know and be able to do by the end of the lesson. This will help you to see the skills, knowledge, and attitudes embedded in the learning objective and prepare for your lesson appropriately. Remember the learning objectives link to the key unit competence. Ensure a conducive learning environment and lead a review of the previous lessons on different routes of drug administration, handle any homework or assignments. Help students link the previous lesson to the current lesson using an appropriate discovery activity.

e) Learning activities 3.7: Introduction to medications errors and classification of medication errors

Teacher's activities:

- Ask students to do in small groups activity 3.7 in their student books.
- Provide the to the students the necessary materials or guide them where they can get the materials.
- Move around in silence to monitor if they are having some problems.
- Guide the students, including those who are weak, without giving them the answers immediately.
- Invite randomly two students to present their findings to the rest of students.
- Ask other students to follow carefully the presentations.
- Those who are not acting may have to listen attentively without disturbing and should applaud the actors after.
- Note on chalk board / Manila paper or flip chart the students' ideas.
- Tick the correct findings and correct those ones which are incorrect and try again to complete those which are incomplete.
- Students may still have few things that are not still clear. Answer or address any questions or challenges about the activity. Guide them to make notes in their books referring to students' book.
- Harmonize and conclude on the learned knowledge.

Student's role:

- Work in small groups on the activity 3.7 as it appears in the student books.
- Use the materials and resources provided by the teacher to give answers to the activity.

- Attempt all the questions ensuring that participation of each member is obvious.
- Assist one another as they may have different levels of understanding.
- Selected members present the findings of the activity to the rest of students.
- Other students follow carefully the presentation of the findings.
- Those who are not presenting have to listen attentively without disturbing and should applaud their colleagues after presentation.
- Ask for more clarifications from the teacher and take notes in their notebooks.

Answers for learning activity 3.7

1. The type of medication error which was committed for this patient is “Prescribing errors.”
2. Other types of medication errors according to their categories or classification are: Transcription errors, Dispensing errors, Administration errors, and Monitoring errors
3. Definition of a medication error: Any preventable event that may cause or lead to inappropriate medication use or patient harm while the medication is in the control of the healthcare professional, patient, or consumer.

Answers for Self-assessment 3.7

1. Causes of medication errors:
 - Expired Product
 - Incorrect Duration
 - Incorrect Preparation
 - Incorrect Strength:
 - Incorrect Rate:
 - Incorrect Timing
 - Incorrect Dose:
 - Incorrect Dosage Form:
 - Incorrect Patient Action:
 - Known Allergen:
 - Known Contraindication
2. (A) Prescribing errors
3. (D) Monitoring errors

Lesson 8: Actions to take in case of medication errors, and use of high alert medications

a) Learning objectives

By the end of this session, the students should be able to:

- Describe correctly actions to take in case of medication errors, and use of high alert medications.

b) Prerequisites/Revision/Introduction

In order to understand well this lesson, the students must have been introduced to principles of pharmacokinetics and pharmacodynamics, drugs names, drug dosage forms, and fundamentals of nursing.

The teacher needs to assess how much students already know and what they would be interested in learning about medication errors, especially on the actions to take in case of medication errors, and precautions to take when using high alert medications to avoid errors. Remind the students that the current session needs to be linked to the previous sessions.

c) Teaching resources

Students' books, internet connectivity, books or magazines, projector, markers, chalks, and any other trustworthy and reliable resources to enhance learning.

d) Possible methods

Think-pair-share, small group discussion, brainstorming, short class presentation, research in the library textbooks or on the internet are the main teaching methods that may be used.

Before the lesson, review the learning objective to determine what students will know and be able to do by the end of the lesson. This will help you to see the skills, knowledge, and attitudes embedded in the learning objective and prepare for your lesson appropriately. Remember the learning objectives link to the key unit competence. Ensure a conducive learning environment and lead a review of the previous lesson on introduction to medication errors and their classification, handle any homework or assignments. Help students link the previous lesson to the current lesson using an appropriate discovery activity.

e) Learning activities 3.8: Actions to take in case of medication errors, and use of high alert medications

Teacher's activities:

- Ask students to do individually activity 3.8 in their student books.
- Provide the to the students the necessary materials or guide them where they can get the materials.

