REB RWANDA BASIC EDUCATION BOARD

PHARMACOLOGY

Associate Nursing Program

Teacher's Guide

SENIOR 5

First Edition

FOREWORD

Dear Teacher,

Rwanda Basic Education Board is honoured to present teacher's guide for associate nursing program which assists the teacher as guidance to the competence-based teaching and learning to ensure consistence in the learning of Pharmacology subject.

The Rwandan educational philosophy is to ensure that student-associate nurses achieve full potential at every level of education which will prepare them to be able to respond to the community health needs and exploit employment opportunities.

In line with efforts to improve the quality of education, the government of Rwanda emphasizes the importance of aligning teaching and learning materials with the syllabus to facilitate their learning process. Many factors influence what they learn, how well they learn and the competences they acquire. Those factors include the relevance of the specific content, the quality of teacher's pedagogical approaches, the assessment strategies and the instructional materials available.

We paid special attention to the activities that facilitate the learning process in which student-associate nurse can develop ideas and make new discoveries during concrete activities carried out individually or with peers. With the help of the teacher, student-associate nurse will gain appropriate skills and be able to apply what they have learnt in real life situations.

Hence, they will be able to develop certain values and attitudes allowing them to make a difference not only to their own life but also to the nation. This is in contrast to traditional learning theories which view learning mainly as a process of acquiring knowledge from the more knowledgeable who is mostly the teacher.

In competence-based curriculum, learning is considered as a process of active building and developing of knowledge and understanding, skills and values and attitude by the student-associate nurses where concepts are mainly introduced by an activity, situation or scenario that helps the student-associate nurses to construct knowledge, develop skills and acquire positive attitudes and values.

In addition, such active learning engages student- associate nurses in doing things and thinking about the things they are doing and they are encouraged to bring their own real experiences and knowledge into the learning processes.

In view of this, your role is to:

- Plan your lessons and prepare appropriate teaching and learning materials.
- Organize group discussions for student-associate nurse considering the importance of social constructivism suggesting that learning occurs more

effectively when the student-associate nurses works collaboratively with more knowledgeable and experienced people.

- Engage student-associate nurses through active learning methods such as inquiry methods, group discussions, research, investigative activities, group and individual work activities.
- Provide supervised opportunities for student-associate nurses to develop different competences by giving tasks which enhance critical thinking, problem solving, research, creativity innovation, communication and cooperation.
- Support and facilitate the learning process by valuing student-associate nurses' contributions in the class activities.
- Guide student-associate nurses towards the harmonization of their findings.
- Encourage individual, peer and group evaluation of the work done in the classroom and use appropriate competence-based assessment approaches and methods.

To facilitate you in your teaching activities, the content of this teacher's guide is self-explanatory so that you can easily use it. **It is divided in 3 parts:**

The part 1: Explains the structure of this teacher's guide and gives you the methodological guidance;

The part 2: Gives the sample lesson plans as reference for your lesson planning process;

The part 3: Provides the teaching guidance for each concept given in the student book.

Even though this teacher's guide contains the Answers to all activities given in the Student book, you are requested to work through each question and activity before judging the student's findings. I wish to sincerely extend my appreciation to the people who contributed towards the development of this Teacher's Guide, the Ministry of Health, Human Resource for Health Secretariat (HRHS), University of Rwanda, School of Nursing and Midwifery, Higher Learning Institutions and Rwanda Basic Education Board.

Special gratitude goes to University faculty, Nurses, Midwives, Teachers, illustrators, designers, HRH Secretariat Staff and REB Staff who diligently worked to successful completion of this book.

Dr. MBARUSHIMANA Nelson

Director General of Rwanda Education Board

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PART I: GENERAL INTRODUCTION

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1.0. About the Teacher's Guide

This book is a teacher's guide for Pharmacology subject, for senior five 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, and guidance on assessment in the course of Pharmacology.

- **Part II: Sample lesson plan**

This part provides a sample lesson plan, developed and designed to help the teachers 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	Describe the relationship and interdependence of sciences Observe, record, interpret data recorded during experiments Identify and use the applications of Pharmacology concepts to solve problems of life and society
Research and Problem solving	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	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	Work in Pairs Small group work Large group work
Communication	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	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 studentsto help each other and to respect opinions of colleagues.
Standardization culture	- 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	- 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 material.

1.2.3. Attention to special educational needs specific to each subject

In the classroom, students learn in different ways depending to their learning pace, needs or any other special problems 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 students have 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:

1) Practical work/ experiments:

Some activities suggested in Pharmacology curriculum as well as in the teacher'sbook 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. This is particularly true when it comes to the need to prescribe and administer different drugs through a diversity of drug administration routes. 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. The majority of the practical works will be carried out in the simulation lab.

2) 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.

3) Project work

Pharmacology teachers are encouraged to sample and prepare project works and engage their studentsin, 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.

4) 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 lets 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's productions**
  - The teacher asks the students to evaluate the productions: which ones are correct, incomplete or false

Term	Date	Subject	Class	Unit No.	Lesson No	Duration	Class Size
1	30/10/2021	Pharmacology	S_5 Ass. N.	1	1 of 12	80 Minutes	30 Students
Type of Special Educational Needs and number of students					2 students with mild hearing impairment will be assisted by ensuring that they occupy the front seats in the class to allow them to better understand. The teacher is requested to speak loudly to allow them capture the content taught. There is 1 student with mild visual impairment. This student will also occupy the front seat in the classroom, and the teacher will use big size letters during teaching. The teacher will also print the teaching material (case studies for example) with bigger font size.		

Topic area	Pharmacology
Sub-topic area	Applied Pharmacology
Unit Title	Antibiotics
Key Unit Competence	Manage different health conditions at the primary healthcare settings by utilizing antibiotics appropriately
Title of the Lesson	Definition of antibiotics and key concepts
Plan for this class(location: in / outside)	In the Class No.005
Instructional Objectives	By the end of the lesson, the students should be able to correctly define antibiotics and describe key concepts related to antibiotic therapy.
Learning Materials	Pharmacology textbooks, case studies, a sample of drug form for each class of antibiotics.
References	MedicineNet. (2021). Medical Definition of Antimicrobial. Retrieved from https://www.medicinenet.com/antimicrobial/definition.htm

Timing for Each step	Description of teaching and learning activity: The activities of this lesson will be conducted in groups in the classroom.		Competences and crosscutting issues to be addressed.
	Teacher's activities	Student's activities	
1. **Introduction** **5 Minutes**	**Ask some questions related to antibiotics:** - What do you mean by an antibiotic? - What is the importance of an antibiotic? - What do you think are the indications of antibiotics? - What do you understand by bacteriostatic and bactericidal antibiotics?	- Give answers - Listen attentively how the teacher defines the key concepts.	**Competences:** -Critical thinking -Communication
2. **Development of the lesson: in 45 minutes**			
2.1. Discovery activity	- Ask students to form five groups. - Provide materials and instructions to students. - Monitor how the students perform the group work and identify their different potentials towards the topic.	- Form five groups and randomly share responsibility. -choose group representative - Taking materials needed for this activity. - Students work in a participative manner on the assignment.	**Competences:** -critical thinking -Communication -Collaboration -Problem solving **Crosscutting issues:** -Gender equality -Lifelong learning -Peace -Financial education
2.2. **Presentation of findings**	-Invite representatives of groups to presents their views.	-Representatives present group work -Other students follow the presentation attentively	**Competence:** -Communication

2.3. **Exploitation of students' findings**	-Ask the students to criticize the presentations one by one. -Ask students to identify correct, incomplete or false information. -Review the ideas of students' products, correct those which are false, complete those which are incomplete, and confirm those which are correct.	**-**Provide the comments to the presentations - Capture the corrections of the teacher	**Competence:** -Communication
2.4. Conclusion: In 20 minutes	-Summarize the knowledge learned -Give more clarifications on the content -Provide the harmonized content.	**-**Listen the clarification given by the teacher -Take summary	**Competence:** -Communication
3. Assessment: in 10 minutes	-Engage each student to work on self-assessment questions indicated in student 's textbook.	**-**Do the exercises required in student's textbook	**Competences:** -Creativity -Lifelong learning -Problem solving -Critical thinking
Comments on the lesson delivery			

PART III: UNIT DEVELOPMENT

UNIT 1 ANTIBIOTICS

1.1. Key Unit Competence:

Manage different health conditions at the primary healthcare settings by utilizing antibiotics appropriately.

1.2. Prerequisite (knowledge, skills, attitudes and values)

Students should have been introduced to course of human biology; ways of drug administration; bacterial multiplication and effects of bacteria to the host; infectious bacterial diseases; medical pathology; surgical pathology; principles of drug administration; and principles of pharmacokinetics as well as pharmacodynamics. This previously learnt courses will help the students to acquire knowledge and skills related to antibiotics, and be able to manage patients with bacterial conditions using antibiotics.

The tutor needs to ensure that this content has been covered in order to be able to use antibiotics appropriately, especially in the management of bacterial infectious diseases treated with antibacterials from different classes.

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

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.

1.4. Guidance on the introductory activity 1.0

This introductory activity is intended to:

- Motivate the students to learn about different classes of antibiotics
- Stimulate the students to search more information on the criteria to choose and use antibiotics
- 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 Students prior knowledge and help to link with the new content that is related to antibiotics.

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:

- The tutors are encouraged to promote learning in small groups of students and provide students with Unit 1 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 1.0: refer to the Student's book

1. Students may have different ideas. Some may say they saw similar patients while others may say they have not seen such kinds of patients. The essential information needed from the students is to recognize that patients have bacterial infections that are more likely treated by antibiotics.
2. The students do not have to necessarily provide the right answers. They may think of different drugs that have been provided. The intent of the teacher is to check if some students heard of, or saw the antibiotics which are the focus of the unit. Check if their answers reflect the topic of antibiotics.
3. The students may provide the ideas if they saw the drugs in the past. If it is the case, they may be in a position to recognize some of these drugs, and they recognize that these are the similar drugs (antibiotics) they saw.
4. Note: you may need to look at the views and ideas of the students in order to know how they will be facilitated in the unit, and throughout the entire course. They even be asked to say what they think will be learnt in the unit.
5. 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/sub-headings including assessments

No of lessons	Lesson title	Learning objectives (from the syllabus including knowledge, skills and attitudes)	Number of Periods
1	Definition of antibiotics and key concepts	• Define antibiotics and key concepts related to antibiotic therapy	1
2	**Ideal antibiotics**	• Identify properties of ideal antibiotics • Provide the clinical rationale for selecting specific antibiotics. • Demonstrate understanding of the clinical importance of selecting the correct antibiotic for the individual patient.	2
	Mechanism of action **of antibiotics**	• Explain the mechanisms by which antibiotic drugs act to kill pathogens or restrict their growth.	
3	**Drug resistance** and prevention of antibiotic resistance	• Identify the mechanism of antibiotic resistance. • Recognize the clinical significance of bacterial resistance. • Utilize the Centers for Disease Control and Prevention (CDC) guidelines for preventing antimicrobial resistance in healthcare settings.	2
4	**Classification of** antibiotics with focus on antibiotics available in healthcare settings in Rwanda	• Classify antibiotics.	1

5	Class of Penicillins and **penicillinase** resistant antibiotics.	• Describe therapeutic actions, indications, pharmacokinetics, contraindications, most common adverse reactions, and important drug-drug interactions associated with the classes of penicillins. • Acknowledge the correct use of penicillins.	2
6	Class of Aminoglycosides	• Describe therapeutic actions, indications, pharmacokinetics, contraindications, most common adverse reactions, and important drug-drug interactions associated with the classes of aminoglycosides. • Acknowledge the correct use of aminoglycosides.	2
7	Class of Cephalosporins	• Describe therapeutic actions, indications, pharmacokinetics, contraindications, most common adverse reactions, and important drug-drug interactions associated with the classes of cephalosporins. • Acknowledge the correct use of cephalosporins.	2
8	Class of Fluoroquinolones	• Describe therapeutic actions, indications, pharmacokinetics, contraindications, most common adverse reactions, and important drug-drug interactions associated with the classes of fluoroquinolones. • Acknowledge the correct use of fluoroquinolones.	2

9	Class of Macrolides	• Describe therapeutic actions, indications, pharmacokinetics, contraindications, most common adverse reactions, and important drug-drug interactions associated with the classes of macrolides. • Acknowledge the correct use of macrolides.	2
10	Class of Tetracyclines	• Describe therapeutic actions, indications, pharmacokinetics, contraindications, most common adverse reactions, and important drug-drug interactions associated with the classes of tetracyclines. • Acknowledge the correct use of tetracyclines.	1
11	Class of Sulfonamides	• Describe therapeutic actions, indications, pharmacokinetics, contraindications, most common adverse reactions, and important drug-drug interactions associated with the classes of sulfonamides. • Acknowledge the correct use of sulfonamides.	1
12	Medications used in treatment of sexually transmitted diseases	• Manage bacterial infectious diseases. • Identify the antibiotic drugs and essential drugs list used at primary healthcare.	2
13	Medications used in treatment of tuberculosis	• Manage bacterial infectious diseases. • Identify the antibiotic drugs and essential drugs list used at primary healthcare.	2
14	End Unit Assessment		2

Lesson 1: Definition of antibiotics and key concepts

a) Learning objectives:

By the end of the session, the students should be able to explain correctly the antibiotics and the key concepts pertaining to antibiotics.

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 about antibiotics and their key concepts. Remind the students that this session is linked to other subjects, and the components related to this session include ways of drug administration; bacterial multiplication and effects of bacteria to the host; infectious bacterial diseases; medical pathology; surgical pathology; principles 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, 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 are the key teaching methods to use.

e) Learning activities 1.1. Definition of antibiotics and key concepts

Teacher's activities:

- Ask students to form small groups of 6 students each and do the 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 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 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 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 Activity 1.1

a. An antibiotic is a medicine that fights bacterial infections in people and animals. It works by killing the bacteria or by making it hard for the bacteria to grow and multiply.

An antimicrobial is a drug used to treat a microbial infection. "Antimicrobial" is a general term that refers to a group of drugs that includes antibiotics, antifungals, antiprotozoals, and antivirals. The antibiotics belong to the wide class of antimicrobials.

b. Narrow-spectrum antibiotics act against a limited group of bacteria while broad-spectrum antibiotics act against a larger group of bacteria

Answers for Self-Assessment 1.1

Students analyze the given questions in the case study which relates to the type of antibiotic (amoxicillin) that is famous in the community, either in groups or in pairs and come with ideas that may result in opportunities to get introduced to the antibiotics, and their intent. This activity may be given as a research question or homework. Depending on the purpose of the learning 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.

Expected answers for self-assessment 1.1

1. An antibiotic is a medicine that fights bacterial infections in people and animals. The antibiotic works by killing the bacteria or by making it hard for the bacteria to grow and multiply. It is used to treat local or systemic bacterial infections.
2. Yes. There is relevance in prescribing that drug (amoxicillin) to the colleague because the wound had developed pus, which is a feature (sign) of infection. ***Note:*** *The students may answer in a diversity of ways, but the key is to recognize occurrence of pus in the wound, that implies infection requiring antibiotic prescription or antibiotic therapy.*

Lesson 2: Ideal antibiotics, and mechanism of action of antibiotics

a. Learning objectives

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

- Describe adequately the characteristics of an ideal antibiotic in order to choose appropriately the antibiotic which more likely to harm the patient less.
- Explain confidently the mechanisms antibiotics use to exert their effects.

b. Prerequisites/Revision/Introduction

In order to understand well this lesson, the students must have been introduced to basic principles of infectious bacterial diseases; medical pathology; surgical pathology; principles of drug administration; and principles of pharmacokinetics as well as pharmacodynamics.

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 ideal antibiotics and mechanism of action of antibiotics.

Remind the students that the current session needs to be linked to the introductory session on the definition of antibiotics and related key concepts.

c. Teaching resources

Basic materials for a class/lesson to be conducted: 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 definition of antibiotics and related concepts, 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: Ideal antibiotics and Mechanism of action of antibiotics

Teacher's activities:

- Ask students to do individually activity 1.2 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 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

a) An ideal antibiotic should be:

- Toxic to microbes and not to humans
- Bactericidal rather than bacteriostatic
- Effective against broad range of bacteria
- Should not cause allergic and hypersensitive reactions
- Should be active in plasma, and other body fluids
- Desired levels should be reached rapidly and maintained for adequate period of time
- Should not give drug resistance with long shelf life
- Cheaper or affordable

b) Mechanisms of action of antibiotics:

- Inhibition of bacterial protein synthesis
- Alteration of bacterial cell membranes
- Inhibition of bacterial cell wall synthesis
- Inhibition of bacterial nucleic acid synthesis
- Functioning as **antimetabolites**

c) **Yes.** It is always required tp consider the mechanism of action of an antibiotic during its prescriptuon, because this guides on the expected result from the antibiotic. As antibiotics work by exterting different mechanisms of action, this has a direct effect on the expectation from the antibiotics towards the bacterial (bactericidal vs bacteriostatic effects).
Note: *The students may provide an explanation different from this, but the key message is that mechanism of action must always be considered because antibiotics provide effects through the mechanisms of action that differ.*

Expected Answers for Self-Assessment 1.2

A 25-year-old female patient comes to the health post where yo work. She comes 3 days after starting treatment with antibiotics, complaining of additional symptoms after starting the treatment. She reports severe diarrhea, nausea, vomiting, skin rashes, and difficult swallowing. The nurse receiving the patient decided to change the antibiotic for the patient, and managed the additional compalints. The patient recovered after a short period of time.

1. Yes. It was very necessary to come back to the health post because the drug might have caused hypersensitive reactions (skin rashes) and other many side effects.
2. No. The antibiotic was not ideal for this specific patient because it caused allergic reactions (skin rashes) and other additional side effects. The evidence that the antibiotic was not ideal is that, after changing the drug, the patient got well and recovered.
3. **(D) The antibiotics that have a link to metabolites act as antimetabolites, and not as metabolites**
4. **FALSE** (Human cells do not make peptidoglycan).

Lesson 3: Drug resistance and prevention of antibiotic drug resistance

a) Learning objectives

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

- Describe confidently different types of antibiotic drug resistance.
- Explain adequately the mechanism of development of antibiotic resistance.
- Describe accurately the ways antibiotic drug resistance can be prevented.

b) Prerequisites/Revision/Introduction

In order to understand well this unit, the students should have covered infectious bacterial diseases; medical pathology; surgical pathology; principles of drug administration; and principles of pharmacokinetics as well as pharmacodynamics.

c) Teaching resources

They include: 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 are the methods to use.

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 ideal antibiotics and mechanism of action of antibiotics, 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: Drug resistance and prevention of antibiotic drug resistance

Teacher's activities:

- Ask students to do individually activity 1.3 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 three 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 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 Activity 1.3

a. She took the initially prescribed antibiotic inappropriately. She interrupted treatment after the first dose, and even after resuming the treatment, she stopped the treatment again. She did not complete the full course of treatment that was for 14 days, and she only took some doses followed by interruption of treatment. ***Note:*** *The students may answer differently, but the key answer is to recognize that the adolescent (patient) interrupted antibiotic treatment before completing the prescribed antibiotic for the entire period (all doses).*

b. Antimicrobial resistance may develop as a result of not responding around-the-clock dosing. In addition, the duration of the antibiotic use was not respected as the patient used to interrupt treatment after taking some doses of the treatment.

