ANIMAL HEALTH CARE SERVICES LEVEL- III

BASED ON MARCH 2018, VERSION 3 OCCUPATIONAL STANDARDS

MODULE TITLE: IDENTIFYING AND ORGANIZING VETERINARY DRUGS AND CHEMICALS

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East Africa Skills for Transformational and Regional Integration (ESTRIP) Project

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LG 81	LO #1. Follow OHS procedures

Instruction sheet
This learning guide is developed to provide you the necessary information regarding the following content coverage and topics: • Recognizing and reporting risks • Following safe work practice • Using, maintaining & storing PPE clothing & equipment • Implementing OHS procedures • Disposing wastes This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, upon completion of this learning guide, you will be able to: • Recognize and report risks in handling and use veterinary drugs • Follow accurately safe work practices including OHS • Use, maintain and store PPE clothing and equipment • Implement OHS procedures in accordance with the Ethiopian Drug and Feed Administration and Control Authority. • Dispose Wastes in line with environmental health policies and legislations.

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below.
3. Read the information written in the “Information Sheets”. Try to understand what are being discussed. Ask your trainer for assistance if you have hard time understanding them.
4. Accomplish the “Self-checks” which are placed following all information sheets.
5. Ask from your trainer the key to correction (key answers) or you can request your trainer to correct your work. (You are to get the key answer only after you finished answering the Self-checks).
6. If you earned a satisfactory evaluation proceed to “Operation sheets
7. Perform “the Learning activity performance test” which is placed following “Operation sheets” ,
8. If your performance is satisfactory proceed to the next learning guide,
9. If your performance is unsatisfactory, see your trainer for further instructions or go back to “Operation sheets”.

1.1. Introduction

Risk is defined as the probability of an adverse effect in an organism, system or (sub) population caused under specified circumstances by exposure to an agent. Or is the likelihood or probability of the hazard occurring and the magnitude of the resulting effects. For example, if you climb a ladder you know there is a chance you could fall off and be injured, although it is unlikely. The ladder is the hazard and the chance of injury is the risk you take by climbing the ladder. In the terminology adopted by the Office International des Epizooties (OIE, 2001), risks are equated with a process of hazard identification, which is designed to answer the question of What can go wrong? However, this refers to trade and it is defined as "the process of identifying any pathogenic agents which could potentially be introduced in the commodity considered for importation".

Recognizing risk

Examination of the risk, made in order to understand its nature or to determine its essential features and consequences.

Reporting risks: An information describing or an account of certain events given or presented to someone (Detail information about the events, adverse effects).

1.2. Recognizing and reporting risks

The essential first step in any risk analysis is to provide a definition of the hazard or risk being considered and in the case of the potential risks associated with the use of veterinary drugs and chemicals in aquaculture it would be prudent to consider two general effect categories, although other minor risks also exist. In general, the **potential risks** are related to the type of agent being considered (Table 1). For instance, the inappropriate use of chemotherapeutants may lead to the development of resistant bacteria or food residues, whereas parasiticides, oxidants, algicides, biocides and herbicides can result in toxicity for animal/human organisms.

Common risks in animal environment includes:

- Animal bite, kick, horning,
- Manual handling,
- Zoonotic diseases,
- Light (ultraviolet), radiation, sharps, odors,
- Chemicals, burn by chemicals and biological- biological waste, electricity, and
- Hypersensitivity, drug residue, over dosage, accidental self-injection
- Zoonosis, release of infective agents (both animal and human), chemical spillage and gas leakages

Table 1. Potential risks associated with the use of drugs and chemicals in aquaculture

Type of agent	Potential Risks
Chemotherapeutants (e.g. antibiotics)	Development of resistant bacteria; residues in food
Parasiticides (e.g. pesticides)	Acute toxicity to marine organisms; irritation to handlers; residues in food; development of resistance
Oxidants	Explosive; toxicity; irritation to handlers
Algicides, biocides and herbicides	Toxic to aquatic life at high dosages; irritation to handlers; liver, kidney and thyroid effects in humans; carcinogenic; blood, liver and kidney effects in animals

1.3. Reporting work place incidents and injuries

To promote a safe work environment, all work related, incidents, injuries, illnesses and exposures will be reported immediately or within 24 hours by the employee to their immediate supervisor or next person in charge at the time of injury, and the Safety Office. When a work related incident/injury/illness/exposure occurs, whether medical attention is needed or not, the following steps must be followed: When there is a potential for an incident to occur, or when a hazard is identified, the employee will file immediately report with their immediate supervisor. The supervisor will assess the near miss and make certain that corrective action is complete to prevent recurrence.

Immediate Action

Depending on the risk of the hazard or incident involved immediate action must be taken to prevent further persons from being injured. This may involve the activation of emergency procedures or other actions to control the immediate risk to persons in the area.

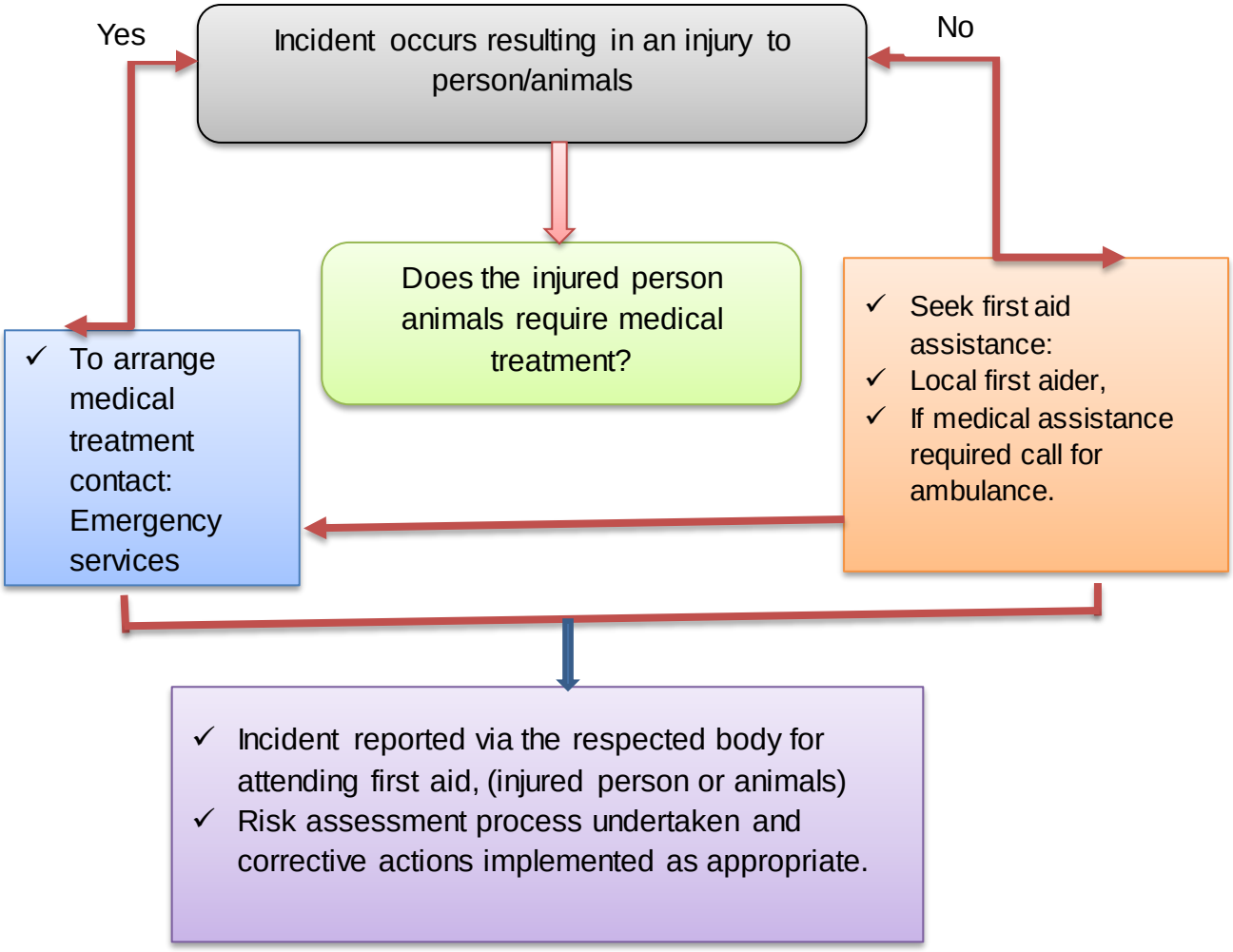

Diagram 1. Diagram of risk management

1.4. Minimizing/ controlling risks

There are a number of ways to control/minimize the risks associated with hazardous chemicals other risks. Some control measures are more effective than others. Control measures can be ranked from the highest level of protection and reliability to the lowest. This ranking is known as the hierarchy of control. Always aim to eliminate a hazard an associated risk first. If this is not reasonably practicable, the risk must be minimized by using one or more of the following approaches:

1. Substitution
2. Isolation
3. Implementing engineering controls.

If a risk then remains, it must be minimized by implementing administrative controls, so far as is reasonably practicable. Any remaining risk must be minimized with suitable personal protective equipment (PPE). Administrative control measures and PPE rely on human behaviour and supervision and when used on their own, tend to be the least effective ways of minimizing risks.

Eliminating the hazard

This means removing the hazard or hazardous work practice from the workplace. This is the most effective control measure and must always be considered before other control measures. For example, not using a hazardous chemical or eliminating exposure by:

- Using nails instead of using chemical based adhesives
- Eliminating a handling activity and potential worker exposure by purchasing pre-mixed or diluted chemicals instead of manually mixing or diluting chemicals at the workplace.

Step of reducing/eliminating hazard/incident

1) Hazard/incident identification
2) Incident description
3) Contributing factors
4) Determine the cause
5) Analyze risk level
6) Implement corrective Actions

Substitution

Substitution is the replacement of a hazardous chemical with a chemical that is less hazardous and presents lower risks, for example:

- Substituting a less volatile material to control a vapor hazard may cost less than the installation and maintenance of a mechanical ventilation system
- Substituting a highly flammable liquid with one that is less flammable or combustible
- Using hazardous chemicals with a single hazard class rather than those with multiple hazards
- Substituting high hazard chemicals like carcinogens, mutagen, reproductive toxicants and sensitizers, with less hazardous chemicals
- Using diluted acids and alkalis rather than concentrates
- Using a product in either paste or pellet form rather than as dust or powder.

Isolation

Isolation involves separating people from the chemicals or hazards by distance or barriers to prevent or minimize exposure. Examples of isolation include:

- Isolate workers from chemicals or other injurious materials
- Use of closed systems such as those used during the processing and transfer of flammable liquids in petroleum refineries, or the use of glove boxes or glove bags
- Placing a process, or a part of it, within an enclosure which may also be fitted with exhaust extraction to remove contaminants
- Isolating operations in one room with access restricted to properly protected Personnel
- Placing operators in a positive pressure cabin that prevents airborne contaminants entering
- Distancing workers from hazardous chemicals and any potential hazards generated by their use.

Engineering controls

Engineering controls are physical in nature, including mechanical devices or processes that eliminate or minimize the generation of chemicals, suppress or contain chemicals, or limit the area of contamination in the event of spills and leaks. They often involve partial enclosure, use of exhaust ventilation or automation of processes. Examples of engineering controls include:

- Using intrinsically safe electrical equipment in hazardous areas
- Using robots to minimize operator exposure, for example, spraying in coating operations
- Partially enclosed and ventilated spray booths or fume cupboards
- Fully enclosed ventilation booth
- Local exhaust ventilation to capture airborne contaminants close to their point of release

Self-check 1

Name_____ **ID**_____ **Date**_____

Directions: Answer all the questions listed below 3 point each. Examples may be necessary to aid some explanations/answers.

Test I Short answer questions

1. What is risk?
2. Describe Common risks in animal environment.
3. Explain how to report risk in the work place.
4. Write the methods of eliminating or minimizing risk.

Test II Choose the correct answer for the following questions.

1. Which one of the following is the concequence of chemical risks in the work environment?
   A. Animal poisoning
   B. Development of drug resistance
   C. Irritation to handlers
   D. All of the abbove
2. _____is the replacement of a hazardous chemical with a chemical that is less hazardous and presents lower risks.
   A. Isolation
   B. Substitution
   C. Engineering control
   D. Elimination

Test III Fill in the bblank space

1. _____are physical in nature, including mechanical devices or processes that eliminate or minimize the generation of chemicals, suppress or contain chemicals, or limit the area of contamination in the event of spills and leaks.

Note: Satisfactory rating – 21 points Unsatisfactory - below 21 points

Information Sheet 2- Following safe work practices

2.1. Introduction

The veterinary profession is comprised of a diverse group of individuals who interact with a wide variety of animal species under working environments which carry occupational hazards and risk of injury. Veterinarians in private practice, particularly those who work with small animals, may take X-rays, perform surgery, use gas or injectable anesthetics, and administer cytotoxic drugs. Individuals who work with large animals are often in unpredictable situations that expose them to physical injury. Even with safe workplace practices, hazards resulting in minor to severe injury occur within the profession.

2.2. Following safe work practice

Chemical hazards are present when a person is exposed to a harmful chemical at home or at work. The chemicals can be in the form of gases, solids or liquids. Exposure to chemicals could cause acute health effects (an immediate or rapid onset) if taken in large quantities in a single dose; and chronic health effects (long-term effects on health) if taken in small doses over an extended time. Detergents (powdered soap, bleaching powder), drugs (veterinary and human) and pesticides (Malathion, diazinon, zinc phosphide, warfarin) are chemical hazards that are commonly found in rural households. Farmers, young children (under 5 years) and household animals are vulnerable to chemical exposure, but it is always possible that anyone might come into contact with the chemical during preparation, spraying, use or storage. A person is exposed to chemicals through various ways: through inhaling the vapours, gases or dusts; through skin contact with solvents, acids and alkalis; and through ingestion of unknown chemicals with food and water. The use of PPE clothing and equipment relevant to the task such as safety goggles, glasses, protective masks and animal handling gauntlets are essential to ensure safe working practices.

To ensure a safe working environment follow safe work procedures

To prevent exposure of personnel to these agents and to prevent sharps and biohazards from showing up in the environment and/or being used by unauthorized personnel, proper disposal procedures must be followed.

- Preserving cleanliness, preventing pathogen build-up and breaking possible pathways of transmission
- Use safety equipments and tools
- Use herbicides and pesticides carefully and according to the manufacturer's instructions and applicable legislation such that animal exposure to these chemicals is minimised.
- Records of usage, including the date and location of application, should be kept.
- Ensure that when feed additives are used, that manufacturer's instructions as to dosage levels and withdrawal periods are followed, and that records of usage of such feed additives are kept.
- Use chemical disinfectants and cleansers strictly in accordance with the manufacture's instructions, ensuring that disinfected or cleaned surfaces and facilities are properly rinsed if necessary.
- Seek professional advice with regard to the use of disinfectants or cleansers.
- Maintain required storage conditions for veterinary medicines and biologicals.
- Ensure that all treatments or procedures are carried out using instruments that are appropriate and correctly calibrated for the administration of veterinary medicines and biologicals.
- Dispose of used instruments (including needles) in a biosecure manner.
- Keep all treated animals on the farm until the relevant withdrawal times have expired (unless the animals should leave the farm for veterinary treatment) and ensure that products from these animals are not used for human consumption until the withdrawal periods have elapsed.

- Ensure that all handling or treatment facilities are safe and appropriate to the species in question, facilitate correct and calm handling and restraint, and that their construction is such that the likelihood of injury is minimised.

Self-check 2

Name_____ID_____Date_____

Directions: Answer all the questions listed below 5 point each. Examples may be necessary to aid some explanations/answers.

Test I Short answer questions

1. What are the working procedure should followed to ensure safe working environment?

Test II Choose the correct answer for the following question.

1. Which one of the following is correct about occupational health and safety procedures
   A. Seek professional advice with regard to the use of disinfectants or cleansers.
   B. Use safety equipments and tools during working
   C. Ensure that all handling or treatment facilities are safe and appropriate
   D. Use herbicides and pesticides carefully and according to the manufacturer's instructions
   E. All of the above

Note: Satisfactory rating - 10 points Unsatisfactory - below 10 points

Information Sheet 3- Using, maintaining and storing personal protective clothing and equipment

3.1. Introduction

Type and importance of personal protective equipment

Personal protective equipment (PPE) includes devices such as safety glasses, gloves, protective clothing, hearing protection, respiratory protection and safety shoes. PPE is typically worn to establish a protective barrier between the wearer and a potentially injurious hazard in the workplace. PPE is generally considered to be the last line of defense for the mitigation of risk and the protection of workers from potential and actual hazards. Where feasible, the following hierarchy should be used when implementing workplace controls:

3.2. Maintaining and storing personal protective clothing and equipment

Personal protective equipments may include, but not limited to: Boots, hats/hard hat, overalls, gloves, protective eyewear, hearing protections, respirator or face mask, sun protection (sun hat, sun screen), and specialized gloves for conducting large animal examinations. Personal protective equipment should be stored in appropriate place and maintained and monitored for their functionality.