- Move around in silence to monitor if they are having some problems.
- Guide the students, including those who are weak, without giving them the answers immediately.
- Invite randomly two students to present their findings to the rest of students.
- Ask other students to follow carefully the presentations.
- Those who are not acting may have to listen attentively without disturbing and should applaud the actors after.
- Note on chalk board / Manila paper or flip chart the students' ideas.
- Tick the correct findings and correct those ones which are incorrect and try again to complete those which are incomplete.
- Students may still have few things that are not still clear. Answer or address any questions or challenges about the activity. Guide them to make notes in their books referring to students' book.
- Harmonize and conclude on the learned knowledge.

Student's role:

- Work individually on the activity 3.8 as it appears in the student books.
- Use the materials and resources provided by the teacher to give answers to the activity.
- Attempt all the questions ensuring that participation of each member is obvious.
- Assist one another as they may have different levels of understanding.
- Selected members present the findings of the activity to the rest of students.
- Other students follow carefully the presentation of the findings.
- Those who are not presenting have to listen attentively without disturbing and should applaud their colleagues after presentation.
- Ask for more clarifications from the teacher and take notes in their notebooks.

Answers for learning activity 3.8

1. Definition of a high alert medication: **High-Alert Medications** are medicines that have high potential risk to the patient when they are utilized in error.
2. Strategies to reduce errors involving High Alert Medication on the aspect of their storage:
 - Minimize High Alert Medications from clinical areas, where possible.
 - High Alert Medication should be stored individually in separate labelled plastic container.

- Label the shelves or containers used for storing Alert Medications as “**HIGH ALERT MEDICATIONS.**”

Answers for Self-assessment 3.8

1. Definition of Look Alike Sound Alike (LASA) medications: Look Alike Sound Alike (LASA) medications involve medicines that are visually similar in physical appearance or packaging and names of medications that have spelling similarities and/or similar phonetics.
2. Meaning of “Tall Man lettering” as a strategy to reduce the errors associated with the use of LASA medications: It is the practice of writing part of a medicines name in upper case letters to help distinguish sound-alike/look-alike medications from one another to avoid medication errors.
3. Strategies to avoid errors with LASA Medications during their supply/dispensing:
 - Identify medicines based on its name and strength and not by its appearance or location.
 - Check the purpose of the medication and the dose for the medicines dispensed.
 - Read medication prescription and label carefully at all dispensing stages
 - Commitment to a final accuracy check by a qualified person, before handing over the medicine to the patient or the patient’s representative
 - Double check should be conducted at any stage during the dispensing and supply process.
 - Highlight changes in medication appearances to patients upon dispensing.
4. Strategies to avoid errors with High Alert Medications during their prescription:
 - Place LASA medications in locations separate from each other or in non-alphabetical order.
 - Write legibly, using both the brand and generic names for prescribing LASA medications.
 - Prescription should clearly specify name of medication, dosage form, dose and complete direction for use.
 - Write the diagnosis or medication’s indication for use. This information helps to differentiate possible choices in illegible orders.
 - In electronic prescribing system, using techniques such as Tall-man lettering, boldface and color differences to reduce the confusion associated with the use of LASA names on the computer screens and medication administration records.

- Communicate clearly. Take your time in pronouncing the drug name whenever an oral order made.
- Ask that the recipient of the oral communication repeat the medication name and dose.
- Minimize the use of Verbal and Telephone orders

Lesson 9: Systems of measurement used in pharmacology

a) Learning objectives

By the end of this session, the students should be able to:

- Perform accurately the conversions using different systems of measurement used in pharmacology.

b) Prerequisites/Revision/Introduction

In order to understand well this lesson, the students must have been introduced to principles of pharmacokinetics and pharmacodynamics, drugs names, drug dosage forms, and fundamentals of nursing.