Antibiotic resistance develops because the patient was not convinced to take the antibiotic by respecting the timing of doses and the length of time to take the antibiotic was not respected.

c) What type of resistance did this adolescent develop?

The adolescent developed the acquired resistance.

Answers for Self-Assessment 1.3

1. **Difference between acquired Resistance and Natural Resistance**

   Acquired Resistance is a type of drug resistance that microorganisms acquire after a certain period of time, yet, they were once very sensitive to the effects of these particular drugs.

   Natural or Intrinsic Resistance is a type of preexisting resistance. This is for the microorganisms that do not use specific enzyme systems or biological processes that anti-infectives target, and they are not affected by a particular anti-infective drug.

2. **Factors that can accelerate the occurrence of Antibiotic Resistance are:**
   - Widespread current use of antibiotics in humans and animals.
   - Improper use of antimicrobial agents to the treatment of specific pathogens known to be sensitive to the drug being used
   - Improper drug dosing
   - Insufficient duration of antibiotic therapy
   - Not respecting around-the-clock dosing
   - Patients who do not respect timing of doses and the length of time to take the drug
   - Health care providers who tend to try newly introduced, more powerful drugs when a more established drug may be just as effective.
3. **FALSE** (Around-the-clock dosing rather prevents the risk of antibiotic resistance)

Lesson 4: Classification of antibiotics with focus on antibiotics available in healthcare settings in Rwanda

a) Learning objectives

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

- Assign correctly antibiotics to their respective classes.
- Characterize confidently antibiotics in different classes.
- Identify appropriately main common side effects of antibiotics.

b) Prerequisites/Revision/Introduction

In order to successfully compete this lesson, the students should have been introduced to the topics related to infectious bacterial diseases; medical pathology; surgical pathology; principles and ways of drug administration; and principles of pharmacokinetics as well as pharmacodynamics. The students need also to have been introduced to key concepts of antibiotics.

Use K-W-L (What students already know-What they want to know-What they have learnt) to assess how much students already know on the precious sessions as well as the current topic, and what they would be interested in learning about classification of antibiotics.

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 antibiotic for each class of antibiotics, 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 key teaching methods to use.

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 antibiotic resistance and prevention of antibiotic drug resistance, handle any homework or assignments. Help students link the previous lesson to the current lesson using an appropriate discovery activity.

e) Learning activities 1.4.1: Introduction to antibiotics

Teacher's activities:

- Ask students to form small groups of 6 students each and do the activity 1.4.1 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 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 1.4.1 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 activity 1.4.1

a. Names of antibiotic drugs observed in the image:

- Ciprofloxacin
- Erythromycin
- Gentamicin
- Ceftriaxone
- Tetracycline (Eye ointment)
- Amoxicillin
- Cotrimoxazole

b. Antibiotics and their respective classes:

DRUG IDENTIFIED (ANTIBIOTIC)	RESPECTIVE CLASS
Ciprofloxacin:	Fluoroquinolones
Erythromycin	Macrolides
Gentamicin	Aminoglycosides
Ceftriaxone	Cephalosporins (third generation)
Tetracycline (Eye ointment)	Tetracyclines
Amoxicillin	Penicillins
Cotrimoxazole	Sulfonamides

c. Common side effects of antibiotics:

- Ocular damage,
- Superinfections (GI and Genito-urinary tract),
- Allergic reactions,
- Bone marrow depression,
- GI effects,
- Dermatological reactions,
- Auditory damage and
- Renal damage

Answers for Self-Assessment 1.4.1

1. **Advantage of using synergistic drugs**

   It allows the patient to take a lower dose of each antibiotic to achieve the desired effect. This helps to reduce the adverse effects that a particular drug may have.

2. **FALSE** (It rather helps to decrease the dose of each drug)**.**

Lesson 5: Class of penicillins and penicillinase resistant antibiotics

a) Learning objectives

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

- Describe confidently the mechanism of action of penicillins and penicillinase resistant antibiotics.
- Identify correctly different drugs in the class of penicillins and penicillinase resistant antibiotics.
- Explain confidently indications and contraindications of penicillins and penicillinase resistant antibiotics.

- Identify correctly main common side effects associated with penicillins and penicillinase resistant antibiotics.

b) Prerequisites/Revision/Introduction

Read the content in the syllabus to determine what students will learn and be able to do by the end of the lesson. 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, and target the specific learning objectives of the lesson.

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 penicillins and penicillinase resistant antibiotics, as one of the classes of antibiotics.

Help the students to link the session to other components such as infectious bacterial diseases; medical pathology; surgical pathology; principles of drug administration; and principles of pharmacokinetics as well as pharmacodynamics.

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 antibiotic for class of penicillins and penicillinase resistant antibiotics, 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 methods to use during teaching.

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 antibiotics, handle any homework or assignments. Help students link the previous lesson to the current lesson using an appropriate discovery activity.

e) Learning activities 1.4.2: Class of Penicillins and penicillinase resistant antibiotics

Teacher's activities:

- Ask students to do individually activity 1.4.2 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 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 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 1.4.2 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 Activity 1.4.2

a. Yes. It is relevant to treat syphilis with the drugs in the class of penicillins, given that the strain that causes syphilis is susceptible to penicillins.

b. Examples of antibiotics in the class of penicillins: Amoxicillin, Penicillin V, Penicillin G procaine, Penicillin G benzathine, Cloxacillin.

c. No. It is not advisable to combine penicillins and parenteral aminoglycosides. This is because when the parenteral forms of penicillins and penicillinase-resistant drugs are administered in combination with any of the parenteral aminoglycosides, inactivation of the aminoglycosides occurs.

Answers for Self-Assessment 1.4.2

1. **(B)** Inhibition of bacterial cell wall synthesis
2. **(A)** Cloxacillin
3. **(D)** Penicillin G benzathine
4. **TRUE** (Penicillins are contraindicated in patients with allergies to penicillin or cephalosporins).

Lesson 6: Class of aminoglycosides

a) Learning objectives

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

- Describe appropriately the mechanism of action of aminoglycosides.
- Identify correctly different drugs in the class of aminoglycosides.
- Explain adequately indications and contraindications of aminoglycosides.
- Identify accurately main common side effects associated with aminoglycosides.

b) Prerequisites/Revision/Introduction

In order to successfully complete this lesson well, the students need to have been introduced to other components, and help the students link the session to other components such as introduction to antibiotics; infectious bacterial diseases; medical pathology; surgical pathology; principles of drug administration; and principles of pharmacokinetics as well as pharmacodynamics.

Use K-W-L (What students already know-What they want to know-What they have learnt) to assess how much students already know on the previous topics or current topic, and what they would be interested in learning about aminoglycosides, as one of the classes of antibiotics. The first thing to do before starting teaching is to

remind students that they have learnt about peniccilins and penicillinase resistant antibiotics and make a brief recall about the previous session.

a) Teaching resources

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

b) Possible methods

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

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 antibiotics, handle any homework or assignments. Help students link the previous lesson to the current lesson using an appropriate discovery activity.

c) Learning activities 1.4.3: Class of Aminoglycosides

Teacher's activities:

- Ask students to form small groups of 6 students each and do the activity 1.4.3 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. 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 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 1.4.3 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 activity 1.4.3

a. Drugs in class of aminoglycosides: Amikacin, Gentamicin, Kanamycin, Neomycin, Streptomycin, Tobramycin, Promomycin and Plazomycin.

b. Mechanism of action of aminoglycosides: inhibition of protein synthesis

Answers for Self-assessment 1.4.3

1. **(A)** Gram negative aerobic bacilli
2. **(C)** Streptomycin
3. **(A)** Diaphoresis

Lesson 7: Class of cephalosporins

a) Learning objectives

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

- Describe correctly the mechanism of action of cephalosporins.
- Identify appropriately different drugs in the class of cephalosporins.
- Explain appropriately indications and contraindications of cephalosporins.
- Identify accurately main common side effects associated with cephalosporins.

b) Prerequisites/Revision/Introduction

Use K-W-L (What students already know-What they want to know-What they have learnt) to assess how much students already know about the and what they would be interested in learning about cephalosporins, as one of the classes of antibiotics. Before starting to teach, remind the students that they have learnt about aminoglycosides, and make a brief recall about the previous session.

Help the students to link the session to other components such as key concepts pertaining to antibiotics; infectious bacterial diseases; medical pathology; surgical pathology; principles of drug administration; and principles of pharmacokinetics as well as pharmacodynamics.

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 antibiotic for class of cephalosporins, 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 methods to use in teaching.

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 antibiotics, handle any homework or assignments. Help students link the previous lesson to the current lesson using an appropriate discovery activity.

e) Learning activities 1.4.4: Class of Cephalosporins

Teacher's activities:

- Ask students to form small groups of 6 students each and do the activity 1.4.4 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. 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 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 1.4.4 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 activity 1.4.4

a. Drugs in class of cephalosporins: Cefadroxil, Cefazolin, Cefoxitin, Cefuroxime, Ceftriaxone and Cefotaxime

b. Mechanism of action of aminoglycosides: inhibition of bacterial cell wall peptidoglycan synthesis.

Answers for Self-assessment 1.4.4

1. **(C)** Cefotaxime
2. **(B)** Allergy to aspirin

Lesson 8: Class of fluoroquinolones

a) Learning objectives

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

- Describe confidently the mechanism of action of fluoroquinolones.
- Identify correctly different drugs in the class of fluoroquinolones.
- Explain accurately indications and contraindications of fluoroquinolones
- Identify correctly the main common side effects associated with fluoroquinolones

b) Prerequisites/Revision/Introduction

Help the students to link the session to other components such as key concepts pertaining to antibiotics; infectious bacterial diseases; medical pathology; surgical pathology; principles of drug administration; and principles of pharmacokinetics as well as pharmacodynamics.

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 fluoroquinolones, as one of the classes of antibiotics. The first thing to do before starting teaching is to remind students that they have learnt about cephalosporins, and make a brief recall about the previous session.

c) Teaching resources

They include: Students' books, internet connectivity, books or magazines, projector, markers, flipchart, sample of the antibiotic for class of fluoroquinolones, 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 to use.

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 antibiotics, handle any homework or assignments. Help students link the previous lesson to the current lesson using an appropriate discovery activity.

e) **Learning activities 1.4.5:** Class of Fluoroquinolones

Teacher's activities:

- Ask students to form small groups of 6 students each and do the activity 1.4.5 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 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 1.4.5 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 Activity 1.4.5

a. Drugs in class of fluoroquinolones: Ciprofloxacin, gemifloxacin, levofloxacin, moxifloxacin, norfloxacin, and ofloxacin.
b. No. It is not advisable to administer fluoroquinolones. They are contraindicated in pregnant or lactating patients because potential effects on the fetus and infant are not known.

Answers for Self-assessment 1.4.5

Nursing **considerations**: Assess for possible contraindications or cautions. Perform physical assessment to establish baseline data for assessing the effectiveness of the drug and the occurrence of any adverse effects associated with drug therapy. Examine the skin for any rash or lesions to provide a baseline for possible adverse effects. Perform culture and sensitivity tests at the site of infection to ensure appropriate use of the drug. Perform renal function tests, including blood urea nitrogen and creatinine clearance, to evaluate the status of renal functioning and to assess necessary changes in dose. Conduct assessment of orientation, affect, and reflexes to establish a baseline for any central nervous system (CNS) effects of the drug.

Lesson 9: Class of macrolides

a) Learning objectives

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

- Describe confidently the mechanism of action of macrolides.
- Identify correctly different drugs in the class of macrolides.
- Explain appropriately indications and contraindications of macrolides.
- Identify correctly main common side effects associated with macrolides.
- Explain adequately nursing considerations for patients taking a macrolide.

b) Prerequisites/Revision/Introduction

In order to learn well this lesson, the students should have been introduced to key concepts on antibiotics; infectious bacterial diseases; medical pathology; surgical pathology; principles of drug administration; and principles of pharmacokinetics as well as pharmacodynamics.

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 macrolides, as one of the classes

of antibiotics. The first thing to do before starting teaching is to remind students that they have learnt about fluoroquinolones, 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 antibiotic for class of macrolides, 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 teaching methods to use.

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 antibiotics, handle any homework or assignments. Help students link the previous lesson to the current lesson using an appropriate discovery activity.

e) Learning activities 1.4.6: Class of Macrolides

Teacher's activities:

- Ask students to do in pairs activity 1.4.6 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. In making pairs, 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 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 pairs on the activity 1.4.6 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 activity 1.4.6

a. Drugs in class of macrolides: erythromycin, azithromycin, clarithromycin, and dirithromycin

b. Macrolides use a mechanism of inhibition of protein synthesis in their mechanism of action.

Answers for Self-assessment 1.4.6

1. **(B)** Clarithromycin
2. **(D)** Streptomycin

Lesson 10: Class of tetracyclines

a) Learning objectives

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

- Describe appropriately the mechanism of action of tetracyclines.
- Identify accurately different drugs in the class of tetracyclines.
- Explain adequately indications and contraindications of tetracyclines.
- Identify correctly main common side effects associated with tetracyclines.
- Explain confidently nursing considerations for patients taking a tetracycline.

b) Prerequisites/Revision/Introduction

In order to understand well this lesson, the students should have covered key concepts of antibiotics; infectious bacterial diseases; medical pathology; surgical pathology; principles of drug administration; and principles of pharmacokinetics as well as pharmacodynamics.

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 macrolides, as one of the classes of antibiotics. The first thing to do before starting teaching is to remind students that they have learnt about macrolides, 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 antibiotic for class of tetracyclines, 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 will be used during teaching this session.

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 antibiotics, handle any homework or assignments. Help students link the previous lesson to the current lesson using an appropriate discovery activity.

e) Learning activities 1.4.7: Class of Tetracyclines

Teacher's activities:

- Ask students to do individually activity 1.4.7 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 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 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 1.4.6 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 activity 1.4.7

a. Drugs in class of tetracyclines: tetracycline, demeclocycline, doxycycline, and minocycline.

b. Tetracyclines use a mechanism of inhibition of protein synthesis in their mechanism of action.

Answers for Self-assessment 1.4.7

1. **(A)** Doxycycline
2. Tetracyclines are contraindicated in children aged less than 8 years because they can potentially damage developing bones and teeth.

Lesson 11: Class of sulfonamides

a) Learning objectives

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

- Describe appropriately the mechanism of action of sulfonamides.
- Identify confidently different drugs in the class of sulfonamides.
- Explain correctly indications and contraindications of sulfonamides.
- Identify main common side effects associated with sulfonamides.
- Explain appropriately nursing considerations for patients taking a sulfonamide.

b) Prerequisites/Revision/Introduction

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 sulfonamides, as one of the classes of antibiotics. The first thing to do before starting teaching is to remind students that they have learnt about sulfonamides, and make a brief recall about the previous session.

The students should have covered the key concepts related to antibiotics; infectious bacterial diseases; medical pathology; surgical pathology; principles of drug administration; and principles of pharmacokinetics as well as pharmacodynamics.

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 antibiotic for class of sulfonamides, 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 methods to use during teaching.

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 tetracyclines, handle any homework or assignments. Help students link the previous lesson to the current lesson using an appropriate discovery activity.

e) Learning activities 1.4.8: Class of Sulfonamides

Teacher's activities:

- Ask students to do individually activity 1.4.8 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 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 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 1.4.8 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 activity 1.4.8

a. Antibiotics that belong to the class of sulfonamides are: sulfadiazine, sulfasalazine, and cotrimoxazole (Bactrim).

b. Sulfonamides act by inhibiting folic acid synthesis

Answers for Self-assessment 1.4.8

1. **(D)** Cotrimoxazole
2. **FALSE**

Lesson 12: Medications used in Treatment of sexually transmitted diseases

a) Learning objectives

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

- Describe accurately the main features of sexually transmitted diseases.
- Describe appropriately the syndromic approaches in the management of sexually transmitted diseases.
- Identify correctly the drugs suitable for each of the syndromes of sexually transmitted diseases.
- Explain correctly how sexually transmitted diseases are treated.

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 lesson. 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 activities on antibiotics to assess how much students already know and what they would be interested in learning about treatment guidelines of sexually transmitted diseases. The first thing to do before starting teaching is to remind students that they have learnt about different classes of antibiotics, and make a brief recall about the previous sessions on antibiotics.

Help the students to link the session to other components such as key concepts pertaining to antibiotics; infectious bacterial diseases; medical pathology; surgical pathology; principles of drug administration; and principles of pharmacokinetics as well as pharmacodynamics.

c) Teaching Resources

Basic materials for a class/lesson to be conducted: Students' books, internet connectivity, books or magazines, projector, markers, flipchart, printed flowcharts on management of different syndromes of sexually transmitted diseases, 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 methods to use during teaching.

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 brief review of the previous lessons on antibiotics, handle any homework or assignments. Help students link the previous lessons to the current lesson using an appropriate discovery activity.

e) Learning activities 1.5.1: Medications used in treatment of sexually transmitted diseases

Teacher's activities:

- Ask students to do in pairs activity 1.5.1 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 pairs, 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 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 pairs on the activity 1.5.1 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 activity 1.5.1

a. The symptoms of the patient may be classified in the lower abdominal pain syndrome.
b. The antibiotics that can be used in the syndromic management of this client: Ceftriaxone and azithromycin.

Answers for Self-assessment 1.5.1

a. Diagnosis for this client basing on the syndromic management of STIs: Genital Ulcer Syndrome
b. The antibiotic that can be used in this case basing on the syndromic management of STIs is benzathine penicillin.

Lesson 13: Medications used in treatment of tuberculosis

a) Learning objectives

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

- Describe appropriately main drugs used in the management of tuberculosis in Rwanda.
- Identify correctly the drugs suitable for primo-treatment and retreatment of tuberculosis in Rwanda.
- Explain correctly how tuberculosis is the treated in Rwanda.

a) Prerequisites/Revision/Introduction

The first thing to do before starting teaching is to remind students that they have learnt about different classes of antibiotics, and make a brief recall about the previous sessions on antibiotics. There is a need to also make a recall about the previous session on the medications used in treatment of sexually transmitted diseases.

Help the students to link the session to other components such as key concepts pertaining to antibiotics; infectious bacterial diseases; medical pathology; surgical pathology; principles of drug administration; and principles of pharmacokinetics as well as pharmacodynamics.

Read the Key unit competence in the syllabus to determine what students will learn and be able to do by the end of the lesson. 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) to assess how much students already know about antibiotics, and what they would be interested in learning about medications used in treatment of sexually transmitted diseases.

b) Teaching resources

Basic materials for a class/lesson to be conducted: Students' books, internet connectivity, books or magazines, projector, markers, flipchart, printed flowcharts on management of different phases of tuberculosis, chalks, and any other trustworthy and reliable resources to enhance learning.

c) 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 to use.

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 brief review of the previous lessons on antibiotics and sexually transmitted diseases, handle any homework or assignments. Help students link the previous lessons to the current lesson using an appropriate discovery activity.

d) Learning activities 1.5.2: Medications used in treatment of tuberculosis

Teacher's activities:

- Ask students to form small groups of 6 students each and do the activity 1.5.2 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 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 1.5.2 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 activity 1.5.2

a. The names of antituberculosis drugs that must be used: isoniazid, rifampicin, pyrazinamide, and ethambutol.
b. The phases for treatment of tuberculosis are Phase 1(**$2HREZ/4HR_3$**) and phase2(**$2HREZ_7/4HR_7$**).