Selecting personal protective equipment

The PPE required in a workplace is determined based on a risk assessment of the workplace hazards. Employers are responsible for identifying, assessing and controlling workplace hazards. In veterinary facilities, hazards may be categorized as chemical (e.g., anesthetics, chemotherapy drugs, disinfectants, and formalin), biological (e.g., zoonotic agents), physical (e.g., radiation, noise) or safety (e.g., bite, cut, scratch, kick or trampling). The selection of PPE must account for the type of hazards present. Consider the following factors when assessing hazards that may be present in veterinary settings:

- Temperament and health status of patient
- Suspected infectious disease in patient and route(s) of transmission

- Hazards in the facility, task or work area
- Chemical properties of products or agents in use
- Risk of splash with bodily fluids to face or body
- Risk of cuts, bites, scratches, kicks, or trampling
- Presence of airborne chemicals, pathogens or allergens
- Persistent noise due to barking, squealing, etc.

For many veterinary practitioners, PPE worn daily may include cotton/polyester lab coats, coveralls or scrubs, closed-toe footwear or rubber boots, impervious disposable gloves and safety glasses. Specific situations and the presence of new hazards may however necessitate the use of additional PPE. The following table identifies PPE categories, types and potential applications in veterinary medicine.

Table 2. PPE category, type and application

Category	Types	Application
Body Protection	• Coveralls • Scrubs • Lab coats • Gowns	• To protect from skin contact with blood, body fluids, chemicals, sun exposure or vectors (e.g., ticks or mosquitoes) and reduce the risk of disease transmission • To prevent contamination of street cloth
Hand Protection	• Examination gloves (nitrile, vinyl) • Palpation sleeves • Chemical-resistant • Work gloves • Cut-resistant gloves	• To reduce risk of disease transmission • To prevent exposure to body fluids during Examinations • To protect from cuts, punctures, bites, scratches, abrasion • To provide protection from skin contact when handling chemicals (e.g., formalin)
Eye and Face Protection	• Safety glasses • Safety goggles • Face shield	• To protect the face and eyes from exposure to blood, body fluids, chemical splashes
Foot Protection	• Closed-toe • Slip resistant	• To protect the foot from punctures, cuts, bites, crushing, exposure to infectious materials or chemicals

	• Protective toe-cap and sole • Rubber boots • Overshoes • Shoe covers	• To reduce the risk of slips and falls when working in wet environments • To reduce the transmission of pathogens
Respiratory Protection	• Air purifying respirator	• To reduce inhalation exposures to airborne agents (e.g., allergens, gases, vapours, pathogens, bedding and feather dusts)
Hearing Protection	• Earplugs • Earmuffs	• To reduce exposure to high noise levels due to sources such as, barking dogs, squealing pigs, roosters/chickens, cattle chutes

Self-check 3

Name_____**ID**_____**Date**_____

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I Short answer questions

1. Describe the importance of personal protective equipment briefly.
2. List hearing and respiratory protective equipment respectively
3. What are the factors should be considered during assessing hazards?

Test II Choose the best answer for the following questions.

1. Which one of the following is classified under chemical hazard?
   A. Toxic drug
   B. Zoonotic agent
   C. Animal bite/snake bite
   D. Ultraviolet radiation
2. The merit of hand protecting equipment are:
   A. Reduce risk of disease transmission
   B. Prevent exposure to body fluids during
   C. Protect from cuts, punctures, bites,
   D. All of the above

Test III Fill in the blank space with the correct word/phrase

1._____is typically worn to establish a protective barrier between the wearer and a potentially injurious hazard in the workplace.

Note: Satisfactory rating - 6 points Unsatisfactory - below 6 points

Information Sheet 4- Implementing OHS procedures

4.1. Introduction

All employees have the right to work in an environment that is free of recognized hazards that may cause death or serious physical harm. The role of the Occupational Safety section is to establish policies, practices and procedures that, when followed, reduce the risk to the working environment of injury while performing their job duties. Occupational health and safety procedure has implemented policies that reflect the current standard of care for safe job performance. Occupational safety staff monitors compliance through periodic job site and maintenance shop inspections. Staff members are available to consult on any occupational safety issue and regular training classes are provided to make sure all stakeholders have the latest information relevant to performing their jobs in a safe manner.

4.2. Applying Occupational health and safety procedures

The recommended practices present a step-by-step approach to implementing occupational safety and health program, built around **seven core elements** that make up a successful program. The main goal of occupational safety and health programs is to prevent workplace injuries, illnesses, and deaths, as well as the suffering and financial hardship these events can cause for workers, their families, and employers. The recommended practices use a proactive approach to managing workplace safety and health. Traditional approaches are often reactive –that is, problems are addressed only after a worker is injured or becomes sick, a new standard or regulation is published, or an outside inspection finds a problem that must be fixed. These recommended practices recognize that finding and fixing hazards before they cause injury or illness is a far more effective approach.

The seven core elements that make up a successful occupational health and safety program.

1. Management leadership.
2. Worker participation.

3. Hazard identification and assessment.
4. Hazard prevention and control.
5. Education and training.
6. Program evaluation and improvement.
7. Communication and coordination for host employers

Employers of veterinary medicine and animal care workers should:

- Develop and implement a comprehensive written workplace-specific safety and health program.
- Review and update the written safety and health program periodically.
- Document and maintain staff records of training, immunizations, and work-related injuries and illnesses.
- Comply with Federal and State occupational hazard laws.
- Comply with relevant Federal, State, and local laws such as proper veterinary waste management and disposal.
- Inform all workers and volunteers about potential workplace hazards.
- Promote safe work habits including best infection control practices.
- Have a medical surveillance system in place to record and report workplace-related injuries and illnesses.
- Ensure that equipment is maintained and operated safely. Employers will find that implementing these recommended practices also brings benefits.

Self-check 4

Name_____ **ID**_____ **Date**_____

Directions: Answer all the questions listed below 2 point each. Examples may be necessary to aid some explanations/answers.

Test I Short answer question

1. Describe the role of occupational health and safety education.
2. What are the seven core elements that make up a successful occupational health and safety program?

Test II Choose the best answer for the following questions

1. To ensure safe work place employers of veterinary medicine and animal care workers should:

A. Document and maintain staff records of training,
B. Comply with Federal and State occupational hazard laws.
C. Comply with relevant Federal, State, and local laws such as proper veterinary waste management and disposal.
D. Inform all workers and volunteers about potential workplace hazards
E. All of the above

Test II Fill in the blank space with appropriate word/phrase

1. _____means that the medicines must be effective against the diseases, in the species of animals, at the dose rate, frequency and duration of treatment.

Note: Satisfactory rating - 10 points Unsatisfactory - below 10 points

Information Sheet 5- Disposing wastes

5.1. Introduction

Storage facility grounds, including the area around health centers, must remain free of health care waste and other garbage. Maintaining a clean environment where pharmaceuticals and other animal health supplies are stored will reduce the number of pests insects and rodents and reduce the number of animals, people, including children, who may be injured by used medical equipment or discarded medicines. Check with local officials about laws that pertain to animal health care waste management and environmental protection before instituting a disposal technique. Plan storage, transportation, and disposal techniques that are practical and simple. Monitor disposal practices on a regular, frequent basis.

5.2. Waste disposal Methods

Waste management options are listed in order of desirability from most desirable at the top to least desirable at the bottom.

Diagram 2. The waste hierarchy.

Type of Wastes

Different types of waste that must be destroyed safely and effectively and their methods of disposal include:

1. Non-medical waste (General Wastes)

a) **Garden rubbish:** Compost leaves, sticks, weeds, and trimmings from shrubs and trees, if feasible. Designate a separate area for composting.

b) **Cardboard cartons:** If possible, recycle cardboard; otherwise, treat like ordinary rubbish.

c) **Ordinary rubbish:** Where municipal solid waste facilities exist, dispose of ordinary rubbish in the municipal dump. Otherwise, burn or bury it.

d) **Human waste:** Use pit latrines or other toileting facilities to dispose of all human waste.

e) Animal wastes (from animals, tissue or bedding)

2. Health care waste

a) **Sharps waste:** Single-use disposable needles, needles from auto-disable syringes, scalpel blades, disposable trocars, sharp instruments requiring disposal, and sharps waste from laboratory procedures.

b) **Hazardous medical waste:**

Waste contaminated with blood, body fluids, animal tissue; compounds such as mercury; pressurized containers; and wastes with high heavy metal content.

c) Pharmaceuticals:

Expired, damaged, or otherwise unusable medicines and items contaminated by or containing medicinal substances.

Figure 1. Expired medical wastes

Waste Disposal Methods

Burial pits and encapsulation are suitable in locations without shallow groundwater and for small volumes of waste.

a) **Burial pits:** The bottom of the pit should be 1.5 m above the groundwater level, 3–5 m deep, and lined with a substance of low permeability, such as clay. Surround the opening with a mound to keep run-off water from entering the hole, and build a fence around the area. Periodically, cover waste layers with 10–15 cm of soil.
b) **Encapsulation:** Cement-lined pits or high-density plastic containers or drums are filled to 75% capacity with animal health care waste. The container is then filled with plastic foam, sand, cement, or clay to immobilize the waste. The encapsulated waste is then disposed of in a landfill or left in place if the container is constructed in the ground.
c) **Incineration:** Medium- and high-temperature incineration devices require a capital investment and an operations and maintenance budget. They operate on fuel, wood, or other combustible material and produce solid ashes and gases. Pollutants are emitted to varying degrees. The ash is toxic and must be buried in a protected pit. Combustible waste is reduced to incombustible waste with a decreased volume. The high temperatures kill microorganisms.
    - **Medium-temperature incinerators,** commonly a double-chamber design or pyrolytic incinerator, operate at a medium-temperature combustion process (800°–1,000°C).

- **High-temperature incinerators,** recommended by WHO, treat health care waste at a temperature >1,000°C. When operated by staff trained in correct use and maintenance, incineration in a device like this one
    - ✓ Completely destroys needles and syringes
    - ✓ Kills microorganisms
    - ✓ Reduces the volume of waste
    - ✓ Generates less air pollution than low-temperature burning.

Note: Incinerate pharmaceuticals only if absolutely necessary.

- **Low-temperature burning:** Burning devices not exceeding 400°C include single-chamber brick hearths, drum burners, and burning pits. They burn incompletely and do not fully destroy waste. They may not kill microorganisms. Given these shortcomings, low-temperature burning should be used only as a short-term solution.

d) Burn and bury: Pit burning is a low-cost but relatively ineffective means of waste disposal. A fence should surround the pit to prevent children, animals, and others from coming into contact with the waste. The pit location should avoid walking paths (high-traffic areas). The fire, usually started with a petroleum-based fuel and allowed to burn, should be supervised by designated staff and located down-wind of the facility and residential areas. The low-temperature fire emits pollutants, and the ash and remaining material should be covered with 10–15 cm of dirt.

Waste types not to be incinerated

- Pressurized gas containers.
- Large amounts of reactive chemical waste.
- Silver salts and photographic or radiographic wastes.
- Halogenated plastics such as polyvinyl chloride (PVC).
- Waste with high mercury or cadmium content, such as broken thermometers, used batteries, and lead-lined wooden panels.
- Sealed ampoules or ampoules containing heavy metals.

Pharmaceutical Disposal

It is very important to dispose of pharmaceuticals properly because there can be very negative consequences to improper disposal. Improper disposal can result in

- Contaminated water supplies
- The diversion and resale of expired or inactive medicines
- Improperly incinerated products, which can release toxic pollutants into the air.

Self-check 5

Name_____ **ID**_____ **Date**_____

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I: Short Answer Questions

1. Write types of waste disposal with describing examples

Test II: Choose the correct answer for the following questions.

1. Which one is correct management of waste in the order of desirability from most desirable at the top to least desirable at the bottom.

   A. Reduce-Reuse-Recovery-Dispose B. Reuse-Reduce-Recovery-Dispose

   C. Reduce-Recovery-Reuse-Dispose D. Recovery-Reuse-Reduce-Dispose

2. High-temperature incinerators, recommended at a temperature >1,000°C can:

   A. Completely destroys needles and syringes B. Kills microorganisms

   C. Reduces the volume of waste

   D. Generates less air pollution than low-temperature burning E. All of the above

3. Among the following listed waste which one is not to be incinerated

   A. Pressurized gas containers. B. Large amounts of reactive chemical waste.

   C. Silver salts and photographic or radiographic wastes. D. None of the above

4. Improper pharmaceutical disposal can result in:

   A. Contaminated water supplies B. The diversion and resale of inactive medicines

   C. Improperly incinerated products, which can release toxic pollutants into the air.

   D. All of the above

Test III Fill in the blank space space provided infront of each question with appropriate word/phrase.

1. _____and _____ are suitable in locations without shallow groundwater and for small volumes of waste.
2. _____ is a low-cost but relatively ineffective means of waste disposal.

Note: Satisfactory rating - 14 points Unsatisfactory - below 14 points

Operation Sheet - Risk/injury/hazard reducing procedures

Step of risk or hazard reducing/elimineting procedures

Step 1 Identify hazar/risks

Step 2 Incident description

Step 3 Identify contributing factors

Step 4 Determine the cause

Stpep 5 Analyze risk level

Step 6 Implement corrective actions

Step 7 Reducing risk/elimination

LAP Test

Name_____ ID_____ Date _____
Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within 1 hour. The project is expected from each student to do it.

During your work: You can ask all the necessary tools and equipment

Lap Test Title: Report risk/hazard in the work place

Task1 Apply risk/injury/hazard reducing procedures

LG 82	LO #2. Explain disposition and fate of drugs

Instruction sheet

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:

- Defining basic terminology of veterinary drugs
- Identifying materials, equipment & chemicals
- Explaining the route of drug administration.

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- Define basic terminologies of veterinary drugs
- Identify and use materials, equipment and chemicals for administration of drugs
- Explain route of drug administration for various species of animals

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below.
3. Read the information written in the "Information Sheets". Try to understand what are being discussed. Ask your trainer for assistance if you have hard time understanding them.
4. Accomplish the "Self-checks" which are placed following all information sheets.
5. Ask from your trainer the key to correction (key answers) or you can request your trainer to correct your work. (You are to get the key answer only after you finished answering the Self-checks).
6. Perform "the Learning activity performance test
7. If your performance is satisfactory proceed to the next learning guide,

Information Sheet 1- Defining basic terminology of veterinary drugs

1.1. Introduction

History of Pharmacology

Prehistoric people undoubtedly recognized the beneficial or toxic effects of many plant and animal materials. The earliest written records from China and from Egypt list remedies of many types, including a few still recognized today as useful drugs. Most, however, were worthless or actually harmful. In the 2500 years or so preceding the modern era there were sporadic attempts to introduce rational methods into medicine, but none were successful owing to the dominance of systems of thought that purported to explain all of biology and disease without the need for experimentatio and observation. These schools promulgated bizarre notions such as the idea that disease was caused by excesses of bile or blood in the body, that wounds could be healed by applying a salve to the weapon that caused the wound, and so on.

Around the end of the 17th century, reliance on observation and experimentation began to replace theorizing in medicine, following the example of the physical sciences. As the value of these methods in the study of disease became clear, physicians in Great Britain and on the Continent began to apply them to the effects of traditional drugs used in their own practices. Thus, materia medica - the science of drug preparation and the medical use of drugs began to develop as the precursor to pharmacology. However, any understanding of the mechanisms of action of drugs was prevented by the absence of methods for purifying active agents from the crude materials that were available and even more by the lack of methods for testing hypotheses about the nature of drug actions.

In the late 18th and early 19th centuries, François Magendie and later his student Claude Bernard began to develop the methods of experimental animal physiology and pharmacology. Advances in chemistry and the further development of physiology in the 18th, 19th, and early 20th centuries laid the foundation needed for understanding how drugs work at the organ and tissue levels.

1.2. Defining basic terminology of veterinary drugs

Drugs in animals can be used for various purposes, such as therapeutic, prophylactic growth promotion and other uses when veterinary drugs are indicated rationally in right dose and route of administration, the potential damages of their use are reduced and their efficacy increased. Rational use of drugs in veterinary medicine has both public health and economic significances.

(a) **Pharmacology:** (pharmaco = drug, logos = study) is a science of interaction between chemical substance & living tissues. It also studies the origin, nature, source, chemistry, effect and uses of drugs.