The teacher needs to assess how much students already know and what they would be interested in systems of measurement used in pharmacology. Remind the students that the current session needs to be linked to the previous sessions.

c) Teaching resources

Students' books, internet connectivity, books or magazines, projector, markers, chalks, and any other trustworthy and reliable resources to enhance learning.

d) Possible methods

Think-pair-share, small group discussion, brainstorming, short class presentation, research in the library textbooks or on the internet are the main teaching methods that may be used.

Before the lesson, review the learning objective to determine what students will know and be able to do by the end of the lesson. This will help you to see the skills, knowledge, and attitudes embedded in the learning objective and prepare for your lesson appropriately. Remember the learning objectives link to the key unit competence. Ensure a conducive learning environment and lead a review of the previous lesson on medication errors, handle any homework or assignments. Help students link the previous lesson to the current lesson using an appropriate discovery activity.

e) Learning activities 3.9: Systems of measurement used in pharmacology

Teacher's activities:

- Ask students to do in small groups activity 3.9 in their student books.

- Provide the to the students the necessary materials or guide them where they can get the materials.
- Move around in silence to monitor if they are having some problems.
- Guide the students, including those who are weak, without giving them the answers immediately.
- Invite randomly two students to present their findings to the rest of students.
- Ask other students to follow carefully the presentations.
- Those who are not acting may have to listen attentively without disturbing and should applaud the actors after.
- Note on chalk board / Manila paper or flip chart the students' ideas.
- Tick the correct findings and correct those ones which are incorrect and try again to complete those which are incomplete.
- Students may still have few things that are not still clear. Answer or address any questions or challenges about the activity. Guide them to make notes in their books referring to students' book.
- Harmonize and conclude on the learned knowledge.

Student's role:

- Work in small groups on the activity 3.9 as it appears in the student books.
- Use the materials and resources provided by the teacher to give answers to the activity.
- Attempt all the questions ensuring that participation of each member is obvious.
- Assist one another as they may have different levels of understanding.
- Selected members present the findings of the activity to the rest of students.
- Other students follow carefully the presentation of the findings.
- Those who are not presenting have to listen attentively without disturbing and should applaud their colleagues after presentation.
- Ask for more clarifications from the teacher and take notes in their notebooks.

Answers for learning activity 3.9

1. It is a teaspoon which is equivalent to 5mL each.
2. Three teaspoons are usually in one tablespoon.

Answers for Self-assessment 3.9

1. The 4 main measuring systems used in pharmacology are:
 - Metric system,

- Apothecary system,
 - Household system, and
 - Avoirdupois system
2. 30mL (metric measurement) are equivalent to 2 tablespoons (household measurement).
 3. The teaspoon is the basic unit of fluid measure in household system
 4. What is the equivalent metric measure of 2 teaspoons?

Lesson 10: Characteristics of a well written medical prescription

a) Learning objectives

By the end of this session, the students should be able to:

- Describe correctly the characteristics of a well written medical prescription

b) Prerequisites/Revision/Introduction

In order to understand well this lesson, the students must have been introduced to principles of pharmacokinetics and pharmacodynamics, drugs names, drug dosage forms, and fundamentals of nursing.

The teacher needs to assess how much students already know and what they would be interested in learning about characteristics of a well written medical prescription. Remind the students that the current session needs to be linked to the previous sessions.

c) Teaching resources

Students' books, internet connectivity, books or magazines, projector, markers, chalks, and any other trustworthy and reliable resources to enhance learning.

d) Possible methods

Think-pair-share, small group discussion, brainstorming, short class presentation, research in the library textbooks or on the internet are the main teaching methods that may be used.