Answers for self-assessment 1.5.2

a. The drug that will be added on the usual tuberculosis primo treatment drugs is Streptomycin.
b. The route of administration for the added drug is intramuscular route (injection).
c. The added drug will be given to the patient for 2 months.

1.6. Summary of the unit

Antibiotics, sometimes referred to as antibacterials, are medicines used in the treatment of bacterial infections. They belong to the class of antimicrobials. Antibiotics exert their effects via a diversity of mechanisms intended to alter bacterial function which ends up with bacterial cell death.

Antibiotics exert these effects using the process of selective toxicity in which the medicine targets the bacterial cells, with less target to the human cells.

Despite this selective toxicity of antibiotics, they may still cause toxicity to human cells, especially because there are some resemblances that human and bacterial cells share.

There are many classes of antibiotics, and this course covered the common antibiotics available in healthcare settings in Rwanda, namely:

- Pencillins and penicillinase-resistant antibiotics,
- Aminoglycosides,
- Cephalosporins,
- Fluoroquinolones,
- Tetracyclines, and
- Macrolides
- Sulfonamides

Sexually transmitted diseases, and tuberculosis, some of the most common infectious bacterial diseases are also managed by different categories of antibiotics.

Tuberculosis, which is usually treated in a specific way is managed with a class of antimicrobials known as antituberculosis drugs. Given the length of its treatment, it is ideal to ensure that the patient takes the drugs as indicated, and ensure that the patient completes the full course of treatment.

Nurses are reminded to provide health education to patients taking antibiotics, with focus on the limitation in the use of antibiotics to avoid antimicrobial resistance, and to complete the full course of antibiotic therapy even when the patient feels better. They also need to remind patients that antibiotics may be associated with a diversity of side effects, some of them being severe requiring medical attention one they occur.

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.

Remind the students that antibiotics are not a panacea. They need to be taken in bacterial conditions, and they need to always remind relatives or other people taking the antibiotics that they need to be taken as they have been prescribed and for the entire duration.

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.

1.8. Answers to end unit assessment

1. **(D)** selective toxicity
2. Prokaryotic
3. **(A)** The anti-infective's effectiveness against different invading organisms.
4. **(C)** prevents the growth of any bacteria.
5. **(B)** a fluoroquinolone.
6. **(D)** Gentamicin
7. **(B)** Tetracyclines
8. **(C)** Streptomycin

9. Bacteriostatic antibiotic is the antibiotic that has ability to prevent the growth of bacteria while bactericidal antibiotic is the one that has ability to kill bacteria. However, several antibiotics are both bactericidal and bacteriostatic, depending on the concentration of the particular drug.

10. **Classes of antibiotics according to their mechanism of action:**
    - Protein synthesis inhibitors.
    - Nucleic acid synthesis inhibitors.
    - Cell wall synthesis inhibitors.
    - Antimetabolites.
    - Inhibitors of cell membrane function.

1.9. Additional activities

1.9.1. Remedial Activities

1. Differentiate the antibiotic from antimicrobial.
2. What do you understand by a selective toxicity of an antibiotic?
3. Give the difference between a narrow-spectrum antibiotic and broad-spectrum antibiotic.

Answers for remedial activities

1. Antibiotics are medicines that fight bacterial infections in people and animals. They work by killing the bacteria or by making it hard for the bacteria to grow and multiply.
2. An antimicrobial is a drug used to treat a microbial infection. “Antimicrobial” is a general term that refers to a group of drugs that includes antibiotics, antifungals, antiprotozoals, and antivirals. The antibiotics belong to the wide class of antimicrobials.
3. Selective toxicity of an antibiotic is its ability to strike foreign cells with little or no effect on human cells.
4. A narrow-spectrum antibiotic is an antibiotic that acts against a limited group of bacteria while a broad-spectrum antibiotic is the one that acts against a larger group of bacteria.

1.9.2. Consolidation activities

1. Antibiotics should be preferably prescribed in the treatment of viral infections or illnesses given their effectiveness in such infections. TRUE or FALSE
2. The healthcare providers should be encouraged to always use newly introduced powerful antibiotics in order to avoid antimicrobial resistance. TRUE or FALSE
3. Give at least 3 antibiotics in the class of fluoroquinolones.

Answers of consolidation activities

1. **FALSE** (Antibiotics are not effective against viral infections. They are rather effective in bacterial infections. Their use should be limited in viral infections, except when associated with bacterial infections).
2. **FALSE** (Health care providers tend to try newly introduced, more powerful drugs when a more established **drug may be just as effective.** Use of a powerful drug in this way leads to the **rapid emergence** of resistant strains to that drug, perhaps limiting its potential **usefulness** when it might be **truly necessary).**
3. **Examples of fluoroquinolones are:** Ciprofloxacin, Gemifloxacin, levofloxacin, moxifloxacin, norfloxacin, and ofloxacin.

1.9.3. Extended activities

1. Give the most common side effects associated with antibiotics.
2. Name at least 5 classes of antibiotics.
3. What are the antituberculosis drugs used in the tuberculosis primo treatment?
4. **Read the scenario below and answer the questions related to it.**

Your classmate has a 35-year-old female relative who has difficulty swallowing and fever for the last 3 days. The classmate says that her relative went to the nearest health post and was diagnosed with streptococcal tonsillitis. She prescribed an antibiotic she cannot remember. She however doubts that the prescribed drug may belong to either the class of tetracyclines or penicillins.

a. What can be the class of an antibiotic would her relative have been prescribed among the two classes? Explain your answer.
b. What can be the advice to your classmate's relative regarding taking this antibiotic?

Answers for extended activities

1. **The most common side effects of antibiotics are:** Ocular damage, Superinfections (GI and Genito-urinary tract), Allergic reactions, Bone marrow depression, GI effects, Dermatological reactions, Auditory damage and Renal damage.
2. **Classes of antibiotics:** Aminoglycosides, carbapenems, cephalosporins, fluoroquinolones, penicillins (and penicillinase-resistant drugs), sulfonamides, tetracyclines, disease-specific antimycobacterials (antitubercular and leprostatic drugs), ketolides (E.g.: telithromycin), lincosamides, lipoglycopeptides (E.g.: televancin), macrolides, and monobactams (E.g.: aztreonam).
3. **Drugs used in tuberculosis primotreatment are:**
   - Ethambutol
   - Pyrazinamide
   - Isoniazid
   - Rifampicin
4. **A.** Her relative would have been prescribed an antibiotic in the class of penicillins? The streptococci which are responsible for streptococcal tonsillitis are susceptible to the antibiotics in the class of penicillins, including penicillin V and both penicillin G procaine and penicillin G benzathine. Tetracyclines are less likely to treat streptococcal tonsillitis.

   B. Advice to the classmate's relative regarding taking this antibiotic:
   - Take the antibiotics as prescribed and use all pills even if she is feeling better. Insist that when she stops taking the pills before she has used them all, there's a likely chance that all of the bacteria have not been killed and the remaining bacteria will become stronger and replicate new bacteria that will be more resistant to the antibiotic next time around.
   - Tell her not to share her antibiotics with someone else.
   - Advise her to always take antibiotics with food to prevent stomach upset, except otherwise indicated.
   - If the antibiotic is making her feel worse, she needs to talk this to her doctor about the symptoms. She may need a different antibiotic or something that will help with the side effects.
   - Diarrhea is a common side effect of antibiotics. As a preventive measure, she can take an over-the-counter probiotic to help reduce diarrhea symptoms.

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Electronic links:

- *https://courses.lumenlearning.com/microbiology/chapter/introduction-to-antimicrobial-drugs/*
- *https://courses.lumenlearning.com/microbiology/chapter/drug-resistance/*
- *https://www.rxlist.com/mefoxin-drug.htm#description, https://www.rxlist.com/mefoxin-drug.htm#indicationshttps://www.webmd.com/drugs/2/drug-18352/cefoxitin-intravenous/details/list-contraindications*
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UNIT 2 ANTHELMINTIC (ANTIHELMINTHIC) DRUGS

2.1. Key Unit Competence:

Utilize appropriate anti-helminthic drugs to manage different health condition at the primary healthcare level.

2.2. Prerequisite (knowledge, skills, attitudes and values)

Students should have been introduced to course of human biology; ways of drug administration; worms' development and infestation and effects of parasites/ microorganisms to the host; medical pathology; surgical pathology; principles of drug administration; and principles of pharmacokinetics as well as pharmacodynamics. These previously learnt courses will help the students to acquire knowledge and skills related to anti-helminthics.

The tutor needs to ensure that this content has been covered in order to be able to use anti-helminthics appropriately, especially in the management of parasitic diseases treated with anti-helminthics from different classes.

2.3. 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.

2.4 Guidance on the introductory activity 2.0

This introductory activity is intended to:

- Motivate the students to learn about different classes of anthelmintic drugs
- Stimulate the students to search more information on the criteria to choose and use anthelmintic drugs
- To rise the curiosity on the content to cover as it relates to pharmacokinetics and pharmacodynamics of anthelmintic drugs.
- 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 anthelmintic drugs.

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:

- The tutors 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.

1. **Have you ever seen the same scenario in your community?**
2. **Which drugs have you seen being used in the same scenario?**

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

1. Students may have different ideas. Some may say they saw similar situation while others may say they have not seen such kinds of situation of mass deworming. The essential information needed from the students is to recognize that students in the mass deworming may have worm infections that are more likely treated by antihelminthics, and they are receiving anthelmintics for deworming (usually mebendazole and albendazole).
2. The students do not have to necessarily provide the right answers. They may think of different drugs that have been provided. The intent of the teacher is to check if some students heard of, took or saw antihelminthc which are the focus of the unit. Check if their answers reflect the topic of antihelminthics.

   The students may provide the ideas if they saw the drugs or have been in the situation in the past. If it is the case, they may be in a position to recognize some of these drugs, and they recognize that these are the similar drugs they saw.

   Note: you may need to look at the views and ideas of the students in order to know how they will be facilitated in the unit, and throughout the entire course. They may even be asked to say what they think will be learnt in 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.

2.5. 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	Introduction to anthelmintic drugs and deworming	• Define anthelmintic drug and mass deworming • Discuss the importance of mass deworming in the community • Appreciate importance of deworming across the lifespan • Demonstrate understanding of the importance deworming in nutrition	**2**
2	Anthelmintic medications	• Describe the therapeutic actions, indications, pharmacokinetics, contraindications, most common adverse reactions, and important drug–drug interactions associated with the anthelmintic drugs • Discuss the use of anthelmintic across the lifespan. • Outline the nursing considerations, including important teaching points to stress for patients receiving an anthelmintic.	**2**
3	National Guidelines and WHO Community Deworming	• Utilize National treatment guidelines to manage common worms	**1**
4	**End Unit Assessment**	**End Unit Assessment**	**1**

Lesson 1: Introduction to anthelmintic drugs and deworming

a) Learning objectives:

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

- Define anthelmintic drugs and mass deworming
- Discuss the importance of mass deworming in the community
- Use effectively the drugs for deworming

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 about introduction to anthelmintic drugs and deworming. Remind the students that this session is linked to other subjects, and the components related to this session include ways of drug administration; worm infection development and multiplication of worms and effects of the host; medical pathology; surgical pathology; principles 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 2.1. Introduction to anthelmintic drugs and deworming

Teacher's activities:

- Ask students to form small groups of 6 students each and do the activity 2.1 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 / 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 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 2.1 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 activity 2.1

1. The patient suffers from ascariasis (He lives in poor sanitary conditions, and the laboratory test revealed eggs of Ascaris).
2. (B): Mebendazole
3. Classes of helminthic parasites targeted in deworming are roundworms, flukes, and tapeworms.

Answers for self-assessment 2.1

1. **Classes of anthelmintic drugs are:**

- Piperazines
- Benzimidazoles
- Heterocyclics
- Natural products
- Vinyl pyrimidines
- Amide
- Nitro derivative
- Imidazo thiazole.

2. **False.** Deworming of children usually involves the use of mebendazole and albendazole.
3. **True.**

Lesson 2: Anthelmintic medications

a) Learning objectives

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

- Describe adequately the characteristics of an ideal antehleminthic in order to prescribe confidently the drugs which are more likely to cause less harm.

b) Prerequisites/Revision/Introduction

In order to understand well this lesson, the students must have been introduced to basic principles of worm infectious diseases; medical pathology; surgical pathology; principles of drug administration; and principles of pharmacokinetics as well as pharmacodynamics.

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 anthelmintic medications. Remind the students that the current session needs to be linked to the introductory session on the definition of helminths drugs and related key concepts.

c) Teaching resources

Basic materials for a class/lesson to be conducted: 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 definition of antibiotics and related concepts, handle any homework or assignments. Help students link the previous lesson to the current lesson using an appropriate discovery activity.

e) Learning activities 2.2: Anthelmintic medications.

Teacher's activities:

- Ask students to do individually 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.
- 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 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 class of drugs used to manage the client's condition (hookworm infestation) is anthelmintic medications
2. The mechanism of action of mebendazole: Mebendazole interferes with the ability of the parasite to use glucose, leading to an inability to reproduce and cell death. Because very little of mebendazole is absorbed systemically, it retains high concentrations in the intestine where it kills the pathogens
3. The common side effects of albendazole: The most common side effects of albendazole are: Headache, neck stiffness, increased sensitivity to light, confusion; fever; nausea, vomiting, stomach pain; abnormal liver function tests; dizziness, spinning sensation; or temporary hair loss.

Answers for self-assessment 2.2

1. **(A):** Praziquantel
2. **Mechanism of action of albendazole:** As a vermicide, albendazole causes degenerative alterations in the intestinal cells of the worm by binding to the colchicine-sensitive site of β-tubulin, thus inhibiting its polymerization or assembly into microtubules (it binds much better to the β-tubulin of parasites than that of mammals). Albendazole leads to impaired uptake of glucose by the larval and adult stages of the susceptible parasites, and depletes their glycogen stores. Albendazole also prevents the formation of spindle fibers needed for cell division, which in turn blocks egg production and development; existing eggs are prevented from hatching.
3. **(D) To target intestinal parasites, albendazole is taken on an empty stomach to stay within the gut.**

Lesson 3: National Guidelines for Deworming and WHO Community Deworming

a) Learning objectives

By the end of this session, the students should be able to utilize appropriately the National treatment guidelines to manage common worms.

b) Prerequisites/Revision/Introduction

In order to understand well this lesson, the students must have been introduced to basic principles of worm infectious diseases; medical pathology; surgical pathology; principles of drug administration; and principles of pharmacokinetics as well as pharmacodynamics.

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 National Guidelines for Deworming and WHO Community Deworming. Remind the students that the current session needs to be linked to the introductory session on the definition of helminths drugs and related key concepts.

c) Teaching resources

Basic materials for a class/lesson to be conducted: 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 definition of antibiotics and related concepts, handle any homework or assignments. Help students link the previous lesson to the current lesson using an appropriate discovery activity.

e) Learning activities 2.3: National Guidelines for Deworming and WHO Community Deworming

Teacher's activities:

- Ask students to do in pairs activity 2.3 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 / 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 pairs 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 primary school students wearing uniform at school, and are performing hand washing using a pedal hand washing station, a car, and a person wearing the white coat with the bottles containing tablets on the table. The students wash their hand before receiving the tables from that person (the health care provider) in the exercise of deworming.
2. The WHO recommends Preventive chemotherapy (deworming), using annual or biannual single-dose albendazole (400 mg) or mebendazole (500 mg).
3. **True.**

Answers for self-assessment 2.3

1. The important part of a comprehensive package to eliminate morbidity due to soil-transmitted helminths at risk population is educate the high risk populations on preventive measures, like good hygiene and provision and administration of anthelmintic drugs.
2. In the community the deworming is organized in way that the population at risk is sensitized to attend that event and then the anthelmintic medication is provided. Especially the children are found at school or at health centre during vaccination. Also this medication is provided to the pregnant women in second trimester.

2.6. Summary of the unit

There are three major groups of helminths: nematodes (roundworms), trematodes (flukes) and cestodes (tapeworms). They are divided into two phyla; nematodes (roundworms) and platyhelminths (trematodes and cestodes).

Anthelminthics are a group of antiparasitic drugs that expel parasitic worms (helminths) and other internal parasites from the body by either stunning or killing them and without causing significant damage to the host. They may also be called vermifuges (those that stun) or vermicides (those that kill).

According to their chemical structures, the anthelminthics may be classified into:

- Piperazines
- Benzimidazoles
- Heterocyclics

- Natural products:
- Vinyl pyrimidines
- Amide
- Nitro derivative
- Imidazothiazole

Deworming is the giving of an anthelmintic drug to a human to rid them of helminths parasites, such as **roundworm, flukes** and **tapeworm**. Mass deworming campaigns of school children have been used both as a preventive as well as a treatment method for helminthiasis, which includes soil transmitted helminthiasis in children. Children can be treated by administering, for example, mebendazole and albendazole.

2.7. Additional information for Teachers

Managing Pinworm Infections

Infestation with worms can be a frightening and traumatic experience for most people. Seeing the worm can be an especially difficult experience.

Pinworms can spread very rapidly among children in schools, summer camps, and other institutions. Once the infestation starts, careful hygiene measures and drug therapy are required to eradicate the disease. After the diagnosis has been made and appropriate drug therapy started, proper hygiene measures are essential.

Some suggested hygiene measures that might help to control the infection include the following:

- Keep the child's nails cut short and hands well-scrubbed because reinfection results from the worm's eggs being carried back to the mouth after becoming lodged under the fingernails when the child scratches the pruritic perianal area.
- Give the child a shower in the morning to wash away any ova deposited in the anal area during the night.
- Change and launder undergarments, bed linens, and pajamas every day
- Disinfect toilet seats daily and the floors of bathrooms and bedrooms periodically.
- Encourage the child to wash hands vigorously after using the toilet.

In some areas, parents are asked to check for worm ova by pressing sticky tape against the anal area in the morning before bathing. The sticky tape is then pressed against a slide that can be taken or sent to a clinical laboratory for evaluation. It may take 5–6 weeks to get a clear reading with this method of testing. Some health care providers believe that the psychological trauma involved in doing this type of

follow-up, especially with a school-age child, makes this task too onerous to ask parents to do. Instead, many believe that the ease of treating this relatively harmless disease makes it more prudent to continue to treat as prescribed and to forgo the follow-up testing. It is important to reassure patients and families that these types of infections do not necessarily reflect negatively on their hygiene or lifestyle. It takes a coordinated effort among medical personnel, families, and patients to control a pinworm infestation.