(b) **Pharmacokinetics:** the study of movement of drug in the body including the process of absorption, distribution, accumulation in the site of action biotransformation (metabolism) and excretion of drug. It deals with what the body does to the drugs.

(c) **Pharmacodynamics:** it is the study of physiological and biological effects of drugs on tissues and systems (It deals with what the drugs do to the body).It also defines the mechanism of action of drugs.

(d) **Pharmacy:** is a branch of health science concerned with collection, identification, purification, isolation, synthesis, standardization, and quality control of drugs. Or it is a place where drugs are prepared or dispensed.

(e) **Toxicology:** is the study of how natural or man-made poisons cause undesirable effects in living organisms. Toxicology addresses a variety of questions. For example, in agriculture, toxicology determines the possible health effects from exposure to pesticides or herbicides, or the effect of animal feed additives, such as growth factors, on people. Toxicology is also used in laboratory experiments on

animals to establish dose-response relationships. Toxicology also deals with the way chemicals and waste products affect the health of an individual.

(f) Pharmacotherapeutics: is the use of drugs in the treatment of disease.

(g) Therapeutics: is treatment of disease in general using drugs, surgery, radiation, behavioural medication & other modalities.

(h) Drug: it is a single active chemical substance present in a medicine (that has medicinal value).

(i) Chemotherapy : is a branch of pharmacology dealing with specific drugs that selectively inhibit or destroy specific agents causing disease such as bacteria, viruses, fungi and other parasites with no or minimal effects on the host.

(j) Dosage: it is the determination and regulation of the size of the drug, the frequency of drug administration, and the number of doses to be administered.

(k) Dose: it is the quantity of the drug to be administered at one time and expressed in mg/kg or iu/kg.

(l) **Drug sources:** natural sources which include plants (e. g. alkaloids), animals (e.g. hormones), micro organisms (e. g. vaccines, antibiotics), minerals (purgatives) and synthetic drugs are obtained by synthetic process, (e. g. Sulf adimidine, Pethidine, Chlorothiazine, etc).

Self-check 1

Name_____ **ID**_____ **Date**_____

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I Short answer questions (3 point each)

1. Define the term pharmacokinetics and pharmacodynamics.
2. What is the difference between dosage and dose? Explain it.

Test II Choose the correct answer for the following questions (2 point).

1. _____the study of movement of drug in the body including the process of absorption, distribution, accumulation in the site of action, biotransformation (metabolism) and excretion of drug.
   A. Chemotherapy
   B. Pharmacokinetics
   C. Pharmacodynamics
   D. Drug metabolizm/iotransformation
2. Which of following indicate the determination and regulation of the size of the drug, the frequency of drug administration, and the number of doses to be administered.
   A. Dose B. Dosage C. Drug action D. Drug metabolism
3. The study of how natural or man-made poisons cause undesirable effects in living Organisms is called_____.
   A. Chemotherapy B. Chemoprophylaxis C. Toxicoloy D. All of the abbove

Note: Satisfactory rating - 6 points Unsatisfactory - below 6 points

Information Sheet 2- Identifying materials and equipment for drug administration

2.1. Materials and equipment used for drug adiminstration

Because of the variety of dosage forms in veterinary medicine and the diversity of animal and bird species treated, drug or dosage delivery sometimes requires the development of specific devices to ensure fast, safe, effective and low cost efficient treatment. There are basically two types of devices

1. Those used to administer the dosage form to the animal. E.g. Balling guns, syringes, implants etc.
2. Those which meter drug from its site of implantation, insertion, ingestion or attachment to the animal over a potentially long period of time.
    1) Oral devices
    2) Topical devices
    3) Parental devices
    4) Nasal devices

1) Oral devices

a. Balling guns b. Esophageal delivery devices c. Drench syringes d. Liquid drench guns e. Powder drench guns f. Paste Dispensers g. Water medication metering devices h. Rumen lodging devices i. Hollow bits j. Non pyloric passage devices k. Miscellaneous oral dose dispensers l. Buyoant devices m. Prolonged release devices

a. Balling guns

The balling gun is commonly used on cattle, horses, pigs, sheep and goats. It consists of a tube with a holder for the medication, usually a capsule, at one end. Veterinarians push the plunger on the end of the tube to force the medication into the animal. Balling guns come in various sizes depending on the species. Balling guns are simple devices used for oral administration of bolus to animals.

Figure 2. Balling gun

b) Drench syringes

The drench syringe can either have a preset volume or be an adjustable hypodrench designed to deliver the desired volume of the solution or suspension to the gullet. The preset volume syringe can be either all metal ranging in size from 2 to 32 OZ.

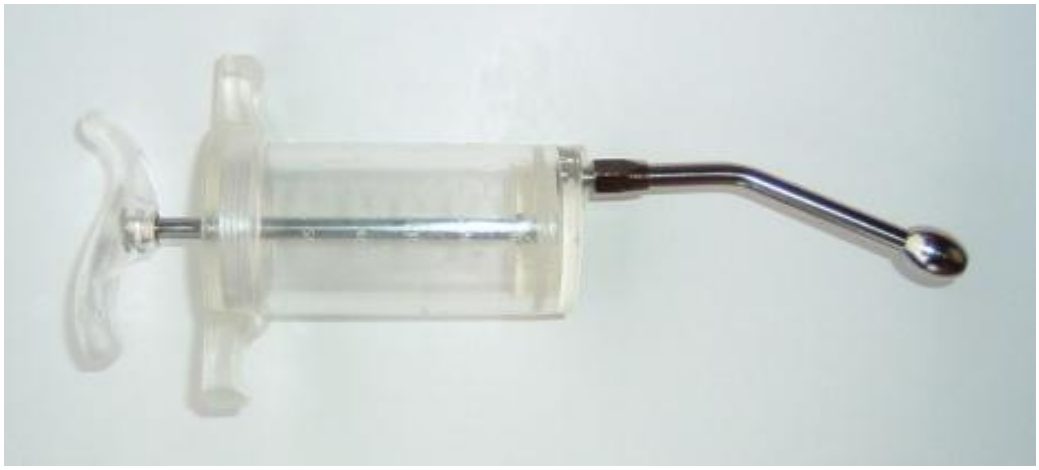

Figure 3. Drench syringe

c) Liquid drench guns

Drenching guns provide an easy, relatively fast means of orally administering solutions or suspensions of either an aqueous or oily nature.

Figure 4. Liquid drench gun

Liquid drench guns are of three types

1) Single dose gun
2) Multidose drench gun
3) Automatic drench gun

1. Single dose gun- This syringe gun is primarily designed for large volume distribution. It is filled by pushing the piston to the end of its stroke and then drawing it back after dipping the end into the liquid to be injected. The free end of the tube is then introduced into the mouth of the animal.

2. Multi dose drench gun: This gun is used to administer doses of drench in step quantifies.

3. Automatic drench gun: Automatic drench guns are so designed that the chamber refills directly after injection from a large volume reservoir which is usually strapped to the operators back. For example May and Baker Ltd. Manufacture a worm drench for cattle, sheep and goats which require no addition of water, mixing or transfer of drench solution to carry packs.

d) Powder drench guns

Drenching of large animals with a powder formulation can be achieved using powder drench guns. To use of these guns the required amount of powder poured into the barrel and inserted in the mouth, the trigger is pulled and powder sprays in the mouth.

Figure 5. Powder drench gun

e) Paste Dispensers

Paste formulation for oral administration to animals may be delivered by

- Paste guns
- Paste syringes
- Squeeze
- Squeeze tubes

Figure 6. Paste dispenser

Paste guns: paste, bolus, injections and drench.

Paste syringes- Syringes can be designed to deliver one single dose which can be varied according to the weight of the animal or they can be set to deliver a limited number of multiple dose paste boluses.

Squeeze bottles or Tubes- Pet Kalorie by Hoover-Lockhart, Shawnee, Kanas is a high calorie dietary supplement in paste form used to treat malnutrition in piglets.

Water medication metering devices

The medications formulated as

- Dry powders for reconstitution

a. Concentrated solutions

Unhealthy animals allow to drink water continuously. Water as medium for drug solubility and quick absorption. Concentration of drugs in water to be half only, this problem may overcome by its limited solubility. In addition, the dry powders are usually formulated with sugar as lactose or dextrose. The use of these may cause a build-up of bacteria and fungi in water lines. The drug stability in water must be stated on the label. The powder medication was dissolved at the time of administration into water to make a stock solution. Medication of a large number of animals or birds can be accomplished by adding regulated amounts of the soluble drug to their drinking water. Medicaments, vaccines, Wormers, electrolytes, disinfectants and antibloat surfactants are dosed in this fashion. The drug concentration in water is half of that in the field as the animals drink twice as much water as they consume feed. Water medication metering devices are falling into two categories

- In line
- Trough

Figure 7. Water medication metering device

2. Topical devices

a. Pour on, spot on application

b. Dust bags

c. Spray race and dip
d. Teat dip
e. Aerosol Dispensers
f. Flea and tick collars
g. Percutaneous devices

a. Pour on, spot on application: These are the liquid products affect systemic activity after being poured on to animal backline or applied as one spot concentrate on the animal back. Spot on mainly used for grubs and lice Eg: levamisole, broad spectrum anthelmintic activity.

Figure 8. Pour on, spot on the application

b. Spray race and dip

For control of ectoparasites in economic animals, dipping is an extensively used method. A dip formulation containing the drug is diluted in a large dipping bath through which the animal is driven. This path must be long, wide, and deep enough to cause immersion of the animal. It must be non toxic to the animal, but toxic to ectoparasites.

Figure 9. Spray race and dip

c. Aerosol Dispensers: Aerosol dispensers provide a number of advantages

1. The medication is delivered directly to the affected area in a desired form such as a spray, stream, quick break foam or stable foam.
2. The medicament is applied without mechanical irritation to the sensitive area.
3. A dose can be delivered without contaminating the remaining material.

Figure 10. Aerosol dispensers

d. Flea and tick collars

There are two types of flea and tick collars

1. Vaporous
2. Powder producing collars

Both contain the insecticide and a plasticized solid thermoplastic resin.

Vaporous collar contains relatively high vapor pressure liquid pesticide mixed throughout the collar. The pesticide is slowly released and fills the atmosphere adjacent to the animal, that kills the pest but innocuous to the animal.

The powder producing collar contains a solid solution of the drug in the resin. Shortly after the collar is processed the particles migrate from within the body of resin and form a coating of particles known as a bloom. Ticks and fleas migrate through the neck area of the animal as they contact the active pesticide is released and kills the pest.

3. Parenteral devices

Single dose syringe

Syringes are used to express the hydrated OTC Tree Injection Formula through the back of the Valve and into the palm.

Figure 11. single dose syringe

Multiple dose syringes

Multi-dose syringes for use in breeding stock.

Figure 12. Multiple dose syringes

Automatic syringes

The vial holder model of this automatic syringe is often used for vaccination or injection of swine.

Figure 13. Automatic syringe

4. Nasal devices

Used for delivery of vaccines as solutions or powders. It includes:

1. Automatic single or multiple dose syringe
2. Single dose dropper vial
3. Spray dispensers
4. Powder mist dispensers

Self-check 2

Name_____ **ID**_____ **Date**_____

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I Short answer Questions (4 point each)

1. List and explain oral medication devices
2. Describe topical medication devices,

Test II Choose the correct answer for the following questions (3 point each).

1. Which one of the following is parentral medication device?
   A. Ulling gun
   B. Drenching gun
   C. Spray dispensers
   D. Single dose syringe
2. Which one is not nasal medication devices?
   A. Single dose dropper vial
   B. Spray dispensers
   C. Powder mist dispensers
   D. Spray race and dip

Note: Satisfactory rating - 5 points Unsatisfactory - below 5 points

Information Sheet 3- Explaining the route of drug administration

4.1. Definition of drug administration

Drug administration: is depositing a drug in to its appropriate position/route in the body and in an appropriate concentration to effect beneficial response.

4.2. Factors affecting route of drug administration

The choice of route and technique of drug administration is influenced most frequently by the following factors:

- Physicochemical properties of the drug (solid/liquid/gas; solubility and stability. PH, irritancy)
- Site of desired action (localized & approachable / generalized and not approachable)
- Effect of digestive juices and first pass metabolism on the drug.
- Rapidity with which the response is desired (routine treatment or emergency),
- Duration of action If a duration is required to be long; the drug is administered 2-4 times daily. This could be done in a depot form as a patch on the skin, another example is treating anaplasmosis, the aqueous oxytetracycline is administered 2-3 days by intramuscular, subcutaneous or intravenous injection. The long acting oxytetracycline, which is designated for slow absorption over 4-5 days.
- Accuracy of dosage required (IV and inhalation can provide fine tuning).
- Condition of the patient (unconscious, vomiting).
- Species of the animals and any physiological conditions.
- The desired bioavailability of the therapist.
- Desired onset of action - how fast the therapist wants to see the manifest effect of the drug. This is important, especially in life threatening conditions or circumstances that require immediate onset of action are shock, circulatory collapse, the nature of the disease and its location of the disease.

Routes of drug administration:

The routes of drug administration for systemic effect may be divided into two major groups: Oral (enteral) and parenteral (systemic). When the gastrointenstinal tract is by-passed by injection or introduction into the lungs (inhalation). When the drug is effect is desired locally it is administered topically, that is on the skin.

1) Oral or enteral administration of drug

Oral ingestion is the most ancient method of drug administration, another organ where the substance or drug to be administered is placed is the rectum. Intravectally The drug could be placed in the mouth, under the tongue, that is (subliquel.The drug could be administered directly into the stomach using intragastric tube. There are large numbers of pharmaceutical preparations available for oral administrations. Solid dosage forms (powders, tablet, capsules, pills etc) and liquid dosage forms (syrups, emulsion, mixture, drench, electrolytes etc)

Advantages:

- Sterility is no required
- Danger of acute drug reaction is minimal
- Convenient (for small ruminants) and safe

Disadvantages:

- Ingestion of drug could cause gastric irritation.
- Nausea
- Vomiting (in animals like dog, pig)
- Complexes formed with ingesta could prevent the drug absorption
- The drug could be destroyed by low gastric pH or by the digestive and live enzymes before entry into the circulation.
- The procedure may be difficult in traction animals (in large animals)-
- A large dose may be required,
- Poor technique may lead into aspiration pneumonia

- Slower onset of action

3) Parenteral administration of drug

Parenterally "par" means beyond "enteral" means intestinal. This is the route of administration of drug without crossing the intestinal mucosa. This is possible when the drug is directly into the blood or tissue fluid using needle and syringe. It is important to not that the man that lead to the introduction of the hypodermic needle and syringe is Alexander wood. The most frequently used parentral routes are IV, IM, SC; common but less frequently used routes include eqidural, Intradermal, intratracheal, intraperitonial. occasional routes of injection include subconjunctival, intratesticular etc. In all cases solution for injection must be sterile/ aseptic technique and the dose must be accurate. The most important and most frequently used parenteral routes are I.V. (intravenous route), intramuscular route and SC (subcutaneous route respectively.

Advantages of Parenteral route of drug administration

1) Bioavailability is faster and more predictable.
2) Gastric irritation and vomiting are provoked.
3) Parenteral routes could be used in unconscious, uncooperative and vomiting patient
4) There are no chances of interference by food or digestive enzymes.
5) Liver enzymes are by-passed.
6) It essential sometimes in the absorption of the active form of the drug.

Disadvantages

1) It is generally more risky
2) The preparation must be sterile
3) The technique is intensive and painful.
4) Drug administered by all routes except intra-arterial might still be eliminated by first pass elimination in liver prior to distribution to the rest of the body.