Before the lesson, review the learning objective to determine what students will know and be able to do by the end of the lesson. This will help you to see the skills, knowledge, and attitudes embedded in the learning objective and prepare for your lesson appropriately. Remember the learning objectives link to the key unit competence. Ensure a conducive learning environment and lead a review of the previous lessons on medication errors, handle any homework or assignments. Help students link the previous lesson to the current lesson using an appropriate discovery activity.

e) Learning activities 3.10: Characteristics of a well written medical prescription

Teacher's activities:

- Ask students to do individually activity 3.10 in their student books.
- Provide the to the students the necessary materials or guide them where they can get the materials.
- Move around in silence to monitor if they are having some problems.
- Guide the students, including those who are weak, without giving them the answers immediately.
- Invite randomly two students to present their findings to the rest of students.
- Ask other students to follow carefully the presentations.
- Those who are not acting may have to listen attentively without disturbing and should applaud the actors after.
- Note on chalk board / Manila paper or flip chart the students' ideas.
- Tick the correct findings and correct those ones which are incorrect and try again to complete those which are incomplete.
- Students may still have few things that are not still clear. Answer or address any questions or challenges about the activity. Guide them to make notes in their books referring to students' book.
- Harmonize and conclude on the learned knowledge.

Student's role:

- Work individually on the activity 3.10 as it appears in the student books.
- Use the materials and resources provided by the teacher to give answers to the activity.
- Attempt all the questions ensuring that participation of each member is obvious.
- Assist one another as they may have different levels of understanding.
- Selected members present the findings of the activity to the rest of students.
- Other students follow carefully the presentation of the findings.
- Those who are not presenting have to listen attentively without disturbing and should applaud their colleagues after presentation.
- Ask for more clarifications from the teacher and take notes in their notebooks.

Answers for learning activity 3.10

1. Meaning of a PRN order to your colleague: A drug may be ordered on a prn (as needed) basis as circumstances indicate. The drug is administered when, in the nurse's judgment, the client's condition requires it.
2. Other types of medication orders:
 - Stat orders
 - Single-dose orders
 - Standing orders
3. In Rwanda, physicians have the broadest prescriptive authority of medications.

Answers for Self-assessment 3.10

1. (C) An order for a single dose of medication to be given immediately, often in emergency situations to modify a serious physiological response
2. The 7 main parts of a drug order:
 - 1) Identification of the client (name, age, sex, etc)
 - 2) The date and time when the order is written
 - 3) The name of the drug to be administered
 - 4) The dosage
 - 5) The route by which it is to be administered and special directives about its administration
 - 6) The time of administration and frequency
 - 7) The signature of the person writing the order, such as the physician or advanced practice registered nurse
3. "Repeats" or "refills" for prescribed drugs specifies whether the patient may obtain more of the same medication without getting a new prescription from the medical practitioner.

Lesson 11: Drug dosage calculation

a) Learning objectives

By the end of this session, the students should be able to:

- Perform accurately the necessary drug calculation according to dosage forms.

b) Prerequisites/Revision/Introduction

In order to understand well this lesson, the students must have been introduced to principles of pharmacokinetics and pharmacodynamics, drugs names, drug dosage forms, and fundamentals of nursing.

The teacher needs to assess how much students already know and what they would be interested in learning about drug dosage calculation. Remind the students that the current session needs to be linked to the previous sessions.

c) Teaching resources

Students' books, internet connectivity, books or magazines, projector, markers, chalks, and any other trustworthy and reliable resources to enhance learning.

d) Possible methods

Think-pair-share, small group discussion, brainstorming, short class presentation, research in the library textbooks or on the internet are the main teaching methods that may be used.

Before the lesson, review the learning objective to determine what students will know and be able to do by the end of the lesson. This will help you to see the skills, knowledge, and attitudes embedded in the learning objective and prepare for your lesson appropriately. Remember the learning objectives link to the key unit competence. Ensure a conducive learning environment and lead a review of the previous lesson that was about medical prescription, handle any homework or assignments. Help students link the previous lesson to the current lesson using an appropriate discovery activity.

e) Learning activities 3.11: Drug dosage calculation

Teacher's activities:

- Ask students to do individually activity 3.11 in their student books.
- Provide the to the students the necessary materials or guide them where they can get the materials.
- Move around in silence to monitor if they are having some problems.
- Guide the students, including those who are weak, without giving them the answers immediately.
- Invite randomly two students to present their findings to the rest of students.
- Ask other students to follow carefully the presentations.
- Those who are not acting may have to listen attentively without disturbing and should applaud the actors after.
- Note on chalk board / Manila paper or flip chart the students' ideas.