2.8. Answers for End unit assessment

1. The major groups of helminths are: nematodes (roundworms), trematodes (flukes) and cestodes (tapeworms).
2. **(D)** Praziquantel
3. **True**
4. **(A)** Mebendazole and albendazole
5. **False**. Praziquantel has no effect on filariae.
6. **(B)** Roundworms, flukes and tapeworm

2.9. Additional activities

2.9.1. Remedial Questions

1. **Which of the following explains the mechanism of action of praziquantel?**
   - A. Blocking acetylcholine transmission at the myoneural junction and paralysis of helminthes
   - B. Inhibiting microtubule synthesis in helminthes and irreversible impairment of glucose uptake
   - C. Increasing cell membrane permeability for calcium, resulting in paralysis, dislodgement and death of helminthes
   - D. Inhibiting oxidative phosphorylation in some species of helminthes

2. **What is the mechanism of action of piperazine?**
   - A. Inhibiting microtubule synthesis in helminthes and irreversible impairment of glucose uptake
   - B. Blocking acetylcholine transmission at the myoneural junction and paralysis of helminthes
   - C. Inhibiting oxidative phosphorylation in some species of helminthes

D. Increasing cell membrane permeability for calcium, resulting in paralysis, dislodgement and death of helminthes

3. Which of the following is a salicylamide derivative?

A. Praziquantel

B. Piperazine

C. Mebendazole

D. Niclosamide

4. Which of the following statements explains the mechanism of action of mebendazole?

A. Inhibiting oxidative phosphorylation in some species of helminthes

B. Increasing cell membrane permeability for calcium, resulting in paralysis, dislodgement and death of helminthes

C. Inhibiting microtubule synthesis in helminthes and irreversible impairment of glucose uptake

D. Blocking acetylcholine transmission at the myoneural junction and paralysis of helminthes

Answers for remedial activities

1. **(D)** Inhibiting oxidative phosphorylation in some species of helminthes
2. **(C)** Inhibiting oxidative phosphorylation in some species of helminthes
3. **(B)** Piperazine
4. **(D)** Blocking acetylcholine transmission at the myoneural junction and paralysis of helminthes

2.9.2. Consolidation activities

1. Tick the drug which inhibits oxidative phosphorylation in some species of helminthes:

A. Niclosamide

B. Piperazine

C. Praziquantel

D. Mebendazole

2. **Which of the following drugs may be used in neurocysticercosis treatment?**
   A. Praziquantel
   B. Pyrantel
   C. Piperazine
   D. Bithionol

3. **Tick the drug, a benzimidazole derivative:**
   A. Praziquantel
   B. Mebendazole
   C. Suramin
   D. Pyrantel

4. **Which of the following diseases is caused by a nematode?**
   A. Amoebiasis
   B. Leprosy
   C. Poliomyelitis
   D. Filariasis

Answers for consolidation activities

1. (c) Praziquantel
2. (A) Praziquantel
3. (B) Mebendazole
4. (D) Filariasis

2.9.3. Extended activities

1. **Enterobiasis diseases is caused by**
   A. Hookworm
   B. Filarial worm
   C. Roundworm
   D. Pinworm
2. **Which of the following conditions is a helminthic disease?**
   A. Polio
   B. Filariasis
   C. Filaria
   D. Diphtheria

3. Albendazole (400 mg) or mebendazole (500 mg) may be used in deworming. **True or False.**

4. **Which of the following statements is true with regard to the WHO recommended deworming for all young children 12–23 months of age?**

   A. The WHO recommends deworming, using annual or biannual single-dose albendazole (200 mg) or mebendazole (200 mg)

   B. The WHO recommends deworming, using annual or biannual single-dose albendazole (2000 mg) or mebendazole (100 mg)

   C. The WHO recommends deworming, using annual or biannual single-dose albendazole (400 mg) or mebendazole (500 mg)

   D. The WHO recommends deworming, using annual or biannual single-dose albendazole (200 mg) or mebendazole (300 mg)

Answers for extended activities

1. **(D)** Pinworm
2. **(B)** Filariasis
3. **True**
4. **(C)**The WHO recommends deworming, using annual or biannual single-dose albendazole (400 mg) or mebendazole (500 mg)

UNIT 3 ANTIPROTOZOAL DRUGS

3.1. Key Unit Competence

At the end of this unit, the student will be able to utilize antiprotozoal drugs to manage different health condition at the primary healthcare settings.

3.2. 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, basic chemical reactions, fundamentals of nursing, medical pathology, and surgical pathology. This previously learnt course will help the students to acquire knowledge and skills related to antiprotozoal drugs, and be able to manage patients with parasitic conditions. The tutor should recall the students the key topics of prerequisites courses that would be helpful to well understand antiprotozoal unit.

3.3. Cross cutting issues to be addressed

a) Inclusive education

This unit involves the need to use antiprotozoal 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.

3.4. Guidance on introductory activity 3.0

This introductory activity is intended to:

- Motivate the students to learn about antiprotozoal drugs.
- 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 antiprotozoal drugs.
- 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 antiprotozoals.

The progress in the learning is gradual. At this point, there are no rights 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 3 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: refer to the student's book

1. Students may have different ideas. Some may say they used such kind of medication or saw someone taking such kind of drugs while others may say they have never used and/or seen someone taking such kind of drugs. The essential information needed from the students is to recognize that these kinds of drugs used to treat protozoal infestations.
2. The students do not have to necessarily provide the right answers. They may think of different conditions following their life experience including previous courses. The intent of the teacher is to check if some students heard of or experienced any disease treated by antiprotozoal drugs which is the focus of the unit.

3.5. List of lessons/ sub-headings including assessments

Content/lesson	Learning objectives	Numbers of periods
1. Definition and Classification of antiprotozoal medications	- Define and classify antiprotozoal drugs	1
2. Plasmodium's life cycle	Explain the importance of plasmodium's life cycle in pharmacotherapy of malaria.	2
3.Antimalarial medications	Describe antimalarial medications Use antimalarial medications Administer correctly the anti-malarial medications	2

4.Antimalarial drugs prototypes	Identify antiprotozoal medications from national essential drugs list and treatment guidelines	**2**
5.Antimalarial Drug Dosage	Administer the correct dosage	**2**
6.Treatment of simple malaria	Explain medications used in treatment of simple malaria	**1**
7. Treatment of severe malaria	Explain medications used in treatment of severe malaria	**2**
8. Treatment of malaria in pregnant women	Identify medications used in management of malaria for pregnant women	**2**
9. Non-malarial antiprotozoal medications (miscellaneous antiprotozoals)	Identify antiprotozoal medications from national essential drug list and treatment guidelines	**1**
10.Health Education About Malaria and Amebiasis Treatment	Provide patients with appropriate health education to prevent drug resistance and limit diseases transmission	**1**
11. End unit assessment		**2**

Lesson 1: Definition and Classification of antiprotozoal medications

a) Learning objectives:

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

- Define antiprotozoal medications
- Classify the antiprotozoal medications

b) Prerequisites/Revision/Introduction:

This is the first lesson of the third unit **antiprotozoal drugs,** in this lesson you will be dealing with definitions of protozoans, and classification of antiprotozoal drugs**.** The first thing to do before starting teaching is to remind students what they have learnt about general pharmacology (principles of pharmacology), fundamentals of nursing, medical pathology, human biology (protozoal lesson) and surgical pathology, and let them discuss the meaning of protozoa so that they can prepare themselves for this antiprotozoal drugs 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 **definition and classification of antiprotozoal medications**.

c) Teaching resources:

They included: Pharmacology books, S5 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 3.1 Definition and Classification of antiprotozoals medications

- Ask students to do in small groups, pairs 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 case of small groups, ensure that the gender considerations are considered, and none is excluded based on gender.
- Assist the students to identify key issues regarding the diagnosis, treatment and control of protozoan infections according to their level of practice.
- Remember to note any areas where students have problems and ensure that these are emphasized in the subsequent learning lessons.
- Discuss in detail the various issues raised but to assure the students that they will be discussed in the subsequent learning lessons.
- 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 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

a. **Antiprotozoal drug:** a drug that destroys protozoans, inhibits their growth and ability to reproduce or prevents the development of protozoans in humans.

Antiprotozoal drugs are classified into 2 classes: antimalarial drugs and miscellaneous antiprotozoals

Antimalarial drugs example: Antimalarial drugs include mefloquine, chloroquine, proguanil with atovaquone and doxycycline, artesunate, artemether lumefantrine and Quinine

Miscellaneous antiprotozoals example: Commonly used miscellaneous antiprotozoals include metronidazole, tinidazole and so on.

b. **-The positive blood smear in the scenario indicates that the patient X has malaria disease. Patient X could receive any of antimalarial drugs like** Artemether, lumefantrine, artesunate, or quinine, etc depending on the corcumstances.

- The presence of entamoeba histolytica in the stool indicates that patient has amebiasis. Patient X may be treated by **miscellaneous antiprotozoals** drugs like Metronidazole, tinidazole, nitazoxanide among others.

Expected answers for self-assessment 3.1

1. **(D)** The physician is likely to prescribe Metronidazole for patient A
2. **(C)** The physician is likely to prescribe pentamidin for patient B
3. **(B)** The physician is likely to prescribe Metronidazole for patient C

Lesson 2: Plasmodium's life cycle

a) Learning objectives:

By the end of the session, the students should be able to explain the importance of Plasmodium's life cycle in pharmacotherapy of malaria.

b) Prerequisites/Revision/Introduction:

This is the second lesson of the third unit "**antiprotozoal drugs."** In this lesson, you will be explaining the **Plasmodium's life cycle.** The first thing to do before starting teaching is to remind students that they have learnt about medical pathology, human biology (protozoal lesson) and surgical pathology, and let them discuss the meaning of protozoan so that they can prepare themselves for this **Plasmodium's life cycle**.

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 **Plasmodium's life cycle.**

c) Teaching resources:

They included: Pharmacology books, S5 pharmacology book guide for students, internet connectivity, projector, markers, chalks, and any other trustworthy, illustrations 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 3.2: Plasmodium's life cycle

Teachers' activities:

- Ask students to do individually, pairs activity 3.2 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.

- Assist the students to identify key issues regarding the Plasmodium's life cycle and malaria treatment.
- Remember to note any areas where students have problems and ensure that these are emphasized in the subsequent learning lessons.
- discuss in detail the various issues raised but to assure the students that they will be discussed in the subsequent learning lessons.
- 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 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 carefully follow 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. **A)** The diagnosis for this case is malaria

   B) Malaria develops via two phases: an **exoerythrocytic and an erythrocytic phase.**

   C) Malaria is transmitted through mosquito bites. Malaria is transmitted from a sick person to a well person by mosquito.

   D) Yes. Malaria is preventable and treatable; but if a person with malaria does not receive appropriate treatment, it can lead to severe illness and death.

2) (C)Infective form of plasmodium for human is **sporozoites**

Expected answers for self-assessment activity 3.2

1. (C)During the phase of erythrocytic, the merozoites lyse the RBCs and this hemolysis is accompanied by the release **of HEMOZOIN pigment** which directly goes and disturbs the HYPOTHALAMIC functioning and causes the occurrence of fever.
2. a) **Exoerythrocytic phase** involves infection of the hepatic system, or liver.
   a) The erythrocytic phase involves infection of the erythrocytes, or red blood cells.
3. **(C)** Plasmodium malariae
4. **(D)** Plasmodium falciparum
5. **(D)** a and b

Lesson 3: Antimalarial medications

a) Learning objectives:

By the end of the session, the students should be able to explain antimalarial medications, and prescribe them confidently.

b) Prerequisites/Revision/Introduction:

This is the third lesson of the third unit, in this lesson you will be explaining the malaria treatment and describe antimalarial drugs prototypes. The first thing to do before starting teaching is to remind students that they have learnt about Plasmodium's life cycle and malaria treatment so that they can prepare themselves for antimalarial medications.

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 Antimalarial medications.

c) Teaching resources:

They included: Pharmacology books, S5 pharmacology book guide for students, internet connectivity, projector, markers, chalks, and any other trustworthy, illustrations 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

Teachers' activities:

- Ask students to do in small groups, pairs activity 3.3 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.
- Assist the students to identify key issues regarding the antimalarial drugs prototypes.
- Remember to note any areas where students have problems and ensure that these are emphasized in the subsequent learning lessons.
- Discuss in detail the various issues raised but to assure the students that they will be discussed in the subsequent learning lessons.
- 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 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 carefully follow 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. **(A) Plasmodium.**
2. **Three antimalarial medications you know used in Rwanda. Student may say but not limited to:**
   - Coartem (Artemether lumefantrine)
   - Quinine
   - Artesunate
3. **For the travellers visiting malaria endemic area are recommended to follow ABCD approach for malaria prevention (drug and non-drug measures):**
   - Awareness of risk (even if you grew up in a country where malaria is common, you still need to take precautions to protect yourself from infection if you're travelling to a risk area).
   - Bite prevention (avoid mosquito bites by using insect repellent, covering your arms and legs, and using a mosquito net. It's not possible to avoid mosquito bites completely, but the less you're bitten, the less likely you are to get malaria).
   - Check whether you need to take malaria prevention tablets (if you do, make sure you take the right antimalarial tablets at the right dose, and finish the course).
   - Diagnosis (Malaria can get worse very quickly, so it's important that it's diagnosed and treated as soon as possible).

Expected answers for self-assessment activity 3.3

1. Selection of drugs for malaria prophylaxis is based on the drug sensitivity of the plasmodial species found in the region to which travel is intended.
2. Once confirmed, appropriate antimalarial treatment must be initiated immediately.
3. **Three antimalarial therapy objectives are:**
   - treatment of an acute attack (clinical cure),
   - prevention of relapse (radical cure), and
   - prophylaxis (suppressive therapy).
4. **True**
5. Because the resistance patterns are constantly changing, depending on geographic location.

Lesson 4: Antimalarial drugs prototypes

a) Learning objectives:

By the end of the session, the students should be able to explain **antimalarial drugs prototypes**.

b) Prerequisites/Revision/Introduction:

This is the forth lesson of the third unit **antiprotozoal drugs,** in this lesson you will be dealing with **Antimalarial drugs prototypes** especially antiprotozoal medications from national essential drug list and treatment guidelines**.** The first thing to do before starting teaching is to remind students that they have learnt about pharmacology (principles of pharmacology senior 4 and Plasmodium's life cycle and malaria treatment in senior 5), fundamentals of nursing, medical pathology, human biology (protozoal lesson) and surgical pathology, and let them discuss so that they can prepare themselves for this **Antimalarial drugs prototypes** 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 **Antimalarial drugs prototypes**.

c) Teaching resources:

They included: Pharmacology books, S5 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 3.4 Explain Antimalarial drugs prototypes

Teachers' activities:

- Ask students to do in small groups, pairs activity 3.4 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.
- Assist the students to identify key issues regarding the Plasmodium's life cycle and malaria treatment.
- Remember to note any areas where students have problems and ensure that these are emphasized in the subsequent learning lessons.
- Discuss in detail the various issues raised but to assure the students that they will be discussed in the subsequent learning lessons.
- 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 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 carefully follow 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.

Expected answers for learning activity 3.4

1. **Antimalarial drugs are:** Artemether-lumefantrine, artesunate, mefloquine, amodiaquine, sulfadoxine-pyrimethamine, Chloroquine and Quinine.
2. **A.** The treatment is artemether-lumefantrine tablets.

   B. No, because it is recommended that the treatment should be initiated when the diagnosis has been confirmed by laboratory tests (positive blood smear results).

Expected answers for self-assessment activity 3.4

1. At usual therapeutic doses, quinine frequently causes:
   - mild cinchonism (a syndrome characterized by tinnitus [ringing in the ears]),
   - headache,
   - visual disturbances,
   - nausea, and
   - diarrhea.
2. Chloroquine can cause dizziness, headache, diplopia, disturbed visual accommodation, dysphagia, nausea, malaise, and pruritus of palms, soles and scalp. It can also cause visual hallucinations, confusion, and occasionally frank psychosis. Intra muscular injections of chloroquine can cause hypotension and cardiac arrest, particularly in children
3. True and false answers
   A. False
   B. True
   C. False
   D. True
   E. True
   F. True

Lesson 5: Anti-malarial drug dosage

a) Learning objectives:

By the end of the session, the students should be able to describe antimalarial drug dosage

b) Prerequisites/Revision/Introduction:

This is the fifth lesson of the third unit "**antiprotozoal drugs."** In this lesson, you will be dealing with **anti-malarial drug dosage.**The first thing to do before starting teaching is to remind students that they have learnt about general pharmacology (principles of pharmacology), Plasmodium's life cycle and malaria treatment, fundamentals of nursing, medical pathology, human biology (protozoal lesson) and surgical pathology, so that they can prepare themselves for this **anti-malarial drug dosage** 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 **Anti-malarial drug dosage.**

c) Teaching resources:

They included: Pharmacology books, S5 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 3.5 Describe Anti-malarial drug dosage

Teachers' activities:

- Ask students to do in pairs activity 3.5 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.
- Assist the students to identify key issues regarding the Plasmodium's life cycle and malaria treatment.
- Remember to note any areas where students have problems and ensure that these are emphasized in the subsequent learning lessons.
- discuss in detail the various issues raised but to assure the students that they will be discussed in the subsequent learning lessons.

- 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 pairs 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 carefully follow 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. **A).** The dosage of oral quinine is prescribed basing on weight or age: Oral quinine: 10 mg/kg 8 hourly for 7 days.

   Therefore, the patient weighing 60 kilograms would receive:

   60x10=600mg every eight hours.

   B). The dosage of artemether -lumefantrine (COARTEM^{R}) is prescribed basing on body weight or age. Therefore, the patient whose weight ranges between 25 to 34 kilograms takes 3 tables of artemether-lumefantrine every 12 hours.

Answers for self-assessment activity 3.5

1. A) No. Because the treatment must be initiated after the diagnosis has been confirmed by laboratory tests. In addition, she did not respect the drug dosage calculation for antimalarials. The mother was giving 3 tables (overdose) instead of 2 tablets of coartem according to the protocol (patient's weight).

   B) No. Because it is recommended that the treatment should be completed once the treatment has been started. However, the mother needed to adjust the dosage according to the client's weight.

   C) The health care worker can manage this patient by:
   - Evaluating the patient carefully for other possible causes of illness.
   - Getting a blood film or Rapid Diagnostic Test done if possible.
   - Completing the full course of artemether-lumefantrine.

2. Artesunate dosage to be administered via IV indicated for initial treatment of severe malaria; should always be followed by a complete treatment course of an appropriate PO antimalarial regimen (Coartem).

   Artesunate dosages are: Child under 20 kg: 3 mg/kg/dose and Child 20 kg and over and adult: 2.4 mg/kg/dose.

3. Dosage calculation for quinine injection for an adult patient with severe malaria: **Quinine dihydrochloride IV is given** in infusion. It is administered as 10 mg per kg body weight per dose, diluted in 5 to 10 ml of 5% or 10% glucose per kg body weight, every eight hours (as a maintenance dose). Note that the treatment starts with a loading dose at 20mg/kg to run in 4 hours.

Lesson 6: Treatment of simple malaria

a) Learning objectives:

By the end of the session, the students should be able to explain how simple malaria is treated.

b) Prerequisites/Revision/Introduction:

This is the sixth lesson of the third unit "**antiprotozoal drugs.**" In this lesson you will be dealing with treatment for simple malaria**.** The first thing to do before starting teaching is to remind students that they have learnt about general pharmacology

(principles of pharmacology), Plasmodium's life cycle and malaria treatment, fundamentals of nursing, medical pathology, human biology (protozoal lesson) and surgical pathology, so that they can prepare themselves for this lesson on treatment for simple malaria.

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 treatment for simple malaria.

c) Teaching resources:

They included: Pharmacology books, S5 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 3.6 Treatment of simple malaria.

Teachers' activities:

- Ask students to do in small groups activity 3.6 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.
- Assist the students to identify key issues regarding the Plasmodium's life cycle and malaria treatment.
- Remember to note any areas where students have problems and ensure that these are emphasized in the subsequent learning lessons.
- Discuss in detail the various issues raised but to assure the students that they will be discussed in the subsequent learning lessons.
- 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 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 carefully follow 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. **A)** It is indicated to prescribe the first line of treatment only after obtaining a positive blood smear or positive rapid diagnostic test. A negative blood smear or rapid diagnostic test excludes the diagnosis of malaria and the administration of an antimalarial. Another cause of the fever should be sought systematically and treated accordingly.