Classification of Various Types of Parenteral Routes

- The various parenteral routes can be classified on the basis of site of action as follows

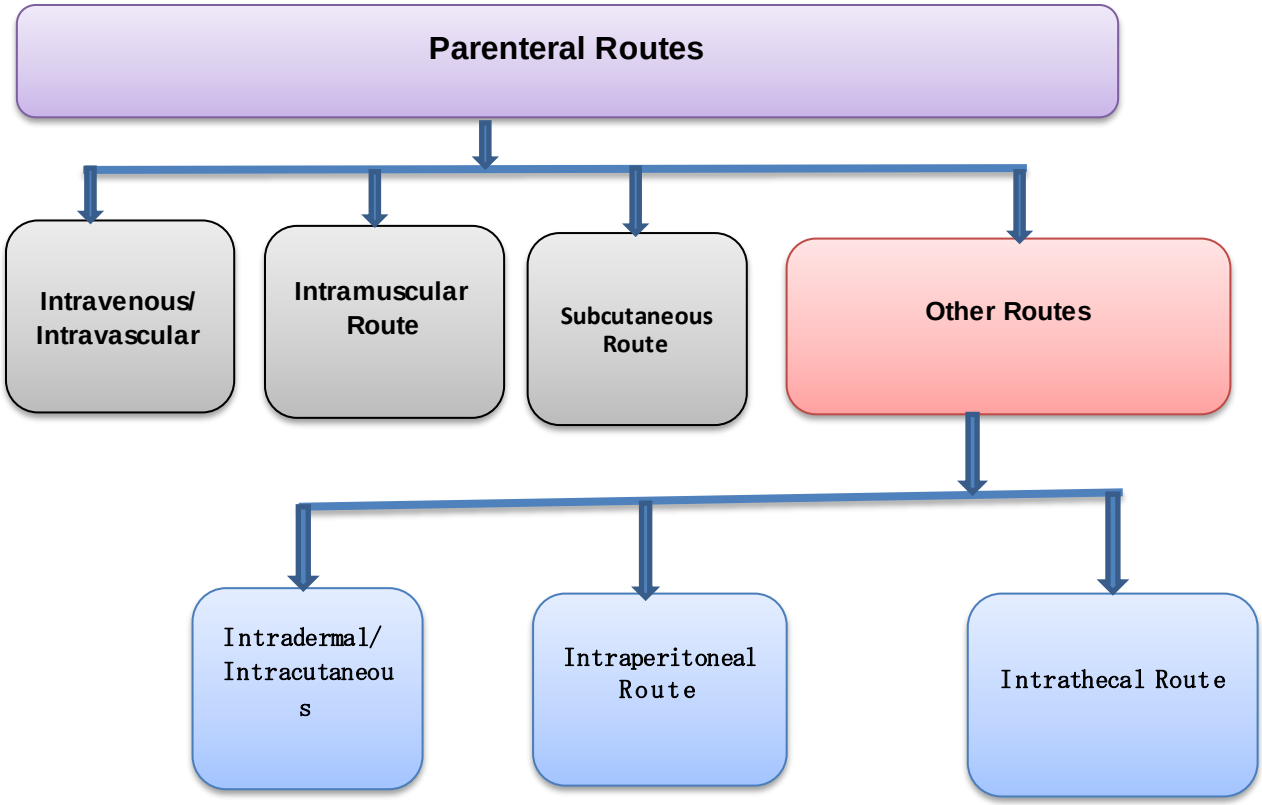

Diagram 3. classification of various parentral routes

1) Intravenous route:

Depositing the drug directly into the vein/blood stream. Aqueous solution are preferable. Irritating and non-isotonic solutions should be injected slowly and carefully.

- Drug reaches the stream of blood immediately having full access to the entire body and hence, rapid action is produced rendering this route to be the most efficient in emergencies.
- Drugs causing even high intensity of irritation can be administered as the vein intima is insensitive and hence, the blood dilutes the drug moiety.
- Very small dose is required.
- Bioavailability is 100%.

- Very large volume infusions of the drug can be given.
- The drug bypasses first pass metabolism.
- Hypertonic solutions can also be administered along with GIT irritation causing drugs.
- Drugs can be delivered at a uniform rate.

Disadvantages

- If the drug administration accompanies extravasation, then thrombophlebitis and venous thrombosis of the vein in which drug is injected and necrosis of the tissues surrounding that particular vein can occur.
- As the vital organs of the body like heart and lungs get exposed to a high drug concentration, thus, this route has the maximum risk factors.
- Only aqueous solutions of the drug can be administered. Suspensions can't be administered.
- Depot preparations i.e. oily solutions and aqueous suspensions of this route can't be made.
- Another factor that makes this route risky is that once the drug has been administered, it can't be removed by various methods like forced emesis or binding of charcoal (activated) as introduction of any particulate matter or any other substance can lead to fatal embolism.
- This route has a high probability of bacterial contamination.
- IV injection may induce hemolysis and other similar conditions if the drug is administered too rapidly.
- The examples of drugs that are given through this route are Propofol (an anesthetic), Diazepam (for treatment of status epilepticus)
- Glucose, Saline Glucose and many antibiotics

2) Intramuscular route

The drug is injected deep in the belly of a large skeletal muscle. The muscles that are usually used are detoid, triceps, Gluteus,. Maximus, rectus, femurs depending on the specie of animal. The muscle is less richly supplied with sensory nerves, hence injecting

a drug 1m is less painful. It is used for relatively irritant drugs, or for administration of depot preparation, for aqueous or oleaginous suspensions. Absorption occurs either haematogenous or via lymphatic and is usually fairly rapid except for long acting preparation.

Advantages

- It is convenient route in administering drugs in animals that are difficult to restrain.
- It is used in administering aqueous or oleaginous suspensions or solutions.
- Muscles are highly vasculorized thus, the drug could be absorbed haematologenously or through the lymphatic fluid.
- Longer duration of action than IV but little shorter than SC

Disadvantages

- Intermuscular injection into fascia might lead to erratic absorption of the drug.
- There is a possibility of improper deposition of drug preparation in nerves, fats, blood vessels or between muscle bundles in connective sheaths.
- Painful if any adverse effect occurs,
- Lower onset of action than iv.
- The possibility of improper disposition in nerves can cause paralysis

3) Subcutaneous route

The drug is deposited in the loose subcutaneous tissue that is richly supplied with nerves but less vascular. The rate of absorption is slower than the intramuscular route. used to administer curative and preventive drugs (vaccines). Preferred when slow and continuous absorption of drug is required. The injected drug disperses through the loose connective tissues then dissolves in tissue fluid before it can enter either capillaries or lymphatic.

Advantages

- It is a good route of administration especially in skin infections.
- It is relatively safer than I.M. and I.V.
- Absorption is slower thus, it is a good route of a prolonged effect is to be achieved.
- Poor absorption in peripheral circulatory failure
- Repeated injection at one site can cause lipoatropia resulting in irratic absorption
- Very slow on set of action

Disadvantages

- If the drug is irritating it might cause the sloughing off of the skin epitheral tissue.
- Other forms of ubcutaneous route include;
- Pellet implantation and dermoject.

Intradermal Route

This route involves the scarring or multiple puncturing of the epidermis through a drug drop to administer the drug into the epidermis.The drug is given in small doses via a tuberculin syringe and the absorption rate is slow. The various examples are BCG vaccines,sensitivity and diagnostic tests

Intraperitoneal Route

The injection is given in the peritoneal space leading to a high absorption rate credited to the available large surface area. This route may cause infections in the peritoneal cavity and is painful and risky. Antirabies drugs are given by this route along with drugs used for treatment of poisoning and renal failure. This is the most common method used for the administration of drugs to animals used in the laboratory.

Intrathecal Route

This route involves the injection of the drug into the sub arachnoid space i.e. the cerebrospinal fluid (CSF) through a lumbar puncture needle. This route offers the advantage of high availability of the drug in the CSF as the blood brain barrier and blood-CSF barrier is by passed. Hence, the drug acts directly on the CNS. However, this injection requires great skill and extreme sterile conditions. Also, it is a painful and risky procedure. Various drugs given by this route are xylocaine injection for anesthesia of the spine, radiopaque media for visualization of the spinal cord, methotrexate for leukemia treatment to prevent CNS relapse, bupivacaine for regional anesthesia, baclofen for muscle spasm treatment. Certain antibiotics, that are necessary in extreme conditions but are unable to cross the blood brain barrier, can be administered via this route. **Subconjunctivalrout**e - disposition of a pharmaceutical preparation beneath the conjunctiava.

Fate of Drug in Body After Parenteral Administration

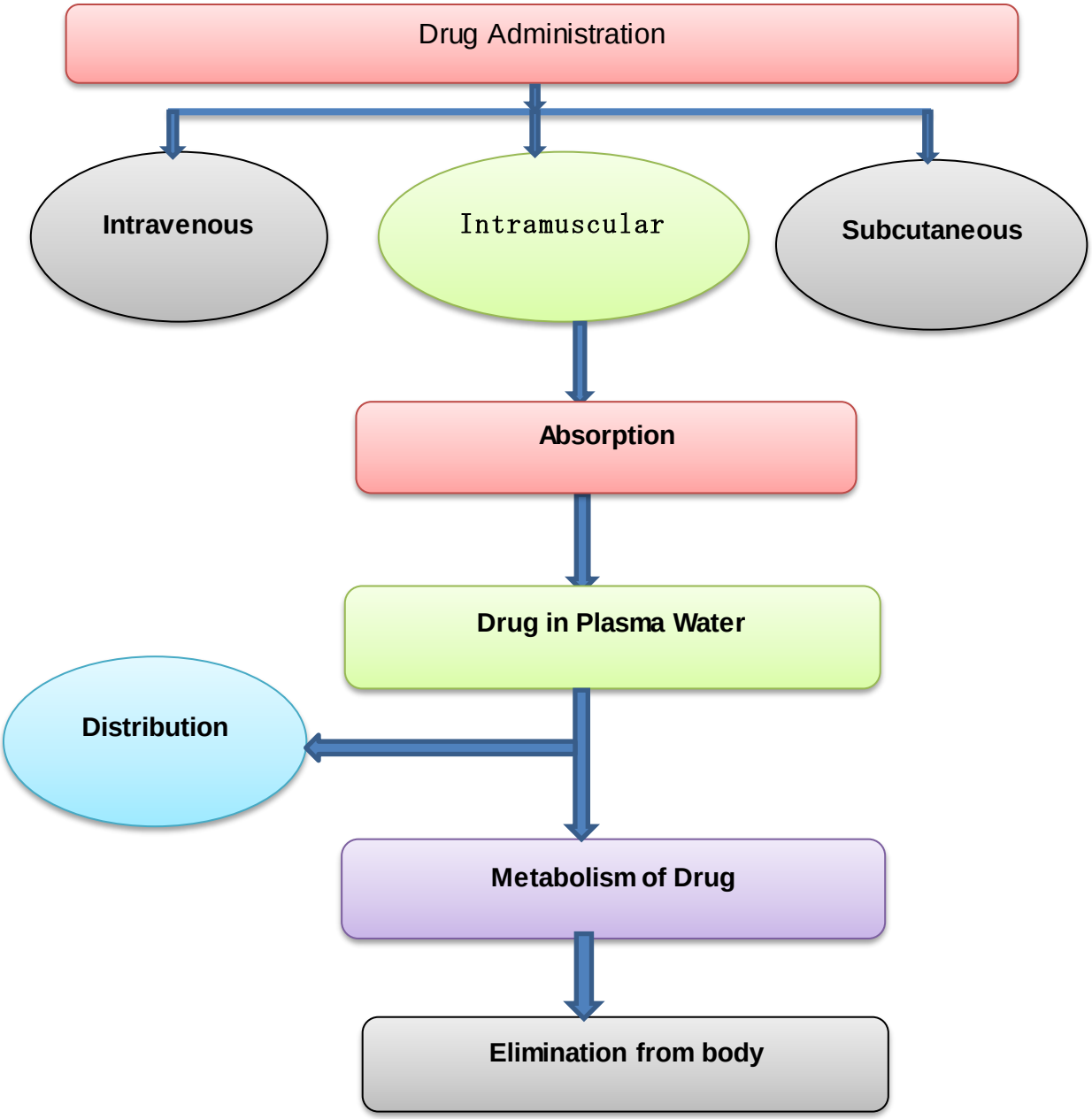

Diagram 4. Fate of drug in body after parenteral administration

Pharmacokinetics and Pharmacodynamics of the drug

a. Pharmacokinetcis

Pharmacokinetis: the study of movement of drug in the body including the process of absorption, distribution, accumulation in the site of action, biotransformation (metabolism) and excretion of drug. It deals with what the body does to the drugs.

1. Absorption of drug: - is the movement of drug from its site of administration into the blood stream across biological membranes to reach on its site of desired action. Thus except when given IV and local application, The drug has to be absorbed/cross biological membranes. The rate of absorption can be influenced by; route of administration, physico-chemical and Pharmacological properties of the drug, area and vascularity of absorbing surface/site

2. Distribution of drugs in the body: - The dispersion of drugs from blood stream to all parts of the body which ends with penetration in to the site of action. is known as **distribution.**

3. Accumulation of drug :Means the tendency of the drug to concentrate/ accumulate at the desired site of action.

4. Biotransformation (metabolism) of drug: The various enzymatically mediated chemical changes, which undergo in the body before final elimination from the body is collectively known as metabolism/biotransformation. These changes usually result in redaction in the toxicity of the administered drug andbecause of this it is called detoxification. drug metabolism is mainly carried out by liver because the enzymes carrying out drug metabolismt are abundant in the liver.Repeated administration of drug can result in drug tolerance, because of a diminishing response of microsomal activity of the liver.

5. Drugs excretion from the body:

Drugs are eliminated from the body via several routes and the principal organs of excretion are kidneys but liver lungs and GIT are also important in drug excretion. Milk, saliva and sweat are less important in excretion. These processes follow two pathways. Kidneys eliminate drugs in the form of urine; Liver eliminates metabolized drugs through bile;Git through faces where as volatile drugs are excreted through the lungs. In general drug can be excreted from the body with different fluids/secretions like milk, saliva and sweats.

b) Pharmacodynamics

Pharmacodynamics studies the effect of drugs on the body cells and systems and their mechanism of action (MOA).

Mechanism of action of drug: This describes the action of the drug on the agent causing disease. It can directly kill the causative agent. Eg in case of bactriocidal drugs or it can inhibit/ suppress the multiplication and proliferation of the causative agent .eg in case of bactriostatic drugs. All drugs are capable of producing adverse effects, following administration, which can be :-

3. **Predictable effect:** means effect of the drug which is expected to occur .this is the problem of the drud on the patient. This includes Side effect, secondary effect, toxic effect and drug intolerance.
4. **Side effect:** -unwanted but unavoidable pharmacodynamic effects, that occur at therapeutic doses.eg Asprine is antinflamatory (pain killer) drug but induces gastritis. Gastritis is the side effect of asprine. Which is unwanted and unavoidable.
5. **Secondary effect-indirect consequence** of primary action of the drug .e.g.- suppression of bacterial microflora by oxy tetracycline which leads in to supper infections.
6. **Drug intolerance-** the appearance of characterstic toxic effects of a drug in an individual at therapeutic dose. This indicates the low threshold of the individual to the action of a drug.

7. **Unpredictable (type 2) reactions.** These are based on peculiarity or problem of the patient and not on drugs known actions,
8. **Drug allergy/hypersensitivity:** they are more serious and often require withdrawal of the drug. Drug allergy is immunologically mediated reaction where the drug acts as an antigen then the patient produces antibody against the antigen.. For this reaction a prior sensitization (hyper sensitivity test) is needed through intra dermal route

Self-check 3

Name_____ **ID**_____**Date**_____

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I Short answer questions (2 point each)

1. Write factors that affect route of drug administartion.
2. Describe mechanism of antibiotic drug action.
3. Explain advantage and disadvantage of interavenous drug administration.

Test II Choose the correct answer for the following questions (2 point each).

1. Which one of the following not advantage of oral drug administration?
   A. Sterility is no required
   B. Danger of acute drug reaction is minimal
   C. Convenient (for small ruminants) and safe
   D. Ingestion of drug could cause gastric irritation.
1. Among the following which one is advantages of Parenteral route of drug administration
   A. Bioavailability is faster and more predictable.
   B. Gastric irritation and vomiting are provoked.
   C. Parenteral routes could be used in unconscious, uncooperative and vomiting patient
   D. All of the above

Test III Fill in the lank space with appropriate wordphrase (2 point each)

1. _____ is depositing a drug in to its appropriate position/route in the body and in an appropriate concentration to effect beneficial response.

2. The dispersion of drugs from blood stream to all parts of the body which ends with penetration in to the site of action. is known as_____.

Note: Satisfactory rating - 5 points Unsatisfactory - below 5 points

LG #83	LO #3. Identify chemotherapeutics drugs and drugs acting on the different body system

Instruction sheet

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:

- Identifying and listing drugs acting on different body system
- Identifying drug Chemotherapeutic action for various disease causing agents
- Preparing prescription based on diagnosis of the parasitic diseases

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- Identify and list drugs acting on the different body systems
- Identify chemotherapeutic drugs for various disease causing agents
- Prepare prescription based on the rational diagnosis of the parasitic diseases correlated with a knowledge of the pharmacology of drugs

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below.
3. Read the information written in the "Information Sheets". Try to understand what are being discussed. Ask your trainer for assistance if you have hard time understanding them.
4. Accomplish the "Self-checks" which are placed following all information sheets.
5. Ask from your trainer the key to correction (key answers) or you can request your trainer to correct your work. (You are to get the key answer only after you finished answering the Self-checks).
6. If you earned a satisfactory evaluation proceed to "Operation sheets
7. Perform "the Learning activity performance test" which is placed following "Operation sheets" ,

8. If your performance is satisfactory proceed to the next learning guide,
9. If your performance is unsatisfactory, see your trainer for further instructions or go back to “Operation sheets”.