- Tick the correct findings and correct those ones which are incorrect and try again to complete those which are incomplete.
- Students may still have few things that are not still clear. Answer or address any questions or challenges about the activity. Guide them to make notes in their books referring to students' book.
- Harmonize and conclude on the learned knowledge.

Student's role:

- Work individually on the activity 3.11 as it appears in the student books.
- Use the materials and resources provided by the teacher to give answers to the activity.
- Attempt all the questions ensuring that participation of each member is obvious.
- Assist one another as they may have different levels of understanding.
- Selected members present the findings of the activity to the rest of students.
- Other students follow carefully the presentation of the findings.
- Those who are not presenting have to listen attentively without disturbing and should applaud their colleagues after presentation.
- Ask for more clarifications from the teacher and take notes in their notebooks.

Answers for learning activity 3.11

1. The milligrams that nurse will administer on this dose

$$1 \text{ kg} \longrightarrow 15\text{mg (of acetaminophen)}$$

$$12 \text{ kg} \longrightarrow 15\text{mg} \times 12$$

Dose: 180 mg

2. The milliliters that the associate nurse will draw from the ampule at each drug administration (dose):

$$80\text{mg} \longrightarrow 2\text{mL}$$

$$60\text{mg} \longrightarrow \frac{60\text{mg} \times 2\text{mL}}{80\text{mg}}$$

Milliliters to draw per dose =1.5 milliliters

3. The patient is prescribed 500mg TDS

500mg are equivalent to 2 tablets of 250mg

The patient will take 6 tablets of 250mg per day.

Answers for Self-assessment 3.11

1. The nurse should give 2 tablets (per dose).
2. $50\text{mg} \times 3\text{ml} / 75\text{mg} = 2\text{ml}$
3. The amount prescribed is 50mg and the amount per measure is 25mg so the number of measures is 2. Now each measure is 5ml so the quantity to be given is $2 \times 5 = 10\text{ml}$.

3.6 Summary of the unit

- The principles of drug administration are essential component of safe drug use. They are the guiding principles in determining the right doses of right drugs to be administered to the right patients.
- It is a standard during nursing education to receive instructions on a guide to clinical medication administration and upholding patient safety known as the 'Ten rights' or 'Ten R's' of medication administration
- The RIGHTS of drug administration that the nurse ought to consider in their daily activities are: Right Patient, Right Reason or Indication, Right drug, Right dose, Right Route and form, Right Time, Right Documentation, Right Response, Right to Refuse, and Right evaluation
- It is the responsibility of nurses who are with clients most of the time, to ensure that clients adhere to the prescribed treatment regimen.
- Adherence describes how a patient follows a medical regime recommended by a healthcare provider.
- It has been proved that poor treatment adherence usually results in poor clinical outcomes to patients.
- Terms "Compliance, adherence and concordance" are usually used interchangeably, with the intent to ensure that drugs are taking their medications the way it should be.
- Proper storage of drugs is an important component of using drugs safely and effectively.
- Some drugs may be damaged with improper storage.
- Some drugs require to be stored on room temperature while there are others that require special measures, including storing them in the refrigerator or the locked container such as the controlled drugs.
- Drugs are administered via different routes. The main routes of drug administration include enteral routes, parenteral routes, and topical route. The parenteral routes are common, and they usually present benefits of being convenient as well as cost-effective. The enteral routes include oral, sublingual, and rectal routes. Parenteral routes involve injecting drugs, and the

most common are intravenous, intramuscular, subcutaneous and intradermal routes. The topical routes rely on applying the drug on a determined site for local action. The transdermal route is another topical route even if it may end up exerting systemic effects.