   The first line treatment recommended is an artemisinin combination therapy (ACT) of 2 molecules in one tablet. That is: Artemether 20 mg and Lumefantrine 120 mg to be taken preferably during meals.

   The combination of artemether – lumefantrine (COARTEM^{R}) is administered orally, twice a day for 3 days.

   Therefore, referring to the national treatment guidelines, a patient diagnosed with simple malaria (if not pregnant) are treated with COARTEM^{R}.

   B) Community health workers are responsible in the management of simple malaria at the community level.

   C) In case of contraindication to coartem, oral quinine sulphate is used.

Answers for self-assessment activity 3.6

1. (A) Coartem
2. In case of pregnant woman during the 1st trimester of pregnancy, coartem is contraindicated. **Quinine dihydrochloride** is the medication of choice (in Rwanda).
3. For children with 28 kilograms, the dosage equals to: 3.2X28=89.6 mg.

Lesson 7. Treatment of severe malaria

a) Learning objectives:

By the end of the session, the students should be able to explain National treatment guidelines for severe malaria.

b) Prerequisites/Revision/Introduction:

This is the seventh lesson of the third unit on "**antiprotozoal drugs."** In this lesson you will be dealing with treatment for severe malaria**.** The first thing to do before starting teaching is to remind students that they have learnt about general pharmacology (principles of pharmacology), Plasmodium's life cycle and malaria treatment, fundamentals of nursing, medical pathology, human biology (protozoal lesson) and surgical pathology, so that they can prepare themselves for this lesson on national treatment guidelines for severe malaria.

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 treatment of severe malaria.

c) Teaching resources:

They included: Pharmacology books, S5 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 3.7. Explain national treatment guidelines for simple malaria.

Teachers' activities:

- Ask students to do in small groups, pairs activity 3.7 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.
- Assist the students to identify key issues regarding the Plasmodium's life cycle and malaria treatment.
- Remember to note any areas where students have problems and ensure that these are emphasized in the subsequent learning lessons.
- Discuss in detail the various issues raised but to assure the students that they will be discussed in the subsequent learning lessons.
- 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 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 carefully follow 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. Treatment for severe malaria

1. **The following are the medications used in pretransfer treatment:**
   - Quinine, preferably by intravenous infusion as a loading dose of 20 mg per kg body weight to run in 4 hours (not exceeding a total dose of 1200 mg for the loading dose); or
   - Quinine by intrarectal route in children, as 20 mg per kg body weight diluted in 4 ml of distilled water or physiological solution, administered with a 5-ml syringe; or
   - Arthemether IM 3.2 mg per kg body weight administered as a single dose before transferring the patient.

2. **The minimum tests that the laboratory should be able to perform in order to confirm severe malaria are:**
   - peripheral blood smear,
   - haemoglobin and haematocrit,
   - blood sugar and
   - proteinuria

3. **Two antibiotic medications used to manage cerebral malaria are:**
   - Ampicillin
   - Chloramphenicol

Expected Answers for Self-Assessment 3.7

1. The management of this patient at the hospital

   Administer a loading dose of 20 mg/kg body weight of quinine dihydrochloride (do not exceed 1200 mg) diluted in an isotonic solution or 5 or 10% glucose on the basis of 5 to 10 ml/kg body weight to run for 4 hours in IV perfusion. Then run IV glucose 5 or 10% for 4 hours as maintenance drip.

   Thereafter, i.e. 8 hours after the beginning of the administration of the loading dose or 4 hours after the beginning of the maintenance drip, administer a maintenance dose of 10 mg/kg body weight of quinine dihydrochloride in infusion, to run for 4 hours. This maintenance dose of quinine will be repeated every 8 hours until the patient can swallow, normally within 48 hours at the most.

   If after 48 hours the patient's state doesn't permit the patient to take quinine orally, one may continue the drip of quinine by reducing the doses to 7 mg/kg every 8 hours to run for 4 hours.

   Change to oral quinine 10 mg/kg of quinine sulphate every 8 hours as soon as the patient can swallow, to complete the 7 days of treatment or oral Artemether 20 mg and Lumefantrine 120 mg, as recommended for the treatment of simple malaria.

2. **No.** For the anaemic form of severe malaria, antibiotherapy is not indicated.

Lesson 8: Treatment of malaria for pregnant women

a. Learning objectives:

By the end of the session, the students should be able to identify medication used in treatment of malaria for pregnant women

b. Prerequisites/Revision/Introduction:

This is the eighth lesson of the third unit "**antiprotozoal drugs."** In this lesson you will be dealing with treatment of malaria for pregnant women. The first thing to do before starting teaching is to remind students that they have learnt about general pharmacology (principles of pharmacology), Plasmodium's life cycle and malaria treatment, fundamentals of nursing, medical pathology, human biology (protozoal lesson) and surgical pathology, so that they can prepare themselves for this lesson on treatment of malaria for pregnant women.

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 thetreatment of malaria in pregnant women.

a. Teaching resources:

They included: Pharmacology books, S5 pharmacology book guide for students, internet connectivity, projector, markers, chalks, and any other trustworthy and reliable resources to enhance learning.

b. Possible methods:

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

c. Learning activities 3.8

Teachers' activities:

- Ask students to do in pairs activity 3.8 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.
- Assist the students to identify key issues regarding the Plasmodium's life cycle and malaria treatment.
- Remember to note any areas where students have problems and ensure that these are emphasized in the subsequent learning lessons.
- Discuss in detail the various issues raised but to assure the students that they will be discussed in the subsequent learning lessons.
- 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 pairs 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 carefully follow 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. Because Malaria during pregnancy can aggravate latent anaemia, it is recommended to do a complete clinical exam.

   The first line treatment of malaria in pregnancy is quinine sulphate peros 10 mg/kg/dose, 3 times a day for 7 days during the first trimester of pregnancy. COARTEM is indicated during the 2nd and 3rd trimesters of pregnancy only.

   In case of fever, administer paracetamol tablets, 500 mg three times per day

2. **False.** During second and third trimesters, coartem may be used for a pregnant woman.

Expected Answers For Self-Assessment 3.8

a. Management of simple malaria with minor digestive symptoms in pregnant women (IN FIRST TRIMESTER)

Administer Quinine dihydrochloride in intravenous infusion: 10 mg/kg/ dose diluted in 10 ml of 5% or 10% glucose per kg, every eight hours until patient is able to take drugs orally making sure the treatment does not exceed 24 hours.

Once the patient can take orally, complete the remaining quinine 3 X10 mg/kg/day to make 7 days by oral route of drug administration.

b. Management of simple malaria with minor digestive symptoms in pregnant women (IN SECOND AND THIRD TRIMESTERS)

Depending on the general status and level of hydration of the patient, drugs may be administered as follows:

Artemether by intramuscular injection:

Administered as dose of 160 mg immediately after the diagnosis followed by 80 mg twelve (12) hours after.

If the patient's condition does not improve within 24 of treatment, refer the patient to the nearest district hospital. If the patient's condition improves, change to oral Artemether-lumefantrine twice a day for three consecutive days.

Quinine dihydrochloride by intravenous administration:

Administered as 10 mg per kg body weight per dose, diluted in 5 to 10 ml of 5% or 10% glucose per kg, every eight hours. If the patient's condition does not improve within 24 hours of treatment, refer the patient to the nearest district hospital. If the patient's condition improves, change to oral Artemether-Lumefantrine, twice a day for three consecutive days, or to oral quinine in case of contraindications to Artemether-Lumefantrine.

c. Symptomatic management of simple malaria with minor digestive symptoms in pregnant women

- In case of diarrhoea or vomiting:
  - Evaluate and monitor the state of hydration;
  - Rehydrate with ORS or other available liquids and even introduce nasogastric tube if necessary ;
  - Anti-emetics are not recommended.
- In case of fever, administer paracetamol 15 mg/kg orally or any other antipyretic that may be indicated.

Lesson 9: Non-malarial antiprotozoal medications (miscellaneous antiprotozoals)

a) Learning objectives:

By the end of the session, the students should be able identify antiprotozoal medications from national essential drugs list and treatment guideline

b) Prerequisites/Revision/Introduction:

This is the night lesson of the third unit on **antiprotozoal drugs.** In this lesson, you will be dealing with non-malarial antiprotozoal medications from national essential drugs list and treatment guide line

The first thing to do before starting teaching is to remind students that they have learnt about general pharmacology (principles of pharmacology), Plasmodium's life cycle and malaria treatment, fundamentals of nursing, medical pathology, human biology (protozoal lesson) and surgical pathology, so that they can prepare themselves for this lesson on non-malarial antiprotozoal medications.

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 non-malarial antiprotozoal medications.

c) Teaching resources:

They included: Pharmacol]ogy books, S5 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 3.9

Teachers' activities:

- Ask students to do in small groups the activity 3.9 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.

- Assist the students to identify key issues regarding the Plasmodium's life cycle and malaria treatment.
- Remember to note any areas where students have problems and ensure that these are emphasized in the subsequent learning lessons.
- Discuss in detail the various issues raised but to assure the students that they will be discussed in the subsequent learning lessons.
- 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 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 carefully follow 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 Non-malarial antiprotozoal medications **(miscellaneous antiprotozoals)**

a. Examples of medications for the first patient with giardiasis:

- Metronidazole,
- Tinidazole,
- Nitazoxanide.

b. Examples of medications for second patient with amebiasis:

- Metronidazole,
- Tinidazole
- Iodoquinol,
- Paromomycin

Expected answers for self -assessment 3.9

1. **(B)** Pentamidine
2. **(D)** Metronidazole
3. **(A)** Being active against trypanosomes
4. **(D)** Malaria

Lesson 10 Health education about malaria and amebiasis treatment

a) Learning objectives:

By the end of the session, the students should be able provide appropriate health education to prevent drug resistance and limit disease transmission.

b) Prerequisites/Revision/Introduction:

This is the tenth lesson of the third unit **antiprotozoal drugs,** in this lesson you will be dealing with health education about malaria and amebiasis treatment

The first thing to do before starting teaching is to remind students that they have learnt about general pharmacology (principles of pharmacology), Plasmodium's life cycle and malaria treatment, fundamentals of nursing, medical pathology, human biology (protozoal lesson) and surgical pathology, so that they can prepare themselves for this lesson on Health Education About Malaria and Amebiasis Treatment.

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 health Education about malaria and amebiasis treatment.

c) Teaching resources:

They included: Pharmacology books, S5 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 3.10 Health Education About Malaria and Amebiasis Treatment

Teachers' activities:

- Ask students to do in small groups 3.10 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.
- Assist the students to identify key issues regarding the Plasmodium's life cycle and malaria treatment.
- Remember to note any areas where students have problems and ensure that these are emphasized in the subsequent learning lessons.
- Discuss in detail the various issues raised but to assure the students that they will be discussed in the subsequent learning lessons.
- 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 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 carefully follow 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 10

1) To be tested for malaria or other illness. The only way to be sure that the person has malaria is to be tested (blood smear or rapid diagnostic test).
   - If you test positive, then you can receive the proper treatment for malaria.
   - To get proper diagnosis and appropriate treatment to avoid complications that may even lead to death

2) This will ensure complete cure, on-going protection and will prevent the drug from becoming less effective to malaria infection (development of drug resistance).
   - Kills the parasite in the sick person and therefore stops transmission to healthy people
   - Treatment is important for saving the life of an infected person

3) **(D)** Both A and B

4) **(C)** To avoid alcoholic beverages

Expected answers for self –assessment 3.10

1. In the instance that you miss a dose, take it as soon as possible that day. For daily regimes, if you miss the dose completely for that day, skip the missed dose entirely and continue with your next dose. Never take a double dose to make up for a missed dose.
2. It's always advisable to purchase all necessary medication prior to your departure. However, in the event that you need antimalarial medication at your destination, you should only purchase medication from a reputable pharmacy
3. -Patients must seek immediate medical advice if they have malaria symptoms or if they become ill while travelling in an area where malaria is found, or after returning from travelling, even if they have been taking antimalarial tablets.
   - It's important that it's diagnosed and treated as soon as possible because malaria can get worse very quickly.

4) Even if you grew up in a country where malaria is common, you still need to take precautions to protect yourself from infection if you're travelling to a risk area.
   - Even if you have been infected, remember that nobody has complete immunity to malaria, and any level of natural protection you may have had is quickly lost when you move out of a risk area.

3.6. Summary of the unit

A protozoan is a parasitic cellular organism. Its life cycle includes a parasitic phase inside human tissues or cells. One of the greatest protozoal problems worldwide is the treatment and prevention of malaria.

Malaria is caused by Plasmodium protozoa, which must go through a cycle in the Anopheles mosquito before being passed to humans by the mosquito bite. Once inside a human the protozoa invade red blood cells. The characteristic cyclic chills and fever of malaria occur when red blood cells burst, releasing more protozoa into the bloodstream.

Antimalarials are agents used to attack Plasmodium at various stages of its life cycle. Sometime Malaria is treated with a combination of drugs that attack the protozoan at various stages in its life cycle. Antimalarial drugs can be classified according to antimalarial activity and according to structure. Most of the currently used antimalarials are caortem, quinine and artesunate.

Amebiasis is caused by the protozoan Entamoeba histolytica, which invades human intestinal tissue after being passed to humans through unsanitary food or water. Metronidazole or Tinidazole are the drugs of choice in the treatment of all tissue infections with E.histolytica. Neither drug is reliably effective against luminal parasites and so must be used with a luminal amebicide to ensure eradication of the infection. There are other antiprotozoals that can be used to manage amebiasis.

Leishmaniasis, a protozoan-caused disease, can result in serious lesions in the mucosa, viscera, and skin. The infection is transmitted by sand-fly bite. It is treated with systemic pentamidine. Pentamidine is an alternative to sodium stibogluconate and newer agents for the treatment of visceral leishmaniasis. The drug has been successful in some cases that have failed therapy with antimonials. The dosage is 2-4 mg/kg intramuscularly daily or every other day for up to 15 doses and a second course may be necessary. Pentamidine has also shown success against cutaneous leishmaniasis, but it is not routinely used for this purpose.

Trypanosomiasis, which is caused by infection with a Trypanosoma parasite, may assume two forms. African sleeping sickness leads to inflammation of the CNS, and Chagas disease results in serious cardiomyopathy. These diseases can be treated with systemic pentamidine, and children with Chagas disease can be treated with benznidazole. Pentamidine has been used for long and is the drug of choice to treat the early hemolymphatic stage of disease caused by Trypanosoma brucei gambiense (West African sleeping sickness).

The drug is inferior to Suramin for the treatment of early East African sleeping sickness. Pentamidine should not be used to treat late trypanosomiasis with central nervous system involvement. A number of dosing regimens have been described, generally providing 2-4 mg/kg daily or on alternate days for a total of 10-15 doses. Pentamidine has also been used for chemoprophylaxis against African trypanosomiasis, with dosing of 4 mg/kg every 3-6 months.

Trichomoniasis is caused by Trichomonas vaginalis. This common cause of vaginitis results in no signs or symptoms in men but results in serious vaginal inflammation in women. It is treated with metronidazole and tinidazole. Metronidazole is the treatment of choice. A simple dose of 2 g is effective. Metronidazole-resistant organisms can lead to treatment failures. Tinidazole may be effective against some of these resistant organisms.

Giardiasis caused by Giardia lamblia. This disease may lead to serious malnutrition when the pathogen invades intestinal mucosa. It is treated with nitazoxanide, metronidazole, and tinidazole. Metronidazole is the treatment of choice for giardiasis. The dosage for giardiasis is much lower than that for amebiasis, and the drug is thus better tolerated. Efficacy after a single treatment is about 90 %. Tinidazole is at least equally effective, and can be used as a single dose.

Pneumocystis jiroveci is an endemic protozoan that does not usually cause illness in humans unless they become immunosuppressed. This is the most common opportunistic infection seen in AIDS patients. It is treated with inhaled pentamidine (300 mg inhaled monthly) and oral atovaquone. Pentamidine is a well-established alternative therapy for pulmonary and extra-pulmonary disease caused by P jiroveci. The drug has somewhat lower efficacy and greater toxicity than trimethoprim-sulfamethoxazole. The standard dosage is 3 mg/kg/daily intravenously for 21 days.

Patients receiving antiprotozoal agents should be monitored regularly to detect any serious adverse effects, including loss of vision, liver toxicity, and so on.

3.7. Additional information for Teachers

- *Treatment of amebiasis*

Clinical Classification of Antiamoebic Drugs

Mixed amebicides: both systemic and luminal: Metronidazole & Tinidazole

Luminal amebicides: treatment of the asymptomatic colonization state: Iodoquinol, Paromomycin & Diloxanide furoate

Systemic amebicides: These drugs are useful for treating liver abscesses and intestinal wall infections caused by amebas: Chloroquine, Emetine & Dehydroemetine

Chemical Classification of amoebicides

1. **Nitroimidazole derivatives:** Metronidazole, Tinidazole, Ornidazole , Secnidazole
2. **Dichloroacetamides:** Diloxanide Furoate, Etofamide, Clefamide, Teclozan
3. **Emetines:** Emetine, Dehydroemetine
4. **Halogenated 8 Hydroxyquinolines:** Clioquinol Iodoquinol
5. **4-amino quinoline derivatives:** Chloroquine
6. **Antibiotics :** Paromomycin, Tetracycline
7. **Nitrothiazolidines:** Nitazoxanide

CLINICAL SETTING	DRUGS OF CHOICE & ADULT DOSAGE	ALTERNATIVE DRUGS & ADULT DOSAGE
Asymptomatic intestinal infection	Luminal agent: Diloxanide furoate 500mg 3 times daily for 10 days or Iodoquinol, 650mg 3 times daily for 21 days or Paromomycin 10mg/kg 3 times daily for 7 days.	
Mild to moderate intestinal infection	Metronidazole 750mg 3 times daily (or 500mg IV every 6 hours) for 10 days or Tinidazole 2 g daily for 3 days plus luminal agent (see above).	luminal agent (see above) Plus either Tetracycline 250 mg 3 times daily for 10 days or Erythromycin 500 mg 4 times daily for 10 days
Severe intestinal infection	Metronidazole 750mg 3 times daily (or 500mg IV every 6 hours) for 10 days or Tinidazole 2 g daily for 3 days plus luminal agent (see above).	luminal agent(see above) Plus either Tetracycline 250 mg 3 times daily for 10 days or Dehydroemetine or Emetine 1 mg/kg SC or IM for 3-5 days
Hepatic abscess, ameboma and other extra-intestinal disease	Metronidazole 750mg 3 times daily (or 500mg IV every 6 hours) for 10 days or Tinidazole 2 g daily for 3 days plus luminal agent (see above).	Dehydroemetine or Emetine 1 mg/kg SC or IM for 8-10 days, followed by (liver abscess only) chloroquine 500mg twice daily for 2 days, then 500 mg daily for 21 days plus Luminal agent (see above)

- ***Treatment of African trypanosomiasis***

Disease	Stage	first-Line Drugs	alternative Drugs
west African	Early	Pentamidine	Suramin, eflornithine
	CNS involvement	eflornithine	Melarsoprol, eflornithine nifurtimox
East African	Early	Suramin	Pentamidine
	CNS involvement	melarsoprol	

- ***Treatment of other protozoal infections***

Organism or clinical setting	Drugs of choice	Alternative drugs
Giardia lamblia	Metronidazole 250mg 3 times daily or 500 mg twice daily for 5 days or tinidazole 2 mg once	Furazolidone 100mg 4 times daily for 7 days or albendazole 400mg daily for 5 days
Trichomonas vaginalis	Metronidazole 2g once or 250mg 3 times daily or tinidazole once	
Balantidium coli	Tetracycline 500mg 4 times daily for 10 days	Metronidazole 750mg 3 times daily for 5 days
Pneumocystis jiroveci, p.carinii	Trimethoprimsulfamethoxazole 15-20mg trimethoprim component/kg/d IV? Or two double strength tablets every 8 hours for 21 days	Pentamidine or trimothoprimdapsone or clindamycin plus primaquine or atovaquone
Toxoplasma gondii		
Acute, congenital, immunocompromised	Pyrimethamine plus clindamycine plus folinic Acid	Pyrimethamine plus sulfadiazine plus folinic Acid
Pregnancy	Spiramycin 3g daily until delivery	

3.8. Answers to end unit assessment

1. (C) Both A and B are correct
2. (B) Quinine
3. (D) Primaquine
4. (C) Mefloquine
5. (D) Malaria
6. (B) Pneumocystis carinii pneumonia
7. (D) Giardiasis
8. (D) pyrimethamine
9. (B) Tinidazole
10. (C) All are correct

3.9. Additional activities

3.9.1. Remedial Activities

1. How many days should the patient avoid alcohol after treatment with metronidazole?
   A. **1 day**
   B. **3 days**
   C. **5 days**
   D. **48 hours**

2. During clinical practice you are assigned to prepare a health education on malaria prevention, give instructions to the patients how to use the chemical diethyltoluamide (DEET) (often used in insect repellents).