Information Sheet 1- Identifying and listing drugs acting on different body system

Terms related to chemotherapy

Antimicrobials: are agents which are used against microorganism, either to inhibit their growth or multiplication, or to kill them. They include antibiotics and chemotherapeutics or chemotherputic agents.

Antibiotics/antibacterial drugs: are the agents which are usually produced by non pathogenic microorganism (bacteria, fungi) and are used for either killing or inhibiting the growth of other pathogenic microorganism, without affecting the host tissue. Penicillin's aminoglycosides chlormphenicol and tetracycline's.

Antiseptics: are drugs that are applied to living tissues to kill or inhibit the growth of bacteria i.e. alcohol and iodine preparation.

Disinfectants: are able to kill bacteria when applied to non-living materials i.e. surface acting compounds.

Germicides: anything that destroys bacteria hut not necessarily spores i.e. 70% ethanol, 1% iodine.

Fungicides: anything that destroys fungi i.e. acids such as benzoic, salicylic have been used for many years as fungistatic agents.

Sporocides: aything that destroys spores i.e. 8% formaldehyde and 2% glutaraldehydc.

Bacteriostatic: refers to the idea, that agents which inhibit the growth or multiplication of microorganism rather than direct killling effect. Chloramphenicol tetracycline sulfonamides and erythromycin.

Bactericidal: refers to the ability to kill the microorganism i.e. penieillins, cephalosporins, aminoglycosides, fluorquinolones and rifampin.

Antimicrobial spectrum: refers to the range of activity of a compound. **A broad spectrum antimicrobial** drugs can affect a wide variety of microorganisms, usually including both gram + ye and gram -ye bacteria i.e. sulfonamide, chloramphenicol e.t.c. **Narrow spectrum antiniicrobials** are only effective either against gram +ve or gram -ye bacteria but not against both; flucloxacillin phenoxy methyl pcnicilin.

Mechanism of action of antibbiotics

All class or kind of antibiotics exists or is discovered, operate by one of the following mechanisms:

- Inhibition of cell wall synthesis
- Inhibition of protein synthesis
- Inhibition of membrane function
- Disruption of Metabolism
- Inhibition of nucleic acid synthesis

Interfering with the synthesis of the bacterial cell wall peptidolycan

The bacterial cell wall possesses the function of resisting the equation of the intra- and extra-cellular osmotic pressures, maintaining the bacterial shape and protecting the somatic function. The main component of the bacterial cell wall is peptidoglycan β-lactam antibiotics affect the third stage of the peptidoglycan synthesis, inhibiting the transpeptidation enzyme that cross-links the peptide chains attached to the backbone of the peptidolycan. The final bactericidal event is the inactivation of an inhibitor of the autolytic enzymes in the cell wall, leading to lysis of the bacterium and death.

Increasing the permeability of the plasma membrane of bacteria the plasma membrane possesses the functions of maintaining the permeability barrier, transporting nutritive substances and excreting the internal wastes, as well as participating in synthesis of cell wall, tropina, zyme and DNA. When antibiotics have an effect on bacteria, the plasma membranes are damaged, and the permeability increases, resulting in the outleakage of important nutritive substances (e.g. nucleinic acid, amino acids, enzyme, phosphoric acid andelectrolyte) in the kytoplasm of bacteria and death. Polypeptides (e.g. polymyxin B and dynalin) and polyenes(e.g. fungicidin and amphotericin) exert antibacterial activities via this mechanism.

Inhibition of nucleic acid synthesis

Inhibition of DNA replication by quinolones: Modulation of chromosomal supercoiling through topoisomerase-catalyzed strand breakage and rejoining reactions is required for DNA synthesis, mRNA transcription and cell division. These reactions are exploited by the synthetic quinolone class of antimicrobials, including the clinically-relevant fluoroquinolones, which target DNA-topoisomerase complexes. Quinolones are derivatives of nalidixic acid, which was discovered as a byproduct of chloroquine (quinine) synthesis and introduced in the 1960s to treat urinary tract infections. Nalidixic acid and other first generation quinolones (i.e., oxolinic acid) are rarely used today owing to their toxicity. Second (i.e., ciprofloxacin), third (i.e., levofloxacin) and fourth (i.e., gemifloxacin) generation quinolone antibiotics can be classified based on their chemical structure along with qualitative differences in how these drugs kill bacteria .The quinolone class of antimicrobials interferes with the maintenance of chromosomal topology by targeting DNA gyrase (topoisomerase Ⅱ) and topoisomerase Ⅳ (topoⅣ), trapping these enzymes at the DNA cleavage stage and preventing strand rejoining. DNA gyrases (Type Ⅱ

Topoisomerases) are responsible for relieving the positive supercoils in the DNA (or introducing negative supercoils) ahead of the moving DNA polymerase, thereby enabling the availability of relaxed DNA strands for continuation of replication, as well as the compaction (negative supercoiling) of the large strands of newly synthesized DNA to pack them in the bacterial cell. Some antibiotics form a stable complex with these DNA gyrases, thereby inhibiting the DNA replication. Example: Quinolones like Cinoxacin, Ciprofloxacin, Levofloxacin, Norfloxacin, Ofloxacin act by this way.

Inhibition of protein synthesis:

The process of mRNA translation occurs over three sequential phases (initiation, elongation and termination) involving the ribosome and a host of cytoplasmic accessory factors . The ribosome organelle is composed of two ribonucleoprotein subunits, the 50S and 30S, which organize (initiation phase) on the formation of a complex between an

mRNA transcript, f-Met charged aminoacyl-tRNA, several initiation factors and a free 30S subunit Drugs that inhibit protein synthesis are among the broadest classes of antibiotics and can be divided into two subclasses: the 50S inhibitors and 30S inhibitors. 50S ribosome inhibitors include the macrolide (e.g., erythromycin), lincosamide (e.g., clindamycin), streptogramin (e.g., dalfopristin/quinupristin), amphenicol (e.g., chloramphenicol) and oxazolidinone (e.g., linezolid) classes of antibiotics

In general terms, 50S ribosome inhibitors work by physically blocking either initiation of protein translation (as is the case for oxazolidinones), or translocation of peptidyl-tRNAs, which serves to inhibit the peptidyltransferase reaction that elongates the nascent peptide chain. Studies on macrolide, lincosamide and streptogramin drugs have provided for a mode-of-action model that involves blocking the access of peptidyl-tRNAs to the ribosome (to varying degrees), subsequent blockage of the peptidyltransferase elongation reaction by steric inhibition, and eventually triggering dissociation of the peptidyl-tRNA. 30S ribosome inhibitors include the tetracycline and aminocyclitol families of antibiotics. Tetracyclines work by blocking the access of aminoacyl-tRNAs to the ribosome.The aminocyclitol class is comprised of spectinomycin and the aminoglycoside family of antibiotics (streptomycin, kanamycin and gentamicin), which bind the 16S rRNA component of the 30S ribosome subunit.

The Disruptors of Metabolism (Folate Pathway Inhibitors)

This class of antibiotics inhibit the pathway responsible for the synthesis of folic acid which is essential for the synthesis of adenine and thymine (important nucleic acids for DNA and RNA synthesis; thymine is not required for RNA though, but required for DNA). And, since humans don't synthesize folic acid, so these antibiotics donot have an inhibitory toxic effect on humans. The folic acid synthesis inhibition can take place by:a. Inhibition of the enzyme dihydrofolate reductase required for folic acid synthesis. Example: Trimethoprim/Sulfamethoxazole acts by inhibiting dihydrofolatereductase. Substrate competition with p-aminobenzoic acid (PABA) thereby preventing synthesis of folic acid. Example: Sulfonamides & Dapsone.

Classes of anthelmintics

There are 8 important classes of anthelmintics. These include Benzimidazoles, Imidazothiazoles, Avermectins, Tetrahydropyrimids Salicylanilides, Piperazines and Praziquantel.

Mode of action of the major antihelmintics

Generally, antihelmentics inhibit energy and cause neuromuscular block and paralysis of parasite.

1) Identifying drugs acting on digestive system

a) Emetic and Anti-emetics

Emesis (vomiting) is protective reflex that occurs in certain species (cats and dogs).

True emesis is not possible, in horse, ruminant rabbits and rodents. In dogs and cats, if they have consumed poisonous or undesirable substances, it is useful to induce emesis within 1-2 hrs of ingestion in order to empty the stomach and minimize further absorption.

Emetic drugs: NaHCO3, NaCI, or mustard deposited at the back of the tongue and swallowed can cause vomiting .

- Apomorphine hydrochloride
- Xylazine hydrochloride in cats
- H2O2 solution (3%) for dogs and cats

Antemetic drugs

- Acepromazine meleate for dogs 0.1mg/kg im or po
- chlorpromazine hydrochloride for dogs
- phenotiazine are broad –spectrum antemetics.

b) Drugs affecting stomach and rumen function:

Antizymotics and antifoaming agents: antizymotics are drugs, which depress (decrease) ruminal fermentation in tympany and bloat in ruminants and tympanic colic equine.

- Oil of turpentine:-is volatile oil and Formaline given po

Antifoaming agents: -the control of acute froathy bloat involves the administration of antifoaming agents to reduce foam stability and promote a release of free gas.

- Mineral oil or Vegetable oil such as peanut oil or Soya bean oil are given po

c) Drug modifying intestinal functions

Laxaitives and purgatives: cause expulsion of intestinal contents, purgatives (cathartics or aperients) being more potent. Purgatives generally act as laxatives in small doses. Liquid paraffin is a laxative, which does not produce purgation even in large dose. Laxatives and purgatives are classified into lubricant, bulk, osmotic, irritant and neuromuscular .

i. Lubricant laxatives(faecal softeners): e.g. liquid paraffin :but may aggravate chronic constipation. Simple bulk laxatives comprises indigestible cellulose, which absorbs water to increase the bulk and forms gel. Mostly given in small animals.

ii. Osmotic (saline) purgatives: comprises inorganic salts, sugar alcohols. They act by increasing osmolarity of intestinal contents so that more fluidis absorbed in to the GIT then diarrhea is facilitated. e.g. Epsum salt (magnesium sulphate) which can act as laxative and purgative depending on dose. Purgative dose: -cow: 250-500gm, Laxative dose: Cattle: 60-120gm, Sodium sulphate (glauber's salt)-its absorption is greater than that of magnesium sulphate. Their doses are identical it act as purgative diuretics.

iii. Irritant purgatives: -they cause irritation of enteric mucosa, decreases absorption and increase secretion and motility leading to purigation. e.g. –caster oil, Linseed oil.

iv. Neuromuscular purgative: enhance GI perstalysis, produce defecation and urination. Contraindicated in intestinal obstruction. Arecoine hydrochloride, Carbanchol, Neostigmine

d) Drugs used in the treatment of diarrhea:

Adsorbents:

- Bismuth salts:, Kaolin (Aluminium silicate and pectin):
- Activated charcoal powder absorbs toxin (endo and exotoxins) dose for all animals: 1-5gm/kg in water as a drench.

f) Enemas: are agents given through the anus and used for the relief of simple faecal impaction and agents used include: -warm soapy water, mineral oil (paraffin), vegetable oils and hypertonic saline. Infuse large volume of such fluid per rectum. Action-the infused

fluid causes distension and slight irritation, which induces or stimulates contraction in the colon and rectum, while the fluid softens the faecal mass.

2) Drugs acting on the nervous system

A Anaesthesia

Anaesthesia: is a reversible loss of sensation of any part or whole of the body produced by agents, which depress the activity of nervous tissue either locally or centrally.

B Importance of anesthetic agents

They are used for two main pur poses

- To make the animal insensible to all feeling in the operation area and,
- To decrease muscular tone, so that manipulation may be carried out easily and quickly (a restraint)

C Classes of anesthetic agents: There are two main groups of anesthe tic agents:

- General anaesthetis age nts cause the loss of sensation through out the body. body.. They have effect on the CNS
- Local anaesthetc agents they desensitize one area of the body and they have no direct effect on the CNS

B. Drugs affecting appetite (appetite stimulants or anorexiants)

They are used for the treatment of partial or complete anorexia in animals. Appetite is controlled by hypothalamus. The neurons of center respond to glucose concentration, amino acid level and fatty acid levels, and impulse f rom receptors sent in the stomach and duodenum. Many diseases can cause anorexia (inappetence).e.g. infections seems to induce fever, that in turn brings about hypozincemaemia, which results in anorexia (inappetence). Agents used to promote appetite include:Vitamins B complex, especially vit.B 12, Glucocorticoides and bitters. B complex with folic acid (Bc) and vitamin C works in carbohydrates, proteins and fat metabolisms.

Glucocorticoides; this agents are steroids. This group includes cortisone acetate, hydrocortisone (cortisol), predenisone and predenisolone. They exert their action on the metabolism of carbohydrate proteins and fats. Cortisone acetate increases the formation of glycogen and blood sugar level.

Bitters (reflex sialagogues): have bitter taste and initiate salivation by stimulating taste buds on the tongue. These drugs improve appetite by increasing saliva production. the tongue. These drugs improve appetite by increasing saliva production. Bitters include orange and lemon peel, gentian and quassia (a bitter drug obtained from wood or Bitters include orange and lemon peel, gentian and quassia (a bitter drug obtained from wood or bark).

Antiinflammatory agents and treatment of inflammation

The cardinal signs of inflammation are: heat, redness, pain, swelling and loss of function. These drugs are not curative but suppress the inflammatory reaction.

There are three classes of a nt inflammatory agents :

- Non steroidal anti inflammatory drugs (NSAID)
- Steroidal
- Miscellaneous

Nonsteroidal anti inflammatory drugs (NSAID)

They are weak carboxylic or enolic acids. Most of the groups have common three properties.These are

1. Anti infl a mmatory effect by their local action of inhibiting the cyclo oxygenase enzymes, (the enzyme that used to synthesis prostaglandin from aracidonic
2. Antipyretic by inh ibition of pyrogen production, which stimulates hypothalamus to increase temperature, set point.
3. Analgesic action: by blocking the pain sensitizing mechanism induced by Bradykinin on nociceptors.

The common side effect of NSA

ID includes gastritis, emesis, gastric ulcer and bleeding.

Drugs include

1. Acetyl salicylic acid/ Aspirin: It is us ed for the trea tment of muscle skeletal pain, arthritis in animals.

2. Propionates drugs like Ibuprofen and Naproxen

- Gastric ulceration is not contradiction for their use But cause repeated vomiting.

3. Pyrazolnes

- They antagonize bradykinin induced inte stinal spasm too.

A. Aprazone it is anti inflammatory, analgesic, antipyretic effect. It has also a potent uricosuric property , used for the treatment of rheumatoid arthritis, osteoarthritis & gout.

B. Diprone It has been used for the treatment of spasmodic colic often in combination with spasmolytic.

C. Phenyl butazone: It is a more potent anti inflammatory agent than aspirin. It has been used for the treatment of arthritis and skeletal muscles disorder, tendinosynovitis, capsulitis, & bursitis. Over therapeut ic range (38.8mg/kg) can produce anorexia, colic, ventral oedema, erosion and ulcers

4 . Paraaminophenols:

A. Acetaminophen (paracetamol) an analgesic & antipyretic, but a weak anti inflammatory agent; peptic ulcers are not contraindications. Its hig h dose leads to renal and hepatic toxicity.

B. Phenacitin it is no more a drug of choice due to its renal toxicity and replaced by acetaminophen.

3. Drug acting on circulatory system

The cardiovascular system refers to the heart, blood vessels and the blood

- Blood contains oxygen and other nutrients which your body needs to survive
- The body takes these essential nutrients from the blood At the same time, the body dumps waste products like carbon dioxide, back into the blood, so they can be removed

- The main function of the cardiovascular system is therefore to maintain blood flow to all parts of the body, to allow it to survive

The major functions of the cardiovascular system are

- To transport nutrients, gases and waste products around the body.
- To protect the body from infection and blood loss.
- To help the body maintain a constant body temperature
- To maintain fluid balance within the body.

Disorders related to cvs

1. Congestive heart failure/Congestive cardiac failure (chf/ccf)

- Where the heart is unable to pump sufficient blood to various parts of the body.
- As a result of this condition blood supply decreases to various parts of the body.