- Medicine errors cause considerable patient morbidity, mortality and increased healthcare cost.
- The medication errors are usually categorized into prescribing errors, transcription errors, dispensing errors, administration errors, and monitoring errors.
- It is the responsibility of the nurses and other healthcare providers to minimize the medication errors, usually by respecting the RIGHTS of medication administration.
- Special measures should be taken for high-alert medications because they have high potential risk to the patient when they are utilized in error.
- Necessary measures also need to be taken for Look Alike Sound Alike (LASA) medications, which are medicines that are visually similar in physical appearance or packaging and names of medications that have spelling similarities and/or similar phonetics.
- It is very common for healthcare providers, and nurses in particular to perform accurate pharmaceutical measurements, calculations and conversions when it comes to medication administration.
- Without this ability, a health care professional is not able to apply their knowledge of pharmacology in a practical manner during their everyday work functions. This is important as one incorrect calculation, conversion or measurements will affect a dosage, and can potentially harm a patient.
- The four main measurement systems are: metric system, the apothecary system, the household system, and the avoirdupois system.
- Administration of drugs must always base on the medical prescription, and the prescription (abbreviated as P_x) may simply be defined as a health-care program implemented by a physician or other medical practitioner in the form of instructions that govern the plan of care for an individual patient.
- Usually, the term prescription is used to mean **an order to take certain medications**.
- It is the responsibility of the nurse and other healthcare providers to ensure that prescription order is well written, and bears all necessary components.
- There are 4 main types of medication orders, mainly stat order, standing order, single-dose orders, and PRN orders. The nurse must then administer drugs according to the type of medication order.

- Finally, it is common for the nurses to make calculations before administering different drugs. It is the responsibility of the nurses to accurately make calculations whenever necessary, to avoid errors in drug administration.

3.7 Additional information for Teachers

I. MEDICATION ERRORS

1. *High Alert Medications Classes/ Categories List*

- Adrenergic agonists. IV (E.g.: EPINEPHrine, Norepinephrine. Phenylephrine)
- Adrenergic antagonists. IV (e.g., Bisoprolol. Propranolol, Labetalol)
- Anaesthetic agents, general, inhaled and IV (e.g., Propofol, Ketamine)
- Antiarrhythmic, IV (e.g., Lidocaine, Amiodarone, Adenosine)
- Antithrombotic agents, (e.g., Warfarin, Heparin. Streptokinase)
- Cardioplegic solutions
- Chemotherapeutic agents, parenteral and oral
- Dextrose, hypertonic. 20% or greater
- Dialysis solutions, peritoneal and hemodialysis
- Epidural or intrathecal medications
- Oral Hypoglycemic: (e.g., Glibenclamide, Gliclazide, Metformin Hcl)
- Inotropic medications, IV: (e.g., Digoxin, Milrinone, Inamrinone)
- Insulin, subcutaneous and IV
- Liposomal forms of drugs (e.g., liposomal amphotericin B) and conventional counterparts (e.g., amphotericin B desoxycholate)
- Moderate sedation agents, IV , oral, for children: (e.g., dexmedetomidine, midazolam)
- Narcotics/opioids, IV, transdermal and oral (including liquid concentrates, immediate and sustained release formulations)
- Neuromuscular blocking agents: (e.g.. Suxamethonium. Rocuronium, Vecuronium)
- Parenteral nutrition preparations
- Radio contrast agents, IV
- Sterile water for injection
- Sodium chloride for injection, hypertonic, greater than 0.9% concentration

2. **Specific High Alert Medications List**

- Colchicine injection
- Epoprostenol, IV
- Insulin, subcutaneous and IV
- Magnesium Sulfate injection
- Methotrexate, oral, for non-oncologic use
- Oxytocin, IV
- Nitroprusside Sodium for injection
- Potassium Chloride for injection concentrate
- Potassium Phosphates injection
- Promethazine, IV
- Sodium Chloride injection, hypertonic (greater than 0.9% concentration)
- Sterile Water for injection. inhalation and irrigation (excluding pour bottles) in containers of 100 mL or more

ii. **DRUG DOSAGE CALCULATIONS**

◆ **Dosage strengths**

This refers to the weight or amount of the medication per unit of measure (weight per tablet, capsule/milliliter, etc).

E.g.: Lidocaine 10mg/ml

◆ **Dilution calculation**

E.g.1.: The physician orders a 6 mL of an 8% solution and the only type of preparation on hand is a 20% solution. How will you prepare that solution to patient?