3. Filling in the missing words to complete the sentence using the words below:

Gametocytocides, Blood schizonticides, Sporontocides, Tissue schizonticides for preventing relapse and Tissue schizonticides for causal prophylaxis

a) **……** these drugs act on the hypnozoites of P. vivax and P. ovale in the liver that cause relapse of symptoms on reactivation.

b) **……** these drugs destroy the sexual forms of the parasite in the blood and thereby prevent transmission of the infection to the mosquito.

c) **……** these drugs act on the blood forms of the parasite and thereby terminate clinical attacks of malaria.

E) ……..these drugs act on the primary tissue forms of the plasmodia which after growth within the liver, initiate the erythrocytic stage

F) ……these drugs prevent the development of oocysts in the mosquito and thus ablate the transmission.

Answers for Remedial Activities

1. (D) 48 hours
2. If the family of the patient has a baby who has less than 2 months inform that it's not recommended for babies who are less than 2 months old. Diethyltoluamide (DEET) is safe for older children, adults and pregnant women if you follow the manufacturer's instructions:
   - use on exposed skin
   - don't spray directly on to your face – spray into your hands and pat on to your face
   - avoid contact with lips and eyes
   - wash your hands after applying
   - don't apply to broken or irritated skin
   - make sure you apply DEET after applying sunscreen, not before
3. **Filling in the missing words to complete the sentence using the words below:**
   a) Tissue schizonticides for preventing relapse
   b) Gametocytocides
   c) Blood schizonticides
   d) Tissue schizonticides for causal prophylaxis
   e) Sporontocides

3.9.2. Consolidation activities

1. **A patient traveling to an area of the world where malaria is known to be endemic should be taught to**
   A. Avoid drinking the water.
   B. Begin prophylactic antimalarial therapy before traveling and continue it through the visit and for 4 weeks after the visit.
   C. Take a supply of antimalarial drugs in case he or she gets a mosquito bite.
   D. Begin prophylactic antimalarial therapy 2 weeks before traveling and stop the drugs on arriving at the destination.

2. **Which of the following drugs is used for leishmaniasis treatment?**
   A. Pyrimethamine
   B. Albendazole
   C. Sodium stibogluconate
   D. Tinidazole

3. **Tick the drug used for trypanosomiasis treatment:**
   A. Melarsoprol
   B. Metronidazole
   C. Tetracyclin
   D. Quinidine

4. **Tick the drug used for trichomoniasis treatment**
   A. Suramin
   B. Metronidazole
   C. Pyrimethamine
   D. Tetracycline

5. **During clinical practice you are assigned to prepare a health education for pregnant woman having malaria and her husband ask you why it is important for pregnant women to be protected against malaria.**
   a) Give explanation to the couple (husband and wife) why it is important for pregnant women to be protected against malaria
   b) Briefly prepare health education session on malaria prevention to the couple (husband and wife) on how can pregnant women protect themselves against malaria.

Answers for consolidation activities

1. **(D)** Begin prophylactic antimalarial therapy before traveling and continue it through the visit and for 4 weeks after the visit.
2. **(C)** Sodium stibogluconate
3. **(A)** Melarsoprol
4. **(B)** Metronidazole
5. **a)** For pregnant women it's advisable to avoid travelling to areas where there's a risk of malaria if you're pregnant because a pregnant women have an increased risk of developing severe malaria, and both the baby and mother could experience serious complications. Because of these risks it's very important to take the right prophylactic measures of malaria prevention (both drug and nondrug) if you're pregnant and unable to postpone or cancel your trip to an area where there's a malaria risk

- Malaria is also particularly life-threatening and dangerous to pregnant women and their babies
- Malaria is harmful to pregnant women and their babies as the malaria parasite destroys the blood cells and makes women anaemic
- Anaemia in the mother and malaria parasites in the placenta can lead to women giving birth to babies early (pre mature) or born very small or die while still in the womb
- Babies who are born too early or are very small at birth as less likely to survive and be healthy

b). Educations session must emphasize on both drug and nondrug prevention measures by using the **using the ABCD approach (A**wareness of risk**, B**ite prevention**, C**heck whether you need to take malaria prevention tablets and **D**iagnosis**).**

3.9.3. Extended activities

1. **During clinical practice you are assigned to prepare a health education for patients having amebiasis.**

   a) Explain to the patient how is amebiasis spread?

   b) Explain what can be done to prevent the spread of amebiasis?

2. **How can malaria be prevented by mosquito bites prevention?**

3. All of the following antimalarial drugs influence blood schizonts, **EXCEPT:**
   A. Mefloquine
   B. Chloroquine
   C. Primaquine
   D. Quinidine

Answers for extended activities

1. **a).** Amebiasis is transmitted from person to person by the fecal-oral route. The spread of amebiasis can occur if an infected person does not wash their hands properly after going to the bathroom. When people touch objects or eat contaminated food they can get the parasite on their hands and into their mouths. People are infectious as long as the parasite is shed in the stool.

b). Public education about the importance of hand hygiene (perform wash hand with soap and water) after defecation and before preparing or eating food. To prevent spreading the infection, every member of the household should wash their hands with soap and clean water often, especially at these times: before eating and drinking, or preparing food, before preparing baby formula, after contact with someone who is sick, after using the bathroom or changing diapers and after handling pets or animals.

The risk of spreading infection is low if the infected person is treated with appropriate antiprotozoal drugs and they practice good personal hygiene.

2. **To avoid being bitten you have to follow these below instructions:**
   Stay somewhere that has effective air conditioning and screening on doors and windows. If this isn't possible, make sure doors and windows close properly.

   - If you're not sleeping in an air-conditioned room, sleep under an intact mosquito net that's been treated with insecticide.
   - Wear light, loose-fitting trousers rather than shorts, and wear shirts with long sleeves. This is particularly important during early evening and at night, when mosquitoes prefer to feed.
   - Use insect repellent on your skin and in sleeping environments. Remember to reapply it frequently. The most effective repellents contain diethyltoluamide (DEET) and are available in sprays, roll-ons, sticks and creams.

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Electronic links:

- ***https://www.cdc.gov/malaria/travelers/drugs.html***
- ***https://www.cdc.gov/malaria/travelers/drugs.html***
- ***https://www.ncbi.nlm.nih.gov/books/NBK8263/***
- ***https://patient.info/medicine/metronidazole-for-infection-flagyl***
- ***https://patient.info/medicine/quinine-for-malaria***
- ***https://medlineplus.gov/druginfo/meds/a609024.html***

UNIT 4 ANTIFUNGAL DRUGS

4.1. Key Unit Competence:

Manage different health conditions at the primary healthcare settings by utilizing antifungal drugs appropriately.

4.2 Prerequisite (knowledge, skills, attitudes and values)

Students should have been introduced to course of human biology; ways of drug administration; fungal multiplication and effects of fungi to the host; infectious fungal diseases; medical pathology; surgical pathology; principles of drug administration; and principles of pharmacokinetics as well as pharmacodynamics. This previously learnt courses will help the students to acquire knowledge and skills related to antifungals, and be able to manage patients with fungal conditions using antifungals.

The tutor needs to ensure that this content has been covered in order to be able to use antifungals appropriately, especially in the management of fungal infectious diseases treated with antifungals from different classes.

4.3. 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.

4.4 Guidance on the introductory activity 4.0

This introductory activity is intended to:

- Motivate the students to learn about different classes of antifungal agents
- Stimulate the students to search more information on the criteria to choose and use antifungal agents
- To rise the curiosity on the content to cover as it relates to pharmacokinetics and pharmacodynamics of antifungals.
- 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 antifungals.

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:

- The tutors are encouraged to promote learning in small groups of students and provide students with Unit 4 introductory activity, give clear instructions to the activity.
- Ask any three to four 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 4.0: Refer to the student's book

1. Students may have different ideas. Some may say they saw similar patients while others may say they have not seen such kinds of patients. The essential information needed from the students is to recognize that patients have fungal infections that are more likely treated by antifungals.
2. The students do not have to necessarily provide the right answers. They may think of different drugs that they have seen being used. The intent of the teacher is to check if some students heard of, or saw these medical conditions and how they were managed (more likely with antifungals).
3. The students may provide the ideas if they saw the drugs in the past. If it is the case, they may be in a position to recognize some of these drugs, and they recognize that these are the similar drugs (antifungal agents) they saw.

Note: you may need to look at the views and ideas of the students in order to know how they will be facilitated in the unit, and throughout the entire course. They may even be asked to say what they think will be learnt in 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.

4.5. 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	Definition and classification of antifungal drugs	Define the antifungal medications Classify antifungal medications	1
2	Systemic antifungals: azole and echinocandin antifungals	Compare and contrast the pharmacotherapy of superficial and systemic fungal infections. Explain the mechanism(s) of drug action, primary indications, contraindications, significant drug interactions, pregnancy category, and important adverse effects of medications available at the primary healthcare settings according to the National Essential list of drugs Outline the nursing considerations for patients receiving a systemic or topical antifungal Choose specific antifungal medications to be used for local and systemic infections Respect the national treatment guidelines to administer antifungal medication	2
3	Systemic antifungals: other antifungal agents	Compare and contrast the pharmacotherapy of superficial and systemic fungal infections. Explain the mechanism(s) of drug action, primary indications, contraindications, significant drug interactions, pregnancy category, and important adverse effects of medications available at the primary healthcare settings according to the National Essential list of drugs Outline the nursing considerations for patients receiving a systemic or topical antifungal Choose specific antifungal medications to be used for local and systemic infections Respect the national treatment guidelines to administer antifungal medication	2

4	Topical antifungal agents	Compare and contrast the pharmacotherapyof superficial and systemic fungal infections. Explain the mechanism(s)of drug action, primary indications, contraindications, significant drug interactions, pregnancy category, and importantadverse effects of medications available at the primary healthcare settings according to the National Essential list of drugs Outline the nursing considerations for patientsreceiving a systemic or topical antifungal Choose specific antifungal medications to be used for localand systemic infections Respect the national treatment guidelines toadminister antifungal medication	2
5	**End Unit Assessment**		1

Lesson 1: Definition and classification of antifungal drugs

a) Learning objectives:

By the end of the session, the students should be able to explain correctly antifungal drugs, and classify them

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 about definition and classification of antifungal drugs. Remind the students that this session is linked to other subjects, and the components related to this session include ways of drug administration; fungal multiplication and effects of fungi to the host; factors influencing fungal infections; infectious fungal diseases; medical pathology; surgical pathology; principles 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, different antifungal 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 are the key teaching methods to use.

e) Learning activities 4.1. Definition and classification of antifungal drugs

Teacher's activities:

- Ask students to form small groups of 6 students each and do the activity 4.1 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 / 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 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 4.1 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 activity 4.1

a. Antifungal drug can simply be defined as a drug used to treat fungal infections.

An antifungal agent is a drug that selectively eliminates fungal pathogens from a host with minimal toxicity to the host.

b. Systemic antifungals, and topical antifungals

Answers for self-assessment 4.1

1. Classes of antifungal drugs are: azoles, polyene antifungals, allylamines, and echinocandin antifungals.
2. (B) **The composition of the fungal cell wall is highly rigid and protective.**

Lesson 2: Systemic antifungals: azole and echinocandin antifungals

a) Learning objectives

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

- Describe adequately the systemic antifungals in the class of azoles and echinocandin antifungals

b) Prerequisites/Revision/Introduction

In order to understand well this lesson, the students must have been introduced to basic principles of infectious fungal diseases; medical pathology; surgical pathology; principles of drug administration; and principles of pharmacokinetics as well as pharmacodynamics.

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 systemic antifungals. Remind the students that the current session needs to be linked to the first session on definition and classification of antifungals.

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 definition and classification of antifungal drugs, handle any homework or assignments. Help students link the previous lesson to the current lesson using an appropriate discovery activity.

e) Learning activities 4.2.1: Systemic antifungals: azole and echinocandin antifungals

Teacher's activities:

- Ask students to do individually activity 4.2.1 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 4.2.1 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 4.2.1 Systemic antifungals: azole and echinocandin antifungals

A. Examples of systemic antifungals:

- Azoles: The azoles include fluconazole, itraconazole, ketoconazole, posaconazole, and voriconazole.
- Echinocandin antifungals: anidulafungin, caspofungin, and micafungin.

B. Indications of azoles are: aspergillosis, leishmaniasis, cryptococcosis, blastomycosis, moniliasis, coccidioidomycosis, histoplasmosis, and mucormycosis, among others.

Answers for self-assessment 4.2.1

1. **FALSE** (The drugs used to treat systemic fungal infections can be toxic to the host and are not to be used indiscriminately).
2. **FALSE** (Ketoconazole is an azole antifungal)
3. **TRUE**

Lesson 3: Systemic antifungals: other antifungal agents

a) Learning objectives

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

- Describe adequately the systemic antifungals that fall in different classes, other than azoles and echinocandin antifungals

b) Prerequisites/Revision/Introduction

In order to understand well this lesson, the students must have been introduced to basic principles of infectious fungal diseases; medical pathology; surgical pathology; principles of drug administration; and principles of pharmacokinetics as well as pharmacodynamics.

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 systemic antifungals, other than azoles and echinocandin antifungals. Remind the students that the current session needs to be linked to the previous session of antifungals.

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 definition and classification of antifungal drugs, handle any homework or assignments. Help students link the previous lesson to the current lesson using an appropriate discovery activity.

e) Learning activities 4.2.2: Systemic antifungals: other antifungal agents

Teacher's activities:

- Ask students to do in small groups activity 4.2.2 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.
- 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 4.2.2 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 4.2.2

a. Indications for nystatin: the treatment of candidiasis (oral form); treatment of local candidiasis, vaginal candidiasis, and cutaneous and mucocutaneous infections caused by Candida species.

b. The usual dosage of nystatin is 500,000–1,000,000 units t.i.d. PO; continue for 48 h after resolution to prevent relapse; also used topically.

Answers for self-assessment 4.2.2

1. **A).** Other indications of amphotericin B are: aspergillosis, leishmaniasis, blastomycosis, moniliasis, coccidioidomycosis, histoplasmosis and mucormycosis; use is reserved for progressive, potential fatal infections due to many associated adverse effects.

   B). Adverse effects of amphotericin B include: severe renal impairment, bone marrow suppression, GI irritation with nausea, vomiting, and potentially severe diarrhea, anorexia and weight loss, and pain at the injection site with the possibility of phlebitis or thrombophlebitis

2. Griseofulvin acts by changing cell membrane permeability and causing cell death.

3. **FALSE.** The uses of flucytosine are limited to the treatment of systemic infections caused by Candida or Cryptococcus

Lesson 4: Topical antifungals

a) Learning objectives

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

- Explain correctly and confidently the topical antifungals

b) Prerequisites/Revision/Introduction

In order to understand well this lesson, the students must have been introduced to basic principles of infectious fungal diseases; medical pathology; surgical pathology; principles of drug administration; and principles of pharmacokinetics as well as pharmacodynamics.

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 topical antifungals. Remind the students that the current session needs to be linked to the previous sessions on definition and classification of antifungals as well as systemic antifungals.

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 definition and classification of antifungal drugs, handle any homework or assignments. Help students link the previous lesson to the current lesson using an appropriate discovery activity.

e) Learning activities 4.2.3: Topical antifungals

Teacher's activities:

- Ask students to do individually activity 4.2.3 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 / 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 4.2.3 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 4.2.3

a. Examples of azole-type antifungals: butoconazole, clotrimazole, econazole, ketoconazole, miconazole, oxiconazole, sertaconazole nitrate, sulconazole, terconazole, and tioconazole.

b. Nursing considerations to takre into account while prescribing topical antifungals:

- Assess for known allergy to any topical antifungal agent to prevent hypersensitivity reactions.
- Perform a physical assessment to establish baseline data for evaluation of the effectiveness of the drug and the occurrence of any adverse effects associated with drug therapy.

- Perform culture and sensitivity testing of the affected area to determine the causative fungus and appropriate medication.
- Inspect the area of application for color, temperature, and evidence of lesions to establish a baseline to monitor the effectiveness of the drug and to monitor for local adverse effects of the drug.

Answers for self-assessment 4.2.3

After going through the session of topical antifungals, answer the following questions:

1. Adverse effects of topical antifungals used as suppositories include
   - nausea,
   - vomiting, and
   - hepatic dysfunction (related to absorption of some of the drug by the GI tract) or urinary frequency,
   - burning, and
   - change in sexual activity (related to local absorption in the vagina).
2. Give the indications of topical clotrimazole are:.
   - treatment of oral and vaginal Candida infections;
   - tinea infections.
3. Topical miconazole is used in the treatment of local, topical mycoses, including bladder and vaginal infections and athlete's foot.
4. Examples of topical antifungals and doses:
   - **Butoconazole** is available as vaginal cream: It is applied only once a day for 4 wk.
   - **Clotrimazole:** As a vaginal suppository, it is used intravaginally once daily (preferably at bedtime) for 7 consecutive days
   - **Miconazole** is available as vaginal suppository: It is applied twice daily for 2–4 wk. It is used in the treatment of local, topical mycoses, including bladder and vaginal infections and athlete's foot.

4.6 Summary of the unit

A fungus is one of the infectious agents, and it is a cellular organism with a hard cell wall that contains chitin and polysaccharides and a cell membrane that contains ergosterols.

Infections caused by fungi are mycoses (mycosis in singular form), and they usually occur in many circumstances.

With the rise of immunocompromising infections such AIDS, many systemic fungal infections are increasing as well, and they usually require special measures in the use of systemic antifungals during their treatment.

There are different types of antifungal agents according to their mechanism of action or chemical structure, and according to where they exert their effects.