2. Atherosclerosis

- It is characterized by deposition of lipids and lipid related materials like cholesterol, triglycerides and lipoproteins in blood vessels specially coronary blood vessels
- As a result of this condition blood supply decreases to heart

Class i drugs

- Sodium Channel Blockers
- Ex. Quinidine, Procainamide, Disopyramide, Flecainide , Propafenone , Moricizine, Lignocaine, Tocainide, Phenytoin

Class ii drugs

- β Blockers
- Ex: Propranolol, Pindolol, Timolol, Sotalol, Atenolol, Acebutalol, Bisoprolol, Nebivolol

Class iii drugs

- Potassium Channel Blockers
- Ex: Bretylium, Amiodarone, Sotalol

Class iv drugs

- Calcium Channel Blockers
- Ex: Verapamil, Diltiazem

4. Drug acting on reproductive system

Drugs used to regulate and control the reproductive system are often naturally occurring hormones or chemical modifications of hormones. These are often used to induce or suppress estrus, the time during the reproductive cycle in animals when the female displays interest in mating, often called “heat.” Some are also used to stimulate testicular function or sperm production. Some of the more commonly used hormones include gonadotropin-releasing hormone and related drugs, follicle-stimulating hormone, human chorionic gonadotropin, equine chorionic gonadotropin, estradiol compounds, progesterone and synthetic progestins, testosterone, and prostaglandins. Another hormone, oxytocin, is used to promote milk production and letdown and to cause contraction of the uterus to either induce labor or to enhance contraction of the uterus after the birth.

Follicle-stimulating hormone (FSH), usually extracted from animal pituitary glands, stimulates follicular growth and estrogen production in females and spermatogenesis in males. It is used for superovulation of several domestic species. It has also found application in induction of fertile estrus in bitches and queens. Prolonged FSH use or higher doses can cause adverse effects such as cystic endometrial hyperplasia and follicular cysts.

Human chorionic gonadotropin (hCG), which exerts mainly luteinizing hormone–like effects in domestic animals, is used for stimulation of gonads (as a test for cryptorchidism and also for treatment of ovarian cysts in cattle or dogs). It is also used to cause ovulation of mature ovarian follicles in cows or mares in controlled-breeding programs. hCG is given parenterally; plasma levels peak in ~6 hr. It is primarily distributed to the ovaries in females and the testes in males, although some is also distributed to the renal proximal tubules.

Equine chorionic gonadotropin (eCG) has FSH activity in most species and is used to induce ovarian follicular growth, both for superovulation and for estrus induction.

Estradiol esters (eg, valerate, cypionate, or propionate) have a longer duration of action than the parent compound. These compounds are used in bitches, mares, and cows for induction or enhancement of fertile estrus or for induction of estrous behavior; treatment of urinary incontinence in bitches; and for antitumor activity in prostatic and perianal tumors. Availability of these compounds and restrictions on their use vary by country. Estrogenic therapy may cause bone marrow suppression and potentially fatal aplastic anemia in dogs and cats; its use is also associated with development of cystic endometrial hyperplasia in these species, and it may have teratogenic effects in pregnant animals. Because of these potential complications, estrogens are no longer recommended for termination of pregnancy in cases of mismating.

The nonsteroidal synthetic compound **diethylstilbestrol** also has estrogenic activity; its use is prohibited in food animals in the USA. Estrogen antagonists, such as tamoxifen, have been proposed for treatment of metastatic mammary carcinoma in dogs.

Progesterone and synthetic progestins are used for suppression or postponement of estrus in bitches and queens. They have also been used in behavior modification and to treat dermatologic disorders. Progesterone supplementation is used to support pregnancies regarded as at risk (eg, in pregnant mares with potentially endotoxemic conditions) and in horses or dogs with demonstrated hypoluteoidism. Adverse effects of progestin administration in small animals include induction of cystic endometrial hyperplasia, adrenocortical suppression, induction or exacerbation of diabetes mellitus, and mammary gland development. Mifepristone (a progesterone-receptor antagonist) has been used experimentally as a canine abortifacient; epostane, a progesterone-synthesis inhibitor, also terminates canine pregnancy.

Testosterone is used for estrus suppression (particularly in racing Greyhounds). Mibolerone, a weak androgenic steroid, is used to prevent estrus in bitches. It should not be used in Bedlington Terriers or cats, and it may exacerbate perianal tumors. After PO administration, mibolerone is absorbed from the intestine, metabolized in the liver, and

excreted in the urine and feces. Chronic administration of testosterone may cause testicular degeneration in male animals. Finasteride, a 5α-reductase inhibitor, prevents the conversion of testosterone to 5α-dihydrotestosterone, the active androgen in male accessory sex glands. It is useful in the treatment of benign prostatic hyperplasia of dogs (0.1–0.5 mg/kg/day, PO). Flutamide blocks dihydrotestosterone receptors and is used for the same purpose. Chemical modifications of testosterone potentiate its anabolic actions while minimizing virilizing effects. These compounds (eg, boldenone undecylenate, stanozolol, nandrolone decanoate) are used for their anabolic effects in convalescing or athletic animals. Protracted use may cause at least temporary infertility in both sexes.

Prostaglandin F2α and its analogues are used mainly for their luteolytic effects to induce predictable onset of estrus (or synchronization of estrus) in a variety of species. They may also be used for termination of pregnancy either alone or in combination with corticosteroids (cattle, sheep) or dopaminergic agents (dogs). These compounds also cause marked uterine contractions, which may be useful for expulsion of uterine contents in pathologic conditions (eg, pyometra).

Oxytocin is used to promote milk letdown, to treat agalactia, as an adjunctive treatment of mastitis, and to cause contraction of the uterus either to induce (or supplement) labor or to enhance postpartum uterine contraction and expulsion of uterine fluid or fetal membranes. It is administered parenterally (IV, IM, or SC). Oxytocin may be given intranasally, but absorption can be erratic. Uterine relaxation is caused by β2-mimetic agents, such as clenbuterol. Such agents have been used to postpone parturition (to reduce obstetrical complications in heifers) and to facilitate obstetric manipulations in large domestic animals. Clenbuterol use in food-producing animals is illegal in the USA.
Dopaminergic agents, such as bromocryptine or cabergoline, cause decreased serum prolactin concentrations. They are useful in treatment of pseudopregnancy in dogs (bromocryptine at 10 mcg/kg, PO, for 10 days, or at 30 mcg/kg for 16 days) and as an adjunct to PGF2α in terminating pregnancy, although not approved in the USA for this use. Prolactin is luteotrophic in some species, including dogs.

Dopamine antagonists, such as sulpiride, have shown promise in the manipulation of seasonal breeding species their use hastens the onset of estrous cycles in mares in the spring. In the UK and New Zealand, melatonin is labeled for use in sheep (and goats in New Zealand) to improve early breeding and ovulation rates. It is available as an 18-mg SC implant; combined with exposure to rams, its use is associated with hastened onset of the breeding season and increased prolificacy.

Glucocorticoids, especially the C-16 substituted steroids dexamethasone, betamethasone, and flumethasone, are used for induction of parturition in ruminants (eg, dexamethasone 20–30 mg, IM, given within 2 wk of normal term). Their therapeutic administration may inadvertently lead to abortion. Xylazine and other α2-adrenergic agents cause myometrial contraction that may harm the fetus or impede obstetrical manipulations.

5. Drug acting on respiratory

Pharmacological agents used to treat respiratory disease in the critically ill. It includes respiratorystimulants, bronchodilators, corticosteroids, magnesium, pulmonary vasodilators and mucolytic agents**.**

Respiratory Stimulants

Respiratory stimulants have limited use in the treatment of ventilatory failure, and Doxapram is the only example that remains in clinical use due to the increased incidence of seizures associated with earlier compounds.

Bronchodilators

Bronchodilator therapy is the mainstay of treatment in obstructive lung disease. The three classes of bronchodilators are β2-adrenoreceptor agonists, anticholinergic agents and methylxanthines.

6. Drug acting urinary system,

The primary function of the renal system is to

- Regulate blood volume and plasma osmolarity
- Waste removal via urine

Disorders of the urinary system

- Urinary tract infections
- Inflammation and irritation of the urinary tract causing
- Smooth muscle spasms, renal failure
- Uroliths (urinary stones)
- Urinary incontinence
- Drug acting on ntegumentary system

Urinary system drugs

Many different types of drugs are used in the management of renal disease and urinary system disorders.

- Some urinary drugs directly influence urine production and electrolyte balance.
- Others maintain blood pressure and reduce urinary system disease.

Urine producing (Diuretics)

- Diuretics increase the volume of urine excreted by the kidneys and thus promote the release of water from the tissues.
- This process called diuresis, lowers the fluid volume in tissues.
- The two main purposes of diuretic use are to decrease edema and to lower blood pressure.
- Diuretics effectively reduce the edema associated with these conditions, as well as edemas of nonspecific nature, pulmonary edema, pulmonary congestion, and any pathological accumulation of noninflammatory liquid.

The Classes of Diuretics

- Thiazides
- Loop agent
- Potassium-sparing diuretics,
- Carbonic anhydrase inhibitors

- Osmotics agent
- Aldosterone antagonist
- ADH antagonist

Table 3. All diuretics act directly on renal tubular epithelia at specific sites in the nephron

Nephron Segment	**Diuretic**
Proximal convoluted tubule	CA inhibitors (e.g., acetazolamide)
	Osmotic agents (e.g., mannitol)
	Xanthines (e.g., aminophylline)
Ascending loop of Henle	Loop agents (e.g., furosemide)
	Osmotic agents
Early distal convoluted tubule	Thiazides (e.g., hydrochlorothiazide)
Late distal tubule and collecting duct	K+ -sparring diuretics (e.g., triamterene or spironolactone)

Self-check 1

Name_____ **ID**_____ **Date**_____

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I Short answer Questions.

1. Define the following terms briefly (5 point each).
   a) Fungicids
   b) Bacteriostatic
   c) Bacteriocidal
   d) Antiacterial Spectrum
2. List drugs used in the treatment of digestive, resparatory, cardiovascular and urinary system respectively
3. List and explain the mechanism of antibiotics action during treating animals.

Test II Choose the correct answer for the following questions (4 point each).

1. Among the following which drug has an antiemetic effect?
   A. Oxytetracycline B. Penstrep C. Acepromazine meleate D. All of the above
2. One of the following is nonsteroidal anti inflammatory drug.
   A. Albendazole B. Sulfadimidine C. Ivermectin D. Aspirin

3. Of the following reproductive drugs wich one has the effect of superovulation in domestic species and induction of fertile estrus in bitches.

A. Dexamethasone

B. Synthetic progestins

C. Follicle-stimulating hormone

D. Human chorionic gonadotropin

Note: Satisfactory rating – 13.5 points Unsatisfactory - below 13.5 points

Information Sheet 2- Identifying chemotherapeutic drugs for various disease causing agent

Chemotherapeutic agents

When an animal is treated with chemotherapeutic agent, there are 3 interacting aspects: The host animal, the pathogen and the drug. This relation-ship is called the chemotherapeutic triangle

Chemotherapeutic agent includes the following

a. **Antibacterial (antibiotics) drugs.** They are drugs that kill or inhibits the growth of bacteria
b. **Antifungal drugs** are drugs that kill fungus.
c. **Antiprotozoal drugs** are drugs that kill protozoa.
d. **Anthelminthic** are drugs that kill /inhibit helminth parasites.
e. **Acaricide** are drugs that kill ticks, lice, fleas and mite (Acarine)
f. **Insecticides:** are drugs that kill insects.

Antibacterial agents

1. Penicillins: They are commonly employed class of B-lacatamase antibiotics. Penicillin G is obtained from penicllium species (mould).The remaining penicillin's are semisynthetic. Dose of penicillin G are expressed in international units (0.6µg), 1 IU = 0.6 µg

Classes of Penicillin: Classification of penicillin's based mainly on deference in antibacterial spectra. These include:

a) **Narrow spectrogram B-Lantamase:** sensitive penicillin eg. Benzyl penicillin Penicillins in this class are active against many gram-positive and a limited (no) number of gram negative bacteria. But they are susceptible to B-lantamase (penicillin's) hydrolysis.
b) **Narrow spectrum B-lantanas resistant penicillin's** Eg. Oxacillin, cloxacillin, dicloxacillin. Methicillin and naficllin are available as parenteral preparations Active against many gram positive and few gram negative bacteria

c) **Broad-spectrum-B-lactamase –sensitive penicillin**. Eg. Ampicillin and amoxicillin Are active against many gram positive and gram-negative bacteria

d) **Broad-spectrum B-lactamase sensitive Penicillins with extended spectra**. Eg. Carboxypenicillins (carbenicillin its acid stable in danylester, and ticarcillin, ureido penicillins (azolocillin and mezlocillin), and piperazine penicillin(piperacillin) Are active against most gram positive and gram-negative bacteria

e) **B-Lactamase protected Broad-spectrum penicillins (potentiated penicillins)**. Examples clavulanate potentiated amoxicillin and tecarcillin

Therapeutic indication

- Penicillins are used to treat local and systemic infection caused by actively growing bacteria.
- They are used in the treatment of: Anthrax, blackleg, bacillary hemoglobin uric, Actinomycosis, Bovine pyelonephritic, canine rickettsiosis, erysipelas, list enosis strangles, synovitis, mastitis, metritis, malignanta edema, nocandiosis and spirochactosis.

Side effects and toxicity: Hypersensitivity reactions: Like other antibiotics penciline drugs have side effects but in case of toxicity they are safe. However the main problem of this drug is it causes hypersensitivity

Drug withdrawal and milk discard times: For withdrawal times for food animals and milk discard times must be allowed according to the instructions.

2. Tetracycline

These are broad-spectrum antibiotics. There are 3 naturally occurring tetracycline: oxytetracycline, chlortetracycline and dimethyl chlortetracycline. They are obtained from Streptomyces species. Semi synthetic tetracycline include: Tetracycline, rolitetracycline, methacycline, minocycline, doxycycline, lymecycline, and others)

Based on elimination times they are classified in to:

1) Short acting tetracycline (tetracycline, oxytetracycline 5-10% &chlortetracycline)
2) Intermediate acting tetracycline (demitylechlortetracycline and methacycline)
3) Long acting tetracycline (20% oxytetracycline doxycycline, minocycline)

Therapeutic Indication: They are effective against gram positive and gram-negative bacteria, rickettsia, mycoplasma, chlamydia and some protozoa. They are used in the treatment of abortion (salmonella), black leg, bovine pyelonephritis, brucellosis, Actinobacillosis, Actinomycosis, anthrax, bacillary hemoglobinuria, bartonellosis, compylobacterasis, colibacillcosis, dermatophylosis, enterotoxaemia, erysipelas exudative epidermatitis, fowl cholera, heart water disease, hemorrhagic septicemia, Infectious keratitis, Infectious necrohepatitis, Infectious pododermatits, Infections poly arthritis, leptospirosis, listeriosis malignant edema, mastitis, nicrobacillosis, Pasturellosis, CCPP, Pneumonia, shigellosis, Actinobacillosis, strangles, synovitis, tetanus, Anaplasmosis, theilenosis, metritis .

Resistance: only Mycobacterium, Pseudomonas and Serratia the resistant bacteria for this drugs. For dose rates, routes and drug withdrawal time, follow the instructions on the leaflet.

Side effects and toxicity: they cause renal toxicity and hepatotoxicity.

High dose administered orally to ruminants will seriously disrupt micro floral

3. Aminoglycosides

Most naturally occurring aminoglycosides are obtained from Streptomyces spp other are semisynthetic

Classes

a) **Narrow spectrum aminoglycosides -** This group includes streptomycin and dihydrostreptomycin
b) **Broad spectrum amoglycosides** - Neomycin, Formycin (neomycin) neomycin B, Paromomycin, and Kanamycin, Gentamycin and tobramycin,
c) **Miscellaneous aminoglycoside** e.g. Apramycin

Therapeutic indication: -The narrow spectrum is effective against aerobic gram-negative bacteria including Actinomycosis, Brucella, campylobacter, Klebsiella, E Coli, Pasturella, salmonella, shigella, and mycobacterium. Framycetin Kanamycin and neomycin additionally kill Bordetella, Hemophilus and pseudomonas. Amikacin gentamycin, netilmicin, sisomicin and toblamycin are broad spectrum antibiotics effective against gram positive bacteria including staphylococcus streptococcus and

Corynebacterium and gram negative bacteria . Apramycin and spectinomycin are narrow spectrum aminoglycosides / aminocyclitols) being effective against aerobic gram negative bacteria including E coli, Pasturella salmonella proteus Klebsiella and mycoplasma.

Side effect: - Ototoxicity, neuromuscular blockage, nephrotoxicity are most frequent toxic reactions Nephrotoxicity has symptoms of poly urea decreased urine Osmolality, protein urea, enzyme urea.