- $C1V1 = C2V2$
- 1: before dilution
- 2: after dilution

If two solutions are needed to prepare one solution:

- $CFVF = C1V1 + C2V2$
- F: final solution
- 1: 1st solution
- 2: 2nd solution
- $C1V1 = C2V2 = 20\% \cdot X \text{ mL} = 8\% \cdot 6\text{mL}$
- $X = 8 \times 6 / 20 = 48 / 20 = 2.4\text{mL}$

- ◆ 2.4mL of 20% will be needed and 3.6mL of diluents will be added to 2.4 mL from the 20% solution for a total dose of 6mL (3.6+2.4) at 8% strength.

E.g.2.: A physician orders for a patient a 100mL solution of glucose 14% and You have on hand a solution of glucose 50% and a solution of glucose 5%. How will you prepare the prescribed solution?

- $CFVF = C1V1 + C2V2$
- $14\% \cdot 100\text{mL} = V1 \cdot 50\% + V2 \cdot 5\%$
- $VT = V1 + V2$
- $V1 = 20\text{ mL}$
- $V2 = 80\text{mL}$
 - ◆ 20mL of glucose 50% will be combined with 80mL of glucose 5% to form a 100mL of solution of glucose 14%

Answers to end unit assessment 3

1. (C) More than half an hour to avoid consequences
2. (A) Right evaluation
3. (B) The controlled drugs should be in double locked container, and 2 licensed personnel count (or verify any discrepancies) every shift.
4. (A) The medication is deposited just beneath the skin in the loose subcutaneous tissue.
5. (B) Administration errors
6. (D) 5 milliliters
7. (D) These are the orders for drugs that are administered routinely as specified until the order is canceled by another order.
8. Social and economic dimensions affecting adherence to medications.
 - Limited language proficiency
 - Low health literacy
 - Lack of family or social support network
 - Unstable living conditions; homelessness
 - Burdensome schedule
 - Limited access to health care facilities
 - Lack of health care insurance
 - Inability or difficulty accessing pharmacy
 - Medication cost
 - Cultural and lay beliefs about illness and treatment
 - Elder abuse

9. Advantages of rectal route of drug administration.
 - It avoids the first-pass metabolism
 - Suitable for children and old age.
 - It is used for unconscious and vomiting patients
10. Disadvantages of administering the drugs by the transdermal route?
 - Some irritation by patch or drug.
 - Permeability of skin is variable with the condition, anatomic site, age and gender.
 - Type of cream or ointment base effects the drug release and absorption.

3.8 Additional activities

3.8.1 Remedial Activities

1. You have been instructed to administer an intravenous injection (Ceftriaxone 1g) to a patient. What is the minimum of times should you check the medication label before administering this drug?
 - A. One
 - B. Three
 - C. Five
 - D. Seven
2. In which of the following types of medication errors would a medication error which involves incorrect drugs product selection based on known allergies be classified?
 - A. Prescribing errors
 - B. Transcription errors
 - C. Dispensing errors
 - D. Monitoring errors
3. Which of the following measuring systems used in pharmacology is based on the decimal system, so all units are determined as multiples of 10?
 - A. Apothecary system
 - B. Household system
 - C. Avoirdupois system
 - D. Metric system
4. Quinine injection is available as an ampule of 600mg/2 mL. This means that the concentration is 300mg/ml. Question: How much volume of liquid (drug) will the client receive when the prescription is to give only 500 mg?