Systemic antifungals work by altering the cell permeability, leading to leakage of cellular components. This ends up in prevention of cell replication and ultimately, cell death.

Because systemic antifungals can be very toxic compared to topical antifungals, and therefore, patients on systemic antifungals should be monitored closely while receiving them. Adverse effects may include hepatic and renal failure.

There is a wide range of local fungal infections such as vaginal and oral yeast infections (Candida) and a variety of tinea infections, including athlete's foot and jock itch.

Topical antifungals are agents that are too toxic to be used systemically but are effective in the treatment of local fungal infections.

Proper administration of topical antifungals improves their effectiveness. They should not be used near open wounds or lesions.

Topical antifungals can cause serious local irritation, burning, and pain. The drug should be stopped if these conditions occur.

4.7 Additional information for Teachers

The associate nurse ought to know the following key components that relate to antifungal drug therapy:

- Culture the affected area before beginning therapy to identify the causative fungus.
- Ensure that the patient takes the complete course of the drug regimen to achieve maximal results.
- Instruct the patient in the correct method of administration, depending on the route, to improve effectiveness and decrease the risk of adverse effects:
  - Troches should be dissolved slowly in the mouth.
  - Vaginal suppositories, creams, and tablets should be inserted high into the vagina with the patient remaining recumbent for at least 10 to 15 minutes after insertion.
  - Topical creams and lotions should be gently rubbed into the affected area after it has been cleansed with soap and water and patted dry. Occlusive bandages should be avoided.

- Advise the patient to stop the drug if a severe rash occurs, especially if it is accompanied by blisters or if local irritation and pain are very severe. This development may indicate a sensitivity to the drug or worsening of the condition being treated.
- Provide patient instruction to enhance patient knowledge about drug therapy and to promote compliance.
- Provide the following patient teaching:
  - The correct method of drug administration; demonstrate proper application.
  - The length of time necessary to treat the infection adequately.
  - Use of clean, dry socks when treating athlete's foot, to help eradicate the infection.
  - The need to keep the infected area clean, washing with mild soap and water and patting dry; keep area dry.
  - The need to avoid scratching the infected area; use of cool compresses to decrease itching can be advised.
  - The need to avoid occlusive dressings because of the risk of increasing systemic absorption.
  - The importance of not placing drugs near open wounds or active lesions because these agents are not intended to be absorbed systemically.
  - The need to report severe local irritation, burning, or worsening of the infection to a health care provider.

4.8 Answers to end unit assessment

1. The nurse will give 5 mL per dose
2. (D) Fungal infection of toenails or fingernails. Actually, terbinafine is used in the treatment of tinea infections
3. The adverse effects of topical antifungal agents: When these drugs are applied locally as a cream, lotion, or spray, local effects include irritation, burning, rash, and swelling. When they are taken as a suppository or troche, adverse effects include nausea, vomiting, and hepatic dysfunction (related to absorption of some of the drug by the GI tract) or urinary frequency, burning, and change in sexual activity (related to local absorption in the vagina).
4. FALSE. (Terbinafine cream is applied twice daily. It is used in the short-term (1–4 wk) treatment of topical mycosis; treatment of tinea infections).
5. FALSE. (Antifungal drugs in topical forms are used to treat a variety of mycoses of the skin and mucous membranes).

6. Two classes of antifungals according to where they exert their effects are:
   - systemic antifungals
   - topical antifungals
7. (D) Amphotericin B
8. Patients who receive amphotericin B should not take other nephrotoxic drugs such as nephrotoxic antibiotics or antineoplastics, cyclosporine, or corticosteroids unless absolutely necessary because of the increased risk of severe renal toxicity.

4.9. Additional activities

4.9.1. Remedial Activities

1. Because of their cellular makeup, bacteria are sensitive to the majority of antifungal drugs. **TRUE or FALSE**
2. Give 3 examples of polyene antifungal drugs include amphotericin, nystatin, and pimaricin.
3. The azoles are a group of antifungals used to treat systemic fungal infections only. **TRUE or FALSE**
4. Topical antifungal should not preferably be used on open lesion. **TRUE or FALSE**
5. Which of the following antifungals may be classified in allylamines?
   A. Terbinafine
   B. Amphotericin B
   C. Fluconazole
   D. Ketoconazole

Answers for remedial activities

1. **FALSE.** (Because of their cellular makeup, bacteria are resistant) to antifungal drugs.
2. Three examples of polyene antifungal drugs are: amphotericin, nystatin, and pimaricin.
3. **FALSE.** (The azoles are a large group of antifungals used to treat systemic and topical infections).
4. **TRUE**
5. (A) Terbinafine

4.9.2. Consolidation activities

1. While using systemic antifungals, it is important to get a culture of the fungus causing the infection to ensure that the right drug is being used. **TRUE or FALSE**
2. Ketoconazole is not the drug of choice for patients with endocrine or fertility problems. **TRUE or FALSE**
3. Itraconazole is the drug of choice to use patients with hepatic failure. **TRUE or FALSE**

Answers for consolidation activities

1. TRUE
2. TRUE
3. FALSE. (Itraconazole has been associated with hepatic failure, should not be used in patients with hepatic failure).

4.9.3 Extended activities

1. What is the mechanism of action of polyene antifungal drugs?
2. The studies have shown that all azoles are safe for use in pregnant women and lactating mothers. TRUE or FALSE
3. Which drugs may interact with itraconazole and cause serious cardiovascular effects if associated with it?
4. What is the usual dosage of anidulafungin?
5. What are the common **uses** of flucytosine?

Answers for extended activities

1. Polyene antifungal drugs interact with sterols in the cell membrane (ergosterol in fungi, cholesterol in humans) to form channels through which small molecules leak from the inside of the fungal cell to the outside.
2. FALSE. (Many of the azoles are associated with liver toxicity and can cause severe effects on a fetus or a nursing baby).
3. Itraconazole has a black box warning regarding the potential for serious cardiovascular effects if it is given with lovastatin, simvastatin, triazolam, midazolam, pimozide, or dofetilide.
4. The usual dosage of anidulafungin is 100–200 mg IV on day 1, then 50–100 mg/d IV for 14 d; with the dose varying with infection being treated.
5. The uses of flucytosine are limited to the treatment of systemic infections caused by Candida or Cryptococcus

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UNIT 5 ANTIVIRAL DRUGS

Key Unit Competence: Utilize antiretroviral medications to limit HIV/AIDS transmission

5.1. Introductory Activity

5.2. Key unit competence:

At the end of this unit, the students will be able to utilize antiretroviral medications to limit HIV/AIDS transmission.

5.3. 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, basic chemical reactions, fundamentals of nursing, medical pathology, and surgical pathology. This previously learnt courses will help the students to acquire knowledge and skills related to antiviral drugs, and be able to manage patients with parasitic conditions. The tutor should recall the students the key topics of prerequisites courses that would be helpful to well understand antiviral unit.

5.4. Cross cutting issues to be addressed

a) Inclusive education

This unit involves the need to use antiprotozoal 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.

5.5. Guidance on introductory activity 5.0

This introductory activity is intended to:

- Motivate the students to learn about antiviral drugs.
- 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 antiprotozoal drugs.
- 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 antiprotozoal.

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 5 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: refer to the student's book

- Students may have different ideas.

  The image A shows different stages of the HIV lifecycle, and these are the stages that antiretroviral drugs target. These antiretroviral drugs may even be classified according to their targets in the HIV lifecycle.

  The image B shows different tablets/capsules of antiretroviral drugs. They come in different dosage forms, and they are usually used in combinations to strengthen their efficacy. Finally, the image C shows an image of person holding the bottles that contain the antiretroviral medications. It is the responsibility of the nurses and other healthcare providers to teach well the patients on how to use the antiretroviral drugs.
- The students do not have to necessarily provide the right answers, given that the intent is to recognize that antiretroviral drugs are the focus of the unit.

5.6. List of lessons/ sub-headings including assessments

Content/lesson	Learning objectives	Numbers of periods
1. Introduction to antiretroviral drugs	At the end of the lesson will be able to define antiretroviral drugs and other key terms	**2**
2. Classification of antiretroviral drugs.	At the end of the lesson will be able to Compare and contrast the classes of antiretroviral medications	**2**
3. 3.Antiretroviral treatment in adolescents and adults	Apply National treatment guidelines for adult HIV/AIDS in clinical practice	**2**

4. Antiretroviral Treatment in Children	Apply National treatment guidelines for children HIV/AIDS in clinical practice	**2**
5. ARV Treatment in Pregnant Women	Describe the antiretroviral protocol used for reducing the risk of perinatal transmission and for treating pediatric patients with HIV AIDS.	**2**
6. Prophylaxis in Newborns with Perinatal HIV Exposure or HIV Infection	Apply the protocol and rational for prophylaxis in newborns with perinatal HIV exposure or HIV Infection	**1**
7. HIV Prevention Among Discordant Couples	Describe HIV prevention among discordant couples	**1**
8. ART for Post-Exposure Prophylaxis (PEP)	Explain the protocol and rationale for post exposure prophylaxis following occupational exposure to HIV infected fluids.	**1**
9. End unit assessment		2

Lesson 1: Introduction to antiretroviral drugs

a) Learning objectives:

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

- Differentiate antiviral from antiretroviral

b) Prerequisites/Revision/Introduction:

This is the first lesson of the fifth unit on **antiviral drugs.** In this lesson you will be dealing with definitions of virus, antiviral, retrovirus and antiretrovial drug. The first thing to do before starting teaching is to remind students what they have learnt about general pharmacology (principles of pharmacology), fundamentals of nursing, medical pathology, human biology (protozoal lesson) and surgical pathology, and let them discuss the meaning of antiretroviral drugs.

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 introduction to antiretroviral drugs.

c) Teaching resources:

They included: Pharmacology books, S5 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 5.1 Antiretroviral and antiviral drugs

- Ask students to do in small groups activity 5.1 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 note any areas where students have problems and ensure that these are emphasized in the subsequent learning lessons.
- Discuss in detail the various issues raised but to assure the students that they will be discussed in the subsequent learning lessons.
- 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 5.1 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 5.1

1. Antiretroviral drugs are the drugs that are used to fight retrovirus infections which mainly include HIV. Different classes of antiretroviral drugs act on different stages of the HIV life cycle.
2. Protease inhibitors are drugs that block the activity of the enzyme protease in HIV. Protease is essential for the maturation of infectious virus, and its absence leads to the formation of an immature and noninfective HIV particle.

Expected Answers for Self-Assessment Activity 5.1

1. **(A)** Antivirals are a class of drugs which are used to treat retroviral infections
2. **(B)** Antiviral drugs are effective drugs for helps simplex
3. Antivirals are a class of drugs which are used to treat viral infection. The antiviral drugs target diverse group of viruses such as helps, herpes, hepatitis, and influenza virus whereas antiretroviral drugs are the drugs that are used to fight retrovirus infections which mainly include HIV. Different classes of antiretroviral drugs act on different stages of the HIV life cycle

Lesson 2: Classification of antiretroviral drugs

a) Learning objectives:

By the end of the session, the students should be able to compare and contrast the classes of antiretroviral medication

b) Prerequisites/Revision/Introduction:

This is the second lesson of the fifth unit on antivirals. In this lesson. you will be explaining the classification of antiretroviral drugs. The first thing to do before starting teaching is to remind students that they have learnt about medical pathology, human biology (protozoal lesson) and surgical pathology, and let them discuss the meaning of antivirus and antiretroviral drugs so that they can prepare themselves for this lesson of classification of antiretroviral drugs.

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 **classification of antiretroviral drugs**

They included: Pharmacology books, S5 pharmacology book guide for students, internet connectivity, projector, markers, chalks, and any other trustworthy, illustrations and reliable resources to enhance learning.

c) Teaching resources:

They included: Pharmacology books, S5 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 5.2 Classification of antiretroviral drugs

Teachers' activities:

- Ask students to do in pairs activity 5.2 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 note any areas where students have problems and ensure that these are emphasized in the subsequent learning lessons.
- discuss in detail the various issues raised but to assure the students that they will be discussed in the subsequent learning lessons.
- 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 pairs on the activity 5.2 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 carefully follow 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 5.2

1. **Classes of antiretroviral drugs that can be used in HIV/AIDS management are:** nucleoside/nucleotide reverse transcriptase inhibitors (NRTIs), non-nucleoside reverse transcriptase inhibitors (NNRTIs), integrase strand transfer inhibitors (INSTIs), and protease inhibitors (PIs), HIV fusion inhibitors and CCR5 antagonists.
2. **The five basic goals of ART are:**
   - Maximal and long-lasting suppression of viral load,
   - restoration and preservation of immune function,
   - improved quality of life,
   - reduction of HIV-related morbidity and mortality and
   - prevention of HIV transmission

Expected answers for Self-Assessment Activity 3.2

1. A combination of several different antiviral drugs is used to attack the virus at various points in its life cycle to achieve maximum effectiveness with the least amount of toxicity
2. (C)Atazanavir
3. The mechanism of action of enfuvirtide: It prevents the HIV envelope from fusing with the cell membrane of CD4 cells, and thereby blocks viral entry and replication. Fusion inhibition results from binding of enfuvirtide to gp41, a subunit of the glycoproteins embedded in the HIV envelope (see Fig. 94.1). As a result of enfuvirtide binding, the glycoprotein becomes rigid, and hence cannot undergo the configurational change needed to permit fusion of HIV with the cell membrane.

Lesson 3 Antiretroviral treatment in adolescents and adults

a) Learning objectives:

By the end of the session, the students should be able to apply the national treatment guidelines for adolescents and adults with HIV/AIDS in clinical practice.

b) Prerequisites/Revision/Introduction:

This is the third lesson of the fifth unit. In this lesson you will be explaining the describe antiretroviral treatment in adults. The first thing to do before starting teaching is to remind students what they have learnt about therapeutic action of different classes of antiretroviral drugs.

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 antiretroviral drug.

c) Teaching resources:

They included: Pharmacology books, S5 pharmacology book guide for students, internet connectivity, projector, markers, chalks, and any other trustworthy, illustrations 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 5.3

Teachers' activities:

- Ask students to do in small groups activity 5.3 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 note any areas where students have problems and ensure that these are emphasized in the subsequent learning lessons.
- Discuss in detail the various issues raised but to assure the students that they will be discussed in the subsequent learning lessons.
- 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 5.3 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 carefully follow 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 5.3 Antiretroviral treatment in adolescents and adults

1. The required combinations of antiretroviral drugs: ART regimens typically contain at least three drugs. Regimens that contain only two drugs are not generally recommended, and monotherapy should always be avoided, except possibly during pregnancy. Additionally, all ART regimens contain drugs from at least two different classes. By using drugs from different classes, we can attack HIV in two different ways (e.g., inhibition of reverse transcriptase and inhibition of protease) and can thereby enhance antiviral effects.
2. Antiretroviral therapy (ART) is recommended for all persons with HIV to reduce morbidity and mortality and to prevent the transmission of HIV to others. The Panel on Antiretroviral Guidelines for Adults and Adolescents recommends initiating ART immediately (or as soon as possible) after HIV diagnosis in order to increase the uptake of ART and linkage to care, decrease the time to viral suppression for individual patients, and improve the rate of virologic suppression among persons with HIV.

Expected Answers for Self-Assessment Activity 5.3

1. Preferred 1st line regimen for adolescent and adults is TDF/3TC/DTG
2. TDF/3TC/EFV600mg is the alternative first-line regimen for adults and adolescents who cannot take TLD
3. If a patient experiences toxicity typical of a particular drug in the regimen, that drug should be withdrawn and replaced with a drug that is (1) from the same class and (2) of equal efficacy. For example, if a patient taking zidovudine were to develop anemia and neutropenia, zidovudine should be discontinued and replaced with another NRTI (e.g., stavudine). Note that when toxicity is the reason for altering the regimen, changing just one drug is proper, whereas when resistance or suboptimal treatment is the reason, at least two of the drugs should be changed.

Lesson 4: Antiretroviral Treatment in Children

a) Learning objectives:

By the end of the session, the students should be able to explain Apply National treatment guidelines for children HIV/AIDS in clinical practice

b) Prerequisites/Revision/Introduction:

This is the fourth lesson of the fifth unit on **antivirals.** In this lesson you will be dealing with **antiretroviral treatment in children.**

The first thing to do before starting teaching is to remind students that they have learnt about pharmacology (principles of pharmacology senior 4 and), fundamentals of nursing, medical pathology, classification of antiretroviral drugs and let them discuss so that they can prepare themselves for this **antiretroviral treatment in children** 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 **antiretroviral treatment in children**.

c) Teaching resources:

They included: Pharmacology books, S5 pharmacology book guide for students, internet connectivity, projector, markers, chalks, and any other trustworthy and reliable resources to enhance learning.

a) Possible methods:

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

d) Learning activities 5.4 Antiretroviral treatment in children

Teachers' activities:

- Ask students to do in small groups the activity 5.4 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 note any areas where students have problems and ensure that these are emphasized in the subsequent learning lessons.
- discuss in detail the various issues raised but to assure the students that they will be discussed in the subsequent learning lessons.
- 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 5.4 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 carefully follow 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.

Expected Answers for Learning Activity 5.4

1. Children weighing less than 20 kilos should be started with ABC sp+3TC sp+LPV/r (40mg/10mg)pt Or ABC+3TC+LPV/r (Syrups). Alternate regimen is ABC+3TC+NVPsp/EFV
2. FALSE. In young children, the course of HIV infection is accelerated. Whereas adults generally remain symptom free for a decade or more, many children develop symptoms by their first birthday. Death often ensues by age 5 even with ART.
3. FALSE. The preferred 1st line option for children of 30kgs and above without renal failure is TDF/3TC/DTG

Expected Answers for Self-Assessment Activity 5.4

1. TB screening is mandatory for all children at enrolment and at each clinical visit. TPT (Tuberculosis preventive therapy) should be integrated in HIV management.
2. The preferred 1st line option for children of 30kgs and above without renal failure is TDF/3TC/DTG.
3. (B) Anti-TB should be initiated immediately and ART within 2 to 8 weeks.

Lesson 5: ARV Treatment in Pregnant Women

a) Learning objectives:

By the end of the session, the students should be able to describe the antiretroviral protocol used for reducing the risk of perinatal transmission and for treating pregnant women with HIV AIDS.

b) Prerequisites/Revision/Introduction:

This is the fifth lesson of the fifth unit of **antiviral drugs.** In this lesson, you will be dealing with national treatment guidelines for **ARV Treatment in Pregnant Women.** The first thing to do before starting teaching is to remind students that they have learnt about general pharmacology (principles of pharmacology), medical pathology, human biology and surgical pathology, normal obstetric so that they can prepare themselves for this lesson on **ARV Treatment in Pregnant Women**.

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 **ARV Treatment in Pregnant Women.**

c) Teaching resources:

They included: Pharmacology books, S5 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 5.5 ARV Treatment in Pregnant Women

Teachers' activities:

- Ask students to do in small groups activity 5.5 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 note any areas where students have problems and ensure that these are emphasized in the subsequent learning lessons.
- Discuss in detail the various issues raised but to assure the students that they will be discussed in the subsequent learning lessons.
- 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 5.5 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 carefully follow 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 5.5

1. Women tested HIV positive during ANC or at the time of labor, should start anti-retroviral therapy immediately. In case of delay, ART initiation should not go beyond 7 days.
2. Every pregnant or breastfeeding woman newly tested positive for HIV should start with ART regimen Tenofovir + Lamivudine + Dolutegravir.