4. Chloramphenicol

It is a highly effective well-tolerated broad-spectrum antibiotic

Classes: Chloramphenicol, Thiamphenicol, floramhenicol

Therapeutic indications: chloramphenicol is used to treat both systemic and local infections. They are used to treat chronic respiratory infections, bacterial meningoencephalitis, brain abscess, ophthalmitis, intraoccular infections, pododermatits, dermal infections, and otitis externa, salmonellosis and urinary tract infection. Even though this drug is very effective for many chronic infections and can pass different barriers, now a days it is becoming out of the market because of its side effects.

Side effect and toxicity: 1.causes hemotoxicosis in the case of high doses

2. Causes Pancytopenia (destruction of stem cells) so that the animal or human being will die because of infections or hemorrhage.

5. Sulphonamide and Sulphonamide Combinations

They are the most widely used antibacterial agents in veterinary medicine. They have synergistic action with trimethoprim.

Classes -There are 5 classes

a) **Standard use Sulphonamide**: They are administered for 1-4 times a day, depending up on the drug. They include: sulfathiazole, sulfamethazine /sulfadimidine/ sulfamerazine, sulfadiazine, sulfapyeidine, sulphabromomethazine, sulfaethoxy pyridazine, sulfamethoxy pyridazine, sulfadimethoxine, and sulfachloryridazine.

b) **Highly Soluble sulfonamides used for urinary tract infections**. They include sulfisoxazole (sulfafurazole) and sulfasomidine

c) **Poorly soluble sulfonamides** used for enteric infections e.g. Phthalyl sulfathiazole and succinylsafathizole.

d) **Potentiated Sulfonamides**: Sulfonamides are used in combination with certain diaminopyrimidines / trimethoprim and pyrimethamine). Sulfonamides combined with pyrimethamine are used to treat protozoal diseases such as leishmaniosis and toxoplasmosis.

e) **Sulfonamides** used topically Mafebide and silver sulfadiazine are used on burn wounds to prevent invasion by many gram negative and gram positive organisms. Sulfathiazole is commonly included in wound powders for the same purpose.

Therapeutic Indications: commonly used to treat or prevent acute systemic or local infection caused by colibacillcosis, Pododermatits, Polyarthritis respiratory infections and toxoplasmosis.

Side effects and toxicity: hypersensitivity or direct toxic effects.

Acute toxic reactions following rapid IV administration or due to excess dose injection could occur clinical signs include muscle weakness blindness ataxia, and collapse gastro intestinal disturbance could also occur.

Anthelmintic Drugs for parasitic disease treatment

1. **Benzimidazoles** : represents a large family of broadspectrum agents, poorly soluble and therefore are generally given by mouth. They are more effective in horses and cattle. This class includes albendazole, Fenbendazole, Mebenazole, triclabendazole etc.

a) **Albendazole** (valbazen)- It is potent broad-spectrum anthelmintics in ruminants against gastro intestinal nematods , lungworms, inhibits ostertagia larvae , moneizia, and Horse lungworms. **Warning (Toxicity):** Albendazole is teratogenic in ewe and embryo toxic in cow, causes abortion so avoid using in early pregnancy (45 days) in this species.

b) **Fenbendazole (Panacur)**

a broad spectrum Anthelimitics. Anthelimitics., a ctive against GI and lung nematodes, cestodes in cattle , sheep, goat.

c) **Mebendazole (vermox**) it is effective against round worms, tapeworms and tapeworm larvae.including in ruminants' major G1 nematodes and whipworms, lungworms& moniezia .In Horse: Ascarids& lung worms Pig : whip worms and lung worms dog and cat : Ascarids, whipworms, tape worms (Taenia , echinococcus) poultry tape worms.

d) **Triclabendazole** narrow spectrum and the most effective anthelmintics against all stages of fasciola.

2. **Imidazothiazoles:** the derivative inclu des levamizole and Tetramizole

a) **Tetramizole Hydrochloride** : It is effective against the major G1 worms of cattle, sheep and goats. It is given by PO or injection. In cattle& shoats: major G1 worms and lung worms

Pig ascaris o esophagostomum, metastrongyles cat: lung worm

b) **Levamisole antinematode and immunostimulant** .It causes spastic paralysis of worms. Anthelmintic spectrum cattle and sheep: major GI nematodes, respiratory nematodes (Dictyocaulus), eye worm (theilazia), pig: Hyostrongylyus and strongyloids ,dog and cats: ascarids and hook worms, chicken ascarids andHetrakis capillarids gapes and oxysperura, eye worms of chicken, levamisol is also effective v/s the immature forms(including the migratory larvae)of ascarids and metastrongylus. Warning: in horse it causes excitement, sweating, increased respiration and nasal discharge. Avoid its use in lactating animals and injection in cattle (cause a transient inflammation on injection site)

c) **Avermectins (Ivermectins)** It is highly effective at low doses, is safe, and provides broad spectrum activity against nematodes and ecto parasites of animals. Ivermectin is also called endectocidal drug because it is active against endoparasites(nematodes)and ectoparasites.Warining Avoid injection in horse They are contraindicated for use in cow and goats being milked for human consumption.

d) **Tetrahydropyrinlidines** it includes salts of morantel and Pyrantel

- **Pyrantel;-** It is a broad spectrum anathematic against GI nematodes in ruminant and horse..Warning: avoid using with piperazine and levamisole is contraindicate d to use in emaciated animals.

- **Morantel-** It has similar action to that of pyrantel. It is safer and rapidly absorbed from the gut. It is highly effective against nematod in ruminants.

e) Salicylanilides include cloxanide, closantel ,niclosamides, oxyclozanide and rafoxanide.

- **clioxanide** : It is highly effective against mature fasciola hepatica of sheep and calf.
- **Closantel** : It is effective a gainst Haemonchus, bunostomum adult and juvenil (immature stages) fasciola flukes . Also against ticks mites and fly larva.
- **Niclosamide** : It is highly effective against tape worms (moniezia) , and immature Paramphistomum of ru minants , dog and cat. ova of tape worms are not affected.
- **Oxyclozanide:** It is highly effective against mature fasciola hepatica of ruminants.
- **Rafoxanide:** It is effective a gainst adult and juvenile (6 - 10weeks) fasciola flukes Haemonchus and bunostomum round worms Others Nasal bots and fly maggots.

f) Aromatic amide this includes a drug called diamfetide. They kill flukes.

- **Diamtentide:** - It shows highest activity against youngest fasciola hepatica (1-9 weeks old). It may be used with sheep and goats 100mg/kg PO repeat at the interval of 6 - 8 weeks.

g) Piperazines; - this group includes piperazine and diethylcarbamazine citrate.

- **Diethyl carbamazine citrate:-** It is used for life time prophylaxis against heart worm microfilaria of dog and for the treatment of paralytic tracheobronchitis of dog and dictyocaulus infection of ruminants.
- **Piperzine:** - It is highly effective against ascarids in all animals and nodular worms / Oesophagostomum) of ruminants and pigs. It is quite a safe drug

h) Praziquantel: It is highly effective against tapeworms and flukes of man and animals Dosage rates and routes of administration of anthelmintics according to the instruction.

1. Acaricide

Acaricide: they are drugs which kill acarines

Classification: there are 6 classes of Acaricide these include Organophosphates, organo chlorines, pyrethrins and pyrethroids, diamidines, Ivermectine and carbamates

1. Organophosphates: These are the most effective and commonly used drugs from the Acaricide which include Diazinon, Ethiomiraz cumaphos, cythioate diclorphone, fenthion, Malathion, ronnel.

Indication: against flies, lice, ticks, mange mites, oestrus ovis and gastrophilus larvae, sheep keds in horse cattle, sheep goat cat pig chicken and dogs.

Technique of Application:

Organ phosphorous compounds are applied in various ways

1. External application: dipping, spray, dust, ear tag and collar. It is used mainly for the control of tick, mange ked, lice fleas fly larval

2. Systemic application

a. Pour on method
b. Feed additive
c. By stomach tube to horses

Advantage: They are used for the treatment of ectoparasites

Disadvantage

All organophosphate compounds are toxic to man and animals. When applying preparations rubber gloves and other protected clothing should be worn and inhalation of spray and skin contamination should be avoided. The application of other groups like Organo chlorines, Pyrethrins and pyrethnoids is limited.

Antifungal Drugs

Fungal infections are termed mycoses and in general can be divided into superficial infections and systemic infections according to the infective location. The superficial infections affect skin, clothing hair, nails, toes, combs or mucous membranes, causing various kinds of dermatomycosis. The systemic infections affect deeper tissues and

organs, e.g. candidiasis, chicken aspergillosis, calf mycotic gastritis and metritis. Many of the fungi that can cause mycoses live with human and livestock as commensals or exist in the environment. Topical infections caused by a large variety of fungi may become established on the skin and adnexia or mucous membranes. Locally active antifungal drugs are used to treat such topical infections. Antifungal agents are also used against a number of serious systemic fungal diseases. Antifungal agents include polyene, macroolide, and Griseofulvin and synthetic antifungal agents.

1. Polyene Mactolide

a. **Amphotaricin nystatin:** These are broad spectrum fungicides.
b. **Natamycin:** for the treatment of fungal keratitis.
c. **Nsystatin:** used in treatment of mucocutaneous candidiasis.

2. **Griseofulvin:** is a systemic antifungal agent. They are fungistatic and are indicated for the treatment of dermatophyte infection in dogs, cat, calves, horses, and, other domestic animals

Antiprotozoal drugs

These are drugs used for the treatment and prevention of protozoal diseases such as Coccidiosis, Babesiosis, Trypanosomosis, Theileriosis and others.

They include: -

1. Anticoccidials,
2. Antibabesials,
3. Antitrypanosomial,
4. Antitheilerials and Miscellaneous antiprotozoals.

1. Anticoccidials:

They are used for prevention and treatment of coccidiosis caused by Eimeria species in ruminants, birds and rabbits, and Isospora spp in pig and dog. Anticoccidials used in poultry and other domestic animals

a) Ionophorous antibiotics: They are coccidiostatics obtained from Streptomyces species

b) Sulfonamides: are codccidiostats. Currently there are simple sulfas and potentiated sulfas.

Simple sulphas: - include sulfamethazine, sulfachlorpyridazine, sulfadimethoxine and sulfa quinoxaline.

The potentiated sulfas: sulfadimethoxine with ormethoprim, sulfadiazine with trimethoprim.

2. Chemotherapy and Chemoprophylaxis in Trypanosomosis

Chemotherapy and chemoprophylaxis are essential in the control of trypanosomosis, particularly in view of lack of effective vaccines and the problems associated with vector control. Treatment of trypanosomosis is frequently complicated by development of drug resistance, toxicity and the damaging dermonecrosis produced by some of trypanocidal agents.

a) **Quinapyramine-methylsulfate (Trypacide) -** is a curative drug for cattle and small ruminants and given sc.
b) **Homidium bromide** (Ethidium) and homidium chloride (Novidium): Ethidium bromide is given to cattle in 1 or 2.5% solution at the rate 1mg/kg. Basically used as a curative drug with some prophylactic properties. Berenil can overcome its resistant strains. Novidium- a mixture of homidium chloride and bromide has the same actions as Ethidium and used in the same way.
c) **Pyrithidium bromide (prothidium):** Basically used for prophylaxis in cattle, and both as a curative and prophylactic drug for horse, donkey and dogs. It easily induces resistant trypanosomes with cross resistance to ethidium and quinapyramine. However these strains are susceptible to berenil and isometamedium.
d) **Isometameidium (Trypamidium/Samorin**): Its resistant strains are susceptible to berenil.
e) **Diaminazine aceturate (berenil):** very active, stable with very low toxicity effective against trypanosomes resistant to other drugs and very effective agains piroplasmosis due to babesia bigemina.
f) **Suramin sodium (Naganol):** used more than 50 years ago for sleeping sickness as a prophylactic drug in man. It is not very effective against T.vivax and T.congolense of cattle.

3. Antibabesials

These are drugs used to treat babesioisis.

a) **Acriflavine-** used for the treatment of babesiosis in horse (B. equi) and cattle (B. begemina and B. bovis) Dose: cattle and horse- 2.2 mg/kg IV as 5% solution
b) **Amicarbalide-** used to treat Babesiosis, but not B. equi and B. canis side effect transient swelling at the site of injection. Horse: 8.8mg/kg IV for two days Cattle: 5 mg/kg IM, 10mg/kg in peracute cases
c) **Diminazinene aceturate**- Trypanocide, babesicide and bactericide. Horse; 5mg/kg IM, cattle, shoat and dog: 3.5mg/kg SC or IM Dog: 6mg/kg, B. gibsoni.
d) **Imidocarb dipropyonate-** used for prophylaxis and treatment of babesiosis and Anaplasmosis. Horse: 2.4mg/kg, cattle: 1.5mg/kg, dog 6mg/kg, Sc for babesiosis therapy. Cattle: 3mg/kg, Sc/IM, for Anaplasmosis therapy or babesiosis prophylaxis to protect for a month.
e) **Phentamidine isothionate**- used for treatment of babesiosis Cattle: 2mg/kg Sc, dog 4mg/kg Sc or
f) **Quinurolium sulfate-** used for treatment of babesiosis, except B. bovis of cattle and B. gibsoni of dog.

Antiviral Drugs

Viruses comprise a core genome of nucleic acid surrounded by a protein shell or capsid. Some viruses are further surrounded by a lipoprotein membrane or envelope. Viruses cannot replicate independently and, as such, are obligate intracellular parasites. The host's pathways of energy generation, protein synthesis, and DNA or RNA replication provide the means of viral replication. Viral replication occurs in five sequential steps: host cell penetration, disassembly, control of host protein and nucleic acid synthesis such that viral components are made, assembly of viral proteins, and release of the virus.

Drugs that target viral processes must penetrate host cells; further, because viruses often assume direction of cell division, drugs that negatively impact a virus are also likely to negatively impact normal pathways of the host. For these reasons, particularly compared with antibacterial drugs, antiviral drugs are characterized by a narrow therapeutic margin. Nephrotoxicity is emerging as an adverse reaction to antiviral drugs in human medicine. Therapy is further complicated by viral latency, i.e., the ability of the virus to incorporate its genome in the host genome, with clinical infection becoming evident without reexposure to the organism. In vitro susceptibility testing must depend on cell cultures, which are expensive. More importantly, in vitro inhibitory tests do not necessarily correlate with therapeutic efficacy of antiviral drugs. Part of the discrepancy between in vitro and in vivo testing occurs because some drugs require activation (metabolism) to be effective.

Only a few antiviral drugs are reasonably safe and effective against a limited number of viral diseases, and most of these have been developed in people. Few have been studied in animals, and widespread clinical use of antiviral drugs is not common in veterinary medicine. The advent of human immunodeficiency virus (HIV) and the development of the cat as a model of HIV infection has somewhat increased the animal knowledge base. Only a selection of the more promising agents and their purported attributes are briefly discussed.

Most antiviral drugs interfere with viral nucleic acid synthesis or regulation. Such drugs generally are nucleic acid analogues that interfere with RNA and DNA production. Other mechanisms of action include interference with viral cell binding or interruption of virus uncoating. Some viruses contain unique metabolic pathways that serve as a target of drug therapy. Drugs that simply inhibit single steps in the viral replication cycle are virustatic and only temporarily halt viral replication. Thus, optimal activity of some drugs depends on an adequate host immune response. Some antiviral drugs may enhance the immune system of the host.

Table 4. Antiviral drugs with their route of administration

Antiviral drugs	Preparation	Dose, route and frequency	Indication
Idoxuridine	0.1% ophthalmic solution 0.5% ophthalmic solution	1 drop, topical, every 5–6 hr 1 drop, topical, every 1–2 hr	
Trifluridine	1% ophthalmic solution	1 drop, topical, every 2 hr initially (2 days), then 3–8 times daily	Ocular herpesvirus infection
Vidarabine	3% ophthalmic solution 200 mg/mL suspension for injection	0.4–1 cm ointment, topical, every 5–6 hr; 3–6 times daily 10–30 mg/kg/day, IV, as CRI for 12–24 hr	Ocular herpesvirus infection
Acyclovir	200-mg capsules or tablets 5% cutaneous ointment 200 mg/5 mL suspension	200 mg, PO, qid, every 4 hr, or 5 times daily Cover lesion, topical, every 3 hr, 6 times daily 80 mg/kg/day (mixed with peanut butter), PO, for 7–14 days	Feline herpesvirus Pacheco's disease in birds
Ganciclovir	500 mg/vial powder 500 mg/vial powder	250–500 mg/m^2, IV, tid, infused over at least 1 hr 2–5 mg/kg, IV, bid-tid	
Ribavirin		11 mg/kg/day, IV, for 7 days	Susceptible viral infections
Zidovudine	10 mg/mL syrup; 10 mg/mL injection	5–20 mg/kg (cats), PO or SC, bid-tid	FIV, FeLV

Amantadine	100- and 500-mg capsules Syrup 10 mg/mL	100 mg total (human), PO, once to twice daily 100 mg/day total (juveniles), PO	
Rimantadine		200–300 mg/day total (human), PO	
Interferon α-2	3×10^6 IU/vial	3×10^6 IU/person/day, SC, IM; 0.5–5 U/kg/day, PO; 100,000 U/kg/day, SC 1 U/day, PO 15–30 U, PO, IM, SC, once daily on alternate weeks	FeLV-associated disease FeLV appetite stimulant FIP, FIV

CRI = constant-rate infusion; FeLV = feline leukemia virus; FIP = feline infectious peritonitis; FIV = feline immunodeficiency virus

Self-check 2

Name_____ **ID**_____**Date**_____

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I Short answer questions (4 point each).