Answers for remedial activities

1. (B) Three
2. (A) Prescribing errors
3. (D) Metric system
4. Answer: $500\text{mg} \times 2\text{ml} / 600\text{mg} = 1.66\text{ mL}$. This means 1.7 mL

3.8.2 Consolidation activities

1. In order to prevent damage of stored drugs, the number of stacks in case of vertical stacking should not exceed five stacks? TRUE or FALSE
2. What are the instructions regarding storage of controlled drugs?
3. Which of the following statements best describes a SINGLE-DOSE order?
 - A. The drug is administered when, in the nurse's judgment, the client's condition requires it such as in case of pain management.
 - B. These are one-time medications or orders that require the administration of drops or even tablets over a short period of time.
 - C. An order for a single dose of medication to be given immediately, often in emergency situations to modify a serious physiological response
 - D. These are the orders for drugs that are administered routinely as specified until the order is canceled by another order.
5. All of the following are the main parts of a medication order, EXCEPT:
 - A. The frequency of drug administration
 - B. The name of the drug to administer
 - C. The time of drug administration
 - D. The signature of the patient

Answers for consolidation activities

1. FALSE. It should not exceed eight stacks
2. Instructions regarding storage of controlled drugs:
 - Controlled drugs must be kept in a locked cabinet or cupboard.
 - The keys to the cabinet must be in the possession of an authorised person. Authorised person refers to ward manager or deputy who must be a trained nurse or midwife.
 - Students should not be responsible for the controlled drug cupboard keys.
3. (B) These are one-time medications or orders that require the administration of drops or even tablets over a short period of time

4. (D) The signature of the patient. It should rather bear the signature of the person writing the order

3.8.3 Extended activities

1. Compliance, adherence and concordance are used interchangeably while defining how a patient follows a medical regime recommended by a healthcare provider. Which term is more preferable between compliance and adherence?
2. Enumerate patient condition-related factors (dimensions) affecting adherence to medications.
3. The liter is the basic unit of liquid measure in the metric system. TRUE or FALSE
4. A syrup is available as 50mg/5ml and the patient must be given 75mg. What volume in milliliters will be given?

Answers for extended activities

1. Adherence is nowadays preferably used because compliance implies an authoritarian, asymmetric physician-patient relationship, in which the doctor has the exclusive decisional power. Physicians give instructions and patients are passive recipients and should follow the prescribed regime without deviation.
2. Condition-related factors (dimensions) affecting adherence to medications are:
 - Chronic conditions
 - Lack of symptoms
 - Severity of symptoms
 - Depression
 - Psychotic disorders
 - Mental retardation/developmental disability
3. TRUE (The liter is the basic unit of liquid measure in the metric system).
4. The amount prescribed is 75mg and the amount per measure is 50mg, so the number of measures is 1.5. Now each measure is 5ml so the quantity to be given is $1.5 \times 5 = 7.5\text{ml}$.

References

1. Karch (2013). Focus on Nursing Pharmacology, 6th edition. Wolters Kluwer Health | Lippincott Williams & Wilkins
2. Michael Patrick Adams, Leland Norman Holland, Jr, and Carol Quam Urban (2014). Pharmacology for Nurses: A Pathophysiologic Approach. 4th edition. Pearson Education, Inc.
3. David E. Golan, Ehrin J. Armstrong, and April W. Armstrong (2017). PRINCIPLES of PHARMACOLOGY THE PATHOPHYSIOLOGIC BASIS OF DRUG THERPY.4th edition. Wolters Kluwer
4. Bertram G.K, Susan B.M., and Anthony.J.Trevor (2012). Basic and Clinical Pharmacology, 12th Ed.Mc Graw Hill LANGE.
5. Chen, S. C. A., & Sorrell, T. C. (2007). Antifungal agents. Medical Journal of Australia, 187(7), 404–409. <https://doi.org/10.5694/j.1326-5377.2007.tb01313.x>
6. David, E. G., Ehrin, J. A., & April, W. A. (2017). Principles of pharmacology: the pathophysiologic basis of drug therapy (4th ed.). Philadelphia : Wolters Kluwer Health. Lippincott Williams & Wilkins.
7. Karch, A. M. (2013). Focus on Nursing Pharmacology (6th ed., Vol. 1). Wolters Kluwer/ Lippincott Williams and Wilkins. www.ketabpezeshki.com
8. Nett, J. E., & Andes, D. R. (2015). Antifungal Agents: Spectrum of Activity, Pharmacology, and Clinical Indications. Infectious Disease Clinics of North America, 1–33. <https://doi.org/10.1016/j.idc.2015.10.012>

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