Answers for self-Assessment Activity 5.5

1. FALSE: Every pregnant woman whose HIV status is unknown during ANC should be tested for HIV at the time of delivery.
2. FALSE. Doses are the same as in non-pregnant adults' HIV treatment.
3. (B) Tenofovir + Lamivudine + Dolutegravir.

Lesson 6: Prophylaxis in Newborns with Perinatal HIV Exposure or HIV Infection

a) Learning objectives:

By the end of the session, the students should be able to explain the protocol and rationale for prophylaxis in Newborns with Perinatal HIV Exposure or HIV Infection.

b) Prerequisites/Revision/Introduction:

This is the sixth lesson of the fifth unit antiviral drugs. In this lesson you will be dealing with Prophylaxis in Newborns with Perinatal HIV Exposure or HIV Infection.

The first thing to do before starting teaching is to remind students that they have learnt about general pharmacology (principles of pharmacology), fundamentals of nursing, medical pathology, human biology (protozoal lesson) antiretroviral drugs and surgical pathology, so that they can prepare themselves for this lesson on Prophylaxis in Newborns with Perinatal HIV Exposure or HIV Infection.

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 Prophylaxis in Newborns with Perinatal HIV Exposure or HIV Infection

c) Teaching resources:

They include: Pharmacology books, S5 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 5.6. Prophylaxis in Newborns with Perinatal HIV Exposure or HIV Infection

Teachers' activities:

- Ask students to do in small groups activity 5.6 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 note any areas where students have problems and ensure that these are emphasized in the subsequent learning lessons.
- Discuss in detail the various issues raised but to assure the students that they will be discussed in the subsequent learning lessons.
- 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 5.6 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 carefully follow 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 5.6

All children born to a known HIV positive mother (before or during labour) will receive zidovudine and Nevirapine (AZT+ NVP) as soon as possible within 72 hours after birth up to six weeks of life.

Answers for Self-Assessment 5.6

If the mother is identified to be HIV-positive at the time of breastfeeding, she should be put on ART. The child will start a combined AZT and NVP as soon as possible for six weeks. At the end of 6 weeks ART prophylaxis; the child will also start cotrimoxazole prophylaxis until the final confirmation of HIV negative status at 24 months of life. And All Breastfed infants who are at high risk of acquiring HIV, including those first identified as exposed to HIV during the postpartum period, should continue infant prophylaxis for an additional 6 weeks (total of 12 weeks of infant prophylaxis) using NVP and AZT.

Lesson 7: HIV Prevention Among Discordant Couples

a) Learning objectives:

By the end of the session, the students should be able to Describe HIV prevention among discordant couples.

b) Prerequisites/Revision/Introduction:

This is the seventh lesson of the fifth unit of **antiviral drugs.** In this lesson, you will be dealing with HIV Prevention Among Discordant Couples. The first thing to do before starting teaching is to remind students that they have learnt about general

pharmacology (principles of pharmacology), fundamentals of nursing, medical pathology, human biology and surgical pathology, so that they can prepare themselves for this lesson on **HIV Prevention Among Discordant Couples.**

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 **HIV Prevention Among Discordant Couples.**

c) Teaching resources:

They include: Pharmacology books, S5 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 5.7 HIV Prevention Among Discordant Couples

Teachers' activities:

- Ask students to do in pairs activity 5.7 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 note any areas where students have problems and ensure that these are emphasized in the subsequent learning lessons.
- Discuss in detail the various issues raised but to assure the students that they will be discussed in the subsequent learning lessons.
- 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 pairs the activity 5.7 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 carefully follow 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 5.7

1. The overall package of interventions is:

- Risk reduction counselling and condom provision
- Initiation of pre-exposure prophylaxis for those whose HIV positive partner is not yet on ARV or are not virally suppressed
- Family planning counselling and service provision
- Repeat HIV testing for the uninfected partner every 12 months
- Care and treatment for the HIV-positive partner
- STI screening and treatment

2. The objectives of these interventions are

- To protect the negative partners from acquiring HIV infection
- To provide care and treatment to HIV positive partners, allowing them access to early treatment that improves clinical outcomes
- To protect future children from HIV infections
- To offer the appropriate HIV prevention package for children and other family members of the HIV positive individuals
- To support the prevention of unwanted pregnancies in discordant couples

Expected Answers for Self-Assessment 5.7

1. **TRUE**
2. **TRUE**

Lesson 8. ART for Post-Exposure Prophylaxis (PEP)

a) Learning objectives:

By the end of the session, the students should be able to explain the protocol and rationale for post exposure prophylaxis following occupational exposure to HIV infected fluids.

b) Prerequisites/Revision/Introduction:

This is the eight lesson of the fifth unit antiviral drugs. In this lesson you will be dealing with ART Post Exposure Prophylaxis/ Accidental Exposure to Blood (AEB) or to Other Biological fluids .

The first thing to do before starting teaching is to remind students that they have learnt about general pharmacology (principles of pharmacology), fundamentals of nursing, medical pathology, human biology and surgical pathology, so that they can prepare themselves for this lesson on Explain the protocol and rationale for post exposure prophylaxis following occupational exposure to HIV infected fluids.

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 Explain the protocol and rationale for post exposure prophylaxis following occupational exposure to HIV infected fluids.

c) Teaching resources:

They include: Pharmacology books, S5 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 5.8 ART for Post-Exposure Prophylaxis (PEP)

Teachers' activities:

- Ask students to do in small groups activity 5.8 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.
- Assist the students to identify key issues regarding the ART for Post-Exposure Prophylaxis (PEP)
- Remember to note any areas where students have problems and ensure that these are emphasized in the subsequent learning lessons.
- Discuss in detail the various issues raised but to assure the students that they will be discussed in the subsequent learning lessons.
- 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 5.8 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 carefully follow 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 5.8

1. **The drugs that may be administered to this patient are:**
   - 1.TDF+ 3TC / FTC +ATV/r
   - 2. AZT + 3TC/ FTC + ATV/r(If no TDF or a contraindication)
2. **FALSE:** An HIV serology test should be performed for the exposed caregiver as soon as possible (ideally within 48 hours).

Expected Answers for Self-Assessment 5.8

1. HIV post-exposure prophylaxis for survivors of sexual assault is considered within 72 hours
2. The severity of the exposure, which is directly linked to the depth of the wound and the type of needle that was responsible for the injury (venipuncture needle, needle for injection, non-sharp instrument). For external contact of secretions with the skin or mucosa (splash), the risk is higher with blood than with any other body secretions (amniotic fluid, serous fluid). The person assumed to be the source should be assessed on his or her HIV status, clinical and immunological status and history of ART.

5.7. Summary of the Unit

Antivirals are a class of drugs which are used to treat viral infections. The antiviral drugs target diverse group of viruses such as herpes, hepatitis, and influenza viruses. A**ntiretroviral drugs fall in the broad category of antivirals, and these are** the drugs that are used to fight retrovirus infections which mainly include HIV. Different classes of antiretroviral drugs act on different stages of the HIV life cycle.

Six classes are currently being used in attempt to control the HIV as follows:

- Nucleoside/nucleotide reverse transcriptase inhibitors (NRTIs)
- Non-nucleoside reverse transcriptase inhibitors (NNRTIs)
- Integrase strand transfer inhibitors (INSTIs),
- Protease inhibitors (PIs) inhibit HIV enzymes.
- HIV fusion inhibitors and
- CCR5 antagonists

They have different mechanisms of action according to where they exert their effects, and their chemical structure. These highly effective regimens can reduce plasma HIV to undetectable levels, causing CD4 T-cell counts to return toward normal, thereby restoring some immune function. However, despite these advances, treatment cannot cure HIV. The HIV mutates over time, presenting a slightly different configuration with each new generation.

These medications are combined to exert their effects, and the monotherapy should always be avoided. Three medications are generally combined to potentiate the actions of one another, and prevent the risk of treatment failure.

Women should be assessed for a possibility of a pregnancy, and if they are pregnant, the antiretroviral therapy should be initiated immediately or as soon as possible. They should benefit from the doses as the guidelines of treatment for adults, and ensure that the right medications are used in order to avoid possible interference with the pregnancy.

Children born to HIV positive women should also benefit from prophylaxis medications that include ARVs and cotrimoxazole. Discordant couples should also benefit from antiretroviral medications according to the guidelines.

5.8. Additional information for taechers

Antiviral Agents: Drugs for Non-HIV Viral Infections

1. **Drugs for Herpes Simplex Virus Infection:** Acyclovir Ganciclovir

Acyclovir

Indications: Treatment of herpes simplex virus (HSV) 1 and 2 infections; treatment of severe genital HSV infections; treatment of HSV encephalitis; acute treatment of shingles and chickenpox; ointment for the treatment of genital herpes infections; cream for the treatment of cold sores (herpes labialis).

Contraindications: It is contraindicated for patient with hypersensitive to acyclovir. In high doses, polyuric renal failure has occurred therefore adequate hydration should be maintained to prevent dehydration.

Mechanism of actions: Inhibits viral DNA replication.

Pharmacokinetics: Half-life: 2.5 to 5 hours; excreted unchanged in the urine.

Adverse Effects: Headache, vertigo, tremors, nausea, vomiting, rash.

2. **Drugs for Hepatitis**

A) Antihepatitis C drugs: are relatively new. They are protease inhibitors specific to the hepatitis C virus. They must be combined with ribavirin and peginterferon. Some antivirals are available only for the local treatment of viral infections, including warts and eye infections. Topical antivirals should

not be applied to open wounds; local reactions can occur with administration. Peginterferon alfa-2b, Lamivudine (nucleoside analog), Peginterferon alfa-2a, Ribavirin (oral nucleoside analog), Simprevir (protease inhibitor), Declatasvir (NS5A inhibitor), and Sofosbuvir (NS5B inhibitor).

Simeprevir

Indications: Treatment of chronic hepatitis C in adults with compensated liver dysfunction in combination with peginterferon alfa and ribavirin.

Contraindications: hypersensitivity to Simeprevir or any component of the formulation

Mechanism of actions: Inhibits hepatitis C protease formation preventing viral replication.

Pharmacokinetics: T1/2: 10 to 12 hours; excreted in the feces.

Adverse Effects: Fatigue, nausea, diarrhea, rash.

B) Antihepatitis B drugs

Adefovir

Indications: Treatment of chronic hepatitis B in adults with evidence of active viral replication and either evidence of persistent elevations in alanine aminotransferase and aspartate aminotransferase or histologically active disease.

Contraindications: contraindicated in patients with previously demonstrated hypersensitivity to any of the components of the product.

Mechanism of actions: Inhibits hepatitis B virus reverse transcriptase, causes DNA chain termination, and blocks viral replication.

Pharmacokinetics: T1/2: 7.5 hours; excreted in the urine.

Adverse Effects: Headache, asthenia, nausea, severe to fatal hepatomegaly with steatosis, nephrotoxicity, lactic acidosis, exacerbation of hepatitis B when discontinued.

3) Drugs for Influenza: Influenza vaccine Oseltamivir

Rimantadine

Indications: Prophylaxis and treatment of illness caused by influenza A virus in adults; prophylaxis against influenza A virus in children.

Contraindications: Rimantadine is contraindicated in patients with a known **rimantadine hypersensitivity, amantadine hypersensitivity, or hypersensitivity to any agent in the adamantane class.** Rimantadine should be used cautiously in patients with a history of seizure disorder

Mechanism of actions: Inhibits viral replication, possibly by preventing the uncoating of the virus.

Pharmacokinetics: T1/2: 25.4 hours; excreted unchanged in the urine.

Adverse Effects: Light-headedness, dizziness, insomnia, nausea, dyspnea, orthostatic hypotension, depression.

Special considerations on Antivirals

Children

Children are very sensitive to the effects of most antiviral drugs, and more severe reactions can be expected when these drugs are used in children. Many of these drugs do not have proven safety and efficacy in children, and extreme caution should be used. Most of the drugs for prevention and treatment of influenza virus infections can be used, in smaller doses, for children. Acyclovir is the drug of choice for children with herpes virus or CMV infections. The drugs used in the treatment of AIDS are frequently used in children, many now have recommended pediatric dosing but others may be used without the evidence of safety because of the seriousness of the disease. Dose should be lowered according to body weight, and children must be monitored very closely for adverse effects on kidneys, bone marrow, and liver.

Adults

Adults need to know that these drugs are specific for the treatment of viral infections. The use of antibiotics to treat such infections can lead to the development of resistant strains and superinfections that can cause more problems. Patients with HIV infection who are taking antiviral medications need to be taught that these drugs do not cure the disease, that opportunistic infections can still occur, and that precautions to prevent transmission of the disease need to be taken. Pregnant women, for the most part, should not use these drugs unless the benefit clearly outweighs the potential risk to the fetus or neonate. Women of childbearing age should be advised to use barrier contraceptives if they take any of these drugs. Zidovudine has been safely used in pregnant women. The Centers for Disease Control and Prevention advises that women with HIV infection should not breastfeed to protect the neonate from the virus.

Older Adults

Older patients may be more susceptible to the adverse effects associated with these drugs; they should be monitored closely. Patients with hepatic dysfunction are at increased risk for worsening hepatic problems and toxic effects of those drugs that are metabolized in the liver. Drugs that are excreted unchanged in the urine can be especially toxic to patients who have renal dysfunction. If hepatic or renal dysfunction is expected (extreme age, alcohol abuse, use of other hepatotoxic or nephrotoxic drugs), the dose may need to be lowered and the patient should be monitored more frequently.

Table: Treatment of Herpes Simplex Virus and Varicella-Zoster Virus Infections

Infection	Drug	Route	Dosage	Duration
HERPES SIMPLEX VIRUS INFECTIONS				
Encephalitis	Acyclovir	IV	10–15 mg/kg every 8 hr	14–21 days
Mucocutaneous in Immunocompromised host (ICH)	Acyclovir	IV	5 mg/kg every 8 hr	7–10 days
	Acyclovir	PO	400 mg 5 times/day	7–14 days
	Valacyclovir	PO	Initial episode: 1 gm twice daily for 10 days Recurrent episode: 500 mg twice daily for 3 days Reduction of transmission: 500 mg once daily Suppressive therapy: Immunocompetent patients: 1 gm once daily (500 mg once daily in patients with < 9 recurrences per year) HIV-infected patients (CD4 ≥ 100 cells/mm3): 500 mg twice daily	
	Famciclovir	PO	500 mg 2 times/day	7–10 days
	Foscarneta	IV	400 mg 2–3 times/day	7–21 days
Neonatal	Acyclovir	IV	5–10 mg/kg every 8 hr	7 days
Orolabial	Acyclovir	Topical	5% cream 5 times/day	4 days
	Penciclovir	Topical	1% cream every 2 hr	4 days
	Docosanol	Topical	10% cream 5 times/day	4 days or until lesions have healed
Genital infections	See Chapter 95			

VARICELLA-ZOSTER VIRUS INFECTIONS				
Varicella	Acyclovir	PO	800 mg 4 times/day	5 days
Varicella in Immunocompromised host (ICH)	Acyclovir	IV	10 mg/kg every 8 hr	7 days
Herpes zoster	Acyclovir	PO	800 mg 5 times/day	7–10 days
	Valacyclovir	PO	1 gm 3 times/day	7 days
	Famciclovir	PO	500 mg 3 times/day	7 days
Herpes zoster in Immunocompromised host ICH	Acyclovir	IV	10 mg/kg every 8 hr	7 days
Acyclovir-resistant zoster	Foscarnet	IV	40 mg/kg every 8–12 hr	10 days

Interferon Alfa Preparations: Dosages for Chronic Hepatitis B and Hepatitis C

Generic Name	Brand Name	Chronic Hepatitis B	Chronic Hepatitis C
CONVENTIONAL INTERFERON ALFA PREPARATIONS			
Interferon alfa-2b	**Intron A**	5 million IU subQ daily or 10 million IU subQ 3 times/week	3 million IU subQ or IM 3 times/week
Interferon alfacon-1	**Infergen**	(Not used)	Monotherapy: 9 mcg subQ 3 times/week With ribavirin: 15 mcg subQ daily
LONG-ACTING INTERFERON ALFA PREPARATIONS			
Peginterferon alfa-2a	**Pegasys**	180 mcg subQ once/week	180 mcg subQ once/week
Peginterferon alfa-2b	**PegIntron, Unitron PEG**		Monotherapy: 1 mcg/kg subQ once/week With ribavirin: 1.5 mcg/kg subQ once/week

5.9. Answers to End Unit Assessment

i. Completing the empty spaces with appropriate terms:

1. Antiviral
2. Retrovirus
3. antiretroviral drugs

ii. Responding by true or false

1. T
2. F
3. F
4. T
5. T
6. F

6.0. Additional Activities

6.0.1. Remedial Activities

Answer by TRUE or FALSE

1. Antiretroviral therapy (ART) is recommended for all persons with HIV to reduce morbidity and mortality and to prevent the transmission of HIV to others
2. The goal of antiretroviral therapy is to decrease the number of CD4 cells so as to improve the immune reconstitution.
3. One of the goals of antiretroviral therapy is to reduce the transmission of HIV

Answers for remedial activities

1. TRUE
2. FALSE
3. TRUE

6.0.2. Consolidation activities

1. Clinical and laboratory evaluations are the cornerstones of care and treatment of HIV positive children of ≤10 years old.
2. In general, the management of HIV infection in pregnant women should follow the same guidelines for managing HIV infection in nonpregnant adults.

3. Which of the following antiretroviral treatment regimens should preferably be initiated to the childern younger than 10 years of age, weighing <20 kg?
   A. **ABC+3TC+NVP**
   B. **ABC sp+3TC sp+EFV**
   C. **ABC sp+3TC sp+LPV**
   D. **ABC+3TC+DTG**

Answers for consolidation activities

1. TRUE
2. TRUE
3. C

6.0.3. Extended Activities

1. Which of the following antiretroviral treatment regimens should prerably be initiated to the childern younger than 10 years of age, weighing 20 -30kg?
   A. **ABC+3TC+NVP**
   B. **ABC sp+3TC sp+EFV**
   C. **ABC sp+3TC sp+LPV**
   D. **ABC+3TC+DTG**
2. According to the Rwanda national guidelines of HIV management, what are the three drugs that should be used for every pregnant or breastfeeding woman newly tested positive for HIV?
3. According to the Rwanda national guidelines of HIV management, what are the three drugs that should be used for every pregnant or breastfeeding woman newly tested positive for HIV with impaired renal function or any contraindication to TDF?
4. Which of the following combinations should a pregnant HIV-negative partner of the discordant couple be given as a single dose at labor?
   A. **TDF+3TC+DTG**
   B. **ABC+3TC+DTG**
   C. **ABC+3TC+NVP**
   D. **EFV+3TC+NVP**

Answers for Extended Activities

1. D
2. Tenofovir + Lamivudine + Dolutegravir.
3. ABC + 3TC+DTG
4. A

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Electronic links:

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- HIV Drugs and the HIV Lifecycle | The Well Project
- https://www.medicinenet.com/antiviral/definition.htm
- https://www.britannica.com/science/retrovirus
- https://clinicalinfo.hiv.gov/en/guidelines/adult-and-adolescent-arv/initiation-antiretroviral-therapy?view=full
- https://clinicalinfo.hiv.gov/en/guidelines/pediatric-arv/when-initiate-therapy-antiretroviral-naive-children
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