1. Describe narrow spectrum aminoglycocide drugs.
2. Describe broad spectrum spectrogram B-Lantamase.
3. Write drug used in the treatment of trypanosomosis.

Test II Choose the correct answer for the following questions ((3point each).

1. One of the following anthelmintic is the most effective anthelmintics against all stages of fasciola,

   A. Fenbendazole B. Mebendazole C. Triclabendazole D. Albendazole

2. Which drug is highly effective at low doses and provides broad spectrum activity against nematodes and ecto parasites of animals?

   A. Ivermectin B. Mebendazole C. Diazinon D. Quinurolium sulfate

3. Among the following drug which one is antifungal agent?

   A. Diaminazine aceturate B. Sulfadimethoxine C. Griseofulvin D. cythioate diclorphone

4. One of the following is not atiprotozoal agent.

   A. Thiamphenicol
   B. Sulfamethazine
   C. Homidium bromide
   D. Imidocarb dipropyonate

Note: Satisfactory rating - 12 points Unsatisfactory - below 12 points

Information Sheet 3- Preparing prescription of drug

3.1. Introduction

A medical prescription (℞) is an order (often in written form) issued by a qualified health care professional (e.g. physician and dentist) to a pharmacist or other therapist for a treatment (medicine or device) to be provided to their patient.

3.2. Preparing prescription of drug

There are two broad legal classifications of medications:

- The medications which can be obtained only by prescription which are referred as prescription drugs or legend drugs.
- The medications which may be purchased without a prescription, which are termed non-prescription drugs or over-the-counter (OTC).

Printed prescription forms are permissible and save a great deal of time. A full prescription paper should have the following.

1) 1The name and address of the patient/owner are required for reference in case of doubts or mistakes.
2) The Date must be included for the same purpose and a prescription reference number may also be included
3) The species of the animal
4) diagnosis reached
5) **The superscription:** which is represented by the Latin sign. (℞). This sign represents ‘‘take thou’’ or ‘‘you take’’ or ‘‘recipe.’’ Sometimes, this sign is also used to denote the pharmacy itself.
6) **The Inscription: -** is the general content of the prescription. It states the name and strength of the medication, either as its brand (proprietary) or generic nonproprietary) name. In the case of compounded prescriptions, the inscription states the name and strength of active ingredients.

7) **The Subscription** represents the directions to the dispenser and indicates the type of dosage form or the number of dosage units. For compounded prescriptions, the subscription is written using English or Latin abbreviations.
8) Name and signature of the prescriber/professional

Parts of a prescription

A typical prescription consists of the following parts:

1) Prescriber office information
2) Date
3) Patient information (name, age, sex and address of the Patient)
4) Superscription (symbol ℞)
5) Inscription (Medication prescribed) - Main part of prescription
6) Subscription (Direction to Pharmacist/Dispenser)
7) Signature or Transcription (Direction for Patient)
8) Renewal instructions
9) Prescriber's signature and registration number.

Choosing Drugs :- The selection should be based on the rational diagnosis of the disease correlated with a knowledge of the applied pharmacology of drugs .

Table 5. Abbreviations used during prescription writings

Abbreviation	Meaning	Abbreviation	Meaning
d.t.d	**gi**ve of such doses	q4h	every 4 hours
aa.	of each	q.i.d	four time a day
tsp	teaspoonful	q.o.d	every other day
a.c	before meal	q.s	a sufficient quantity
a.d	right ear	s.i.d	once a day
a.s	left ear	sig	directions to on label
a.u	both ears	stat	immediately
ad.lib	freely as wanted	SC	Sucut, Subcutaneous
amp	ampule	ss.	half
b.i.d	twice a day	sos	If necessary, as needed
c.	with	Sol.	solution
cap	capsule	Susp.	suspension
cc	cubic centimeter	t.i.d	three times a day
Gtt	frop	h.s.	at bed time
IM	intramuscular	IV	intravenous
IP	intraperitoneal	o.d.	Every day
p.c.	after meal	p.o.	mouth, per os
Syr.	syrup	tab.	tablet
ID	intradermal	IT	intrathecal
Top.	topically	V or PV	vaginally

Prescription format for physicians

PRESCRPTION PAPER

Code_____

Name of health institution…… Institution Name_____**Tel. No**_____

Name and Address of Owner…..

Name_____**Tel.No**_____

Patient History Sex: _____**Age:**_____ **Weight:** _____ **Tag No:** _____

Region: _____ **Town:** _____ **Woreda:** _____

Type of Diagnosis……_____

Superscription	**Drug name, Strength, Dosage form, Dose, Frequency, Duration, Quantity, How to use and other information**	**Price (Dispensers use only**
Inscription	**RX**	
Inscription	**Oxytetracycline 10%**	
	IM, for three days 10 ml per day	
	30ml	
	Total Price	

Prescriber's **Dispenser's**

Prescriber/dispenser information…. Full name_____ _____

Qualification _____ _____

Registration #_____ _____

Signature_____ _____

Date_____ _____

Emergencies encounter during handling/dealing with animals

1. Animal escapes

Animal Escape: any event when a zoo collection animal is no longer securely enclosed by the primary containment barriers for its exhibit or holding facility.

The employee reporting the escape should remain calm, speak deliberately and clearly and provide the following information to the best of their knowledge:

Reporting an animal escape

1) Name of reporting employee
2) If reporting via telephone give the location and phone extension number you are reporting from so you can be located/contacted again as needed.
3) The species of escaped animal. (If the exact species is not known use closest group term for example bear, large cat, antelope, etc.)
4) The number of escaped animals observed
5) Exact location of animal(s)
6) Direction of animal(s) movement
7) Condition and behavior of animal (injured, panicked, running, etc)
8) Any humans injured by the escaped animal
9) Animal description (sex, adult/young, specific ID) if known

2. Electrocution,

Electrocution means accidental injuries or death caused by electric shock passing through the body of the animal. It can happen due to lightning, high voltage electric current from fallen transmission wires and accidental chewing of live electric wires. An animal may come directly in contact with such wires or indirectly through electrification of ponds by fallen electric transmission wires. The clinical signs of electric shock depend upon the amount of voltage to which the animal is exposed. In most cases of electrocution by lightning stroke, the animal dies on the spot and falls without any struggle. Occasionally, affected animal becomes unconscious but may recover in a few minutes to several hours. Other signs of electrocution are depression, blindness, etc., which may persist for few days or weeks. Electrocution due to lightning can be detected on the basis of history of

lightning, single mark of injury on the dead body of the animal and damage to the immediate environment like burning of adjoining ground area.

Treatment is carried out in mildly affected animals and on the basis of clinical signs observed in them. Affected animals are kept in quiet and calm area with minimum disturbances. Adequate water is offered to the affected animals. Skin wounds are treated with application of antibiotic creams.

3. Chemical spills

Chemical spill: The inadvertent release of a liquid chemical regarded as hazardous to human health, irrespective of the volume or place of release indoors or environmental which, in a workplace, is identified with hazardous materials labels. In the event of a chemical spill, the individual(s) who caused the spill is responsible for prompt and proper clean-up. It is also their responsibility to have spill control and personal protective equipment appropriate for the chemicals being handled readily available.

A spill is defined as an uncontrolled release of a chemical. Spills can be categorized into two types:

1) Major spills
2) Minor spills

Major spills meet these criteria:

- There is fire or potential for fire or explosion.
- The spill poses an immediate danger to life or health.
- There are injuries requiring medical attention.
- You do not know the properties or hazards of the spilled material

Major spills require an external emergency response

Minor spills are spills that do not meet the criteria of a major spill and can normally be dealt with by office personnel.

Procedure for chemical spills management

1) Notify your safety representative as well as all people in the laboratory of the chemical spill immediately.

2) Contain spill as best as possible using absorbent paper/s and or appropriate chemicals. If liquid has spilled from a container, return the container to the upright position to prevent further spread of the liquid.
3) Close all drains to prevent the spill from reaching the environment.
4) Switch off all electrical equipment in the vicinity of the spill.
5) Cordon off the area and control access of unnecessary persons.
6) Assist any person that has been exposed to chemical contamination.
7) First aid kit is available in the laboratory.
8) Spill kit is available at the Emergency shower.
9) Trained first aid workers are available in the department.
10) Technical staff will report spill to supervisor/ officer if help is needed.
11) Clean up spill

4. Anaphylactic shock

Anaphylaxis is defined as the acute onset of a hypersensitivity reaction causing the release of mediators from mast cells and basophils. Anaphylaxis may be a life-threatening condition that can involve one or more organ systems. Often, a specific cause for anaphylaxis is not known. Anaphylaxis may be brought on by anaphylactic or anaphylactoid reactions; treatment is the same regardless of reaction type. Anaphylactic shock is extremely serious. It can block airways and prevent from breathing. It can also stop heart functioning. This is due to the decrease in blood pressure that prevents the heart from receiving enough oxygen Veterinarians are seeing an increasing number of anaphylaxis patients because of the range of substances patients are exposed to, such as vaccines, new medications, and those from outdoor physical exposures. However, anaphylaxis is often misdiagnosed because definitive criteria to distinguish anaphylaxis from an allergic reaction are lacking.

Treatment of anaphylaxis is entirely based on clinical signs but should follow the guidelines for fundamental life support. Treatment should be initiated quickly and take priority over diagnostics because of the likelihood of rapid progression of clinical signs

and increasing possibility of death. As with all life support treatment, rapid triage assessment, including airway, breathing, circulation, and mental status, is paramount. Delays in treatment can lead to worsening outcomes. Immunologic and no immunologic hypersensitivity responses produce identical clinical signs and are thus treated the same.

5. Poisoning

It is a condition in which the animals suffer from a toxic substance or venom of an animal. Poisoning causes deleterious effects on the animals. Animals might swallow the poison, inhale it or absorb it through the skin. Even overdose of medicines given to animals may prove poisonous. Usually farm animals suffer from poisoning by eating poisonous plants, accidentally ingesting urea, rodenticides, pesticides, etc. Poisoning causes minor irritations like mild abdominal pain, dullness and depression in the animals. In severe cases, the animal refuses to take feed and shows sudden onset of nervous signs like muscular trembling, convulsions and excessive frothing from the mouth. The animal may ultimately die if not treated in time.

General principles of first aid in case of poisoning include immediate attention to the affected animal. If the route of poisoning is through ingestion then purgatives are given to the affected animals. Under field conditions, the poisoned animal is fed with crushed coal because charcoal acts as an antidote for poisoning. If the animal is suspected of poisoning through skin, then the skin of the animal is washed thoroughly with soap and water. Apart from these, expert veterinary care is necessary.

6. Sun stroke

It is also known as heat stroke. Sun stroke is an emergency situation which results due to excessive muscular exertion of the animal in high environmental temperatures and humidity. Sun stroke results in hyperthermia in the animal. Hyperthermia is the elevation of body temperature above 104ºF, which leads to increase in heart rate and respiration rate coupled with restlessness. Hyperthermia causes difficulty in breathing and convulsions and could result in death of the animal. The treatment for heat stroke consists of reducing the body temperature of the animal. The affected animal is immediately

moved to shaded and well-ventilated areas. Water is poured on the body and adequate glucose and water is given orally to the animal. Cold water enema may also be given in some cases depending on the severity of sun stroke. Special veterinary attention is required for the complete recovery of the animal.

Burn injuries mean any type of thermal injury caused by fire, flames and hot solids. Injuries caused by hot fluids or steam are termed as scald. The extent of a burn injury depends upon the temperature of the hot object and the duration of time for which it came in contact with the animal. Depending upon the involvement of skin tissue, burns may be classified into three categories, i.e., first degree burn injury, second degree burn injury and third degree burn injury. Common clinical signs of burn injuries involve pain, thirst, anemia and loss of necessary salts from the body. There is swelling, redness and blisters in the affected areas. The recovery and survivability of the affected animal depends upon the body area involved, rather than the degree of burn. For treatment, local dressing of the burn with antiseptic like Betadine is done. The contamination of the wound is prevented by covering the area with clean and sterile cloth. Sufficient water and glucose solution is given to the animal.

Table 6. Types of burn injury

First degree burn injury	Second degree burn injury	Third degree burn injury
• Only superficial and outer layer of skin is involved. • It is a mild type of injury and recovers within few days.	• Partial thickness of the skin is involved. • Vesicles are formed and for early and complete recovery, special care is taken to prevent secondary infection due to bacteria.	• Full thickness of skin and even underlying organs may be involved. • It is the most severe form of burn injury and special attention is required for complete cure of the animal.

9. Natural Disaster Emergency Procedures (Flood, Fire, Biological emergencies)

There is need to assess risk levels, preparedness and contingency plans in the event of natural disasters, and infectious diseases that may affect facility staff levels. An outcome of natural disasters involving one animal facility is the possible relocation of animals to another animal facility or suitable holding area. Suitably of the area should be assessed

on the basis of provision of temperature, humidity and light/dark cycles optimal for rodent husbandry.

7. Wounds

A wound may be defined as any injury in the skin or other body tissues due to a cut, blow or other impact. Are allowed to heal on their own without any special care or treatment. A careful and intelligent treatment of wounds greatly reduces the loss resulting from these injuries. The method of treatment varies for the different kinds of wound.

Self-check 3

Name_____ **ID**_____ **Date**_____

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I Short answer questions (3 point each)

1. Write types of burn injuries.
2. Discuss briefly what mean by anaphlactic shock.
3. Write the criteria of major chemical spill.

Test II Choose the correct answer for the following questions (2 point each).

1. _____is an order (often in written form) issued by a qualified health care professional to a pharmacist or other therapist for a treatment to be provided to their patient.

   A. Prescription B. Superscription C. Inscreption D. All of the above

2. Which one of the following is an element of prescription format?

   B. Prescriber office information

   C. Date

   D. Patient information (name, age, sex and address of the Patient)

   E. Signature

   F. All of the above

3. One of the following is an emergency condition occuring in the work place.

   G. Animal escape B. Poisonong C. Chemical Spill D. Fire E. All of the above

4. _____ is an emergency situation which results due to excessive muscular exertion of the animal in high environmental temperatures and humidity.

   A. Poisoning B. Sun stroke C. Heat stroke D. B and C

Note: Satisfactory rating – 8.5 points Unsatisfactory - below 8.5 points

Operation 1 Sheet 3 Procedures of chemical spill management

Procedures of chemical spill management

Step 1 Put on all protective clothing, goggles and acid resistant gloves.

Step 2 Cover all wet spills with vermiculate

Step 3 Clean up dry spills using the scoop.

Step 4. Try not to mix chemicals when scooping up.

Step 5 Place all dry chemicals in a sturdy plastic bag, tie with bag ties, and label if contents are known and put into blue plastic drum with lid supplied Enviroserv.

Step 6 Pick up all broken glass using tongs and put it into the broken glass containers supplied in every lab. Take note of all information on the labels from broken containers, both safety information and toxicity.

Step 7 Put used vermiculate into plastic bags in blue plastic drum.

Step 8 Clean the floor carefully

Step 9 Dispose the cleared waste safely

Operation 2 Sheet Reporting animal escape

Step of animal escape reporting

Step 1 Name of reporting employee

Step 2 If reporting via telephone give the location and phone extension number you are reporting from so you can be located/contacted again as needed.

Step 3 The species of escaped animal. (If the exact species is not known use closest group term for example bear, large cat, antelope, etc.)

Step 4 The number of escaped animals observed

Step 5 Exact location of animal(s)

Step 6 Direction of animal(s) movement

Step 7 Condition and behavior of animal (injured, panicked, running, etc)

Step 8 Any humans injured by the escaped animal

Step 9 Animal description (sex, adult/young, specific ID) if known

LAP TEST Animal escape reporting

Name_____ **ID**_____
Date_____
Time started: _____ **Time finished:** _____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within 30 minutes. The project is expected from each student to do it.

During your work: You can ask all the necessary tools and equipment
Lap Test Title: Animal escape reporting
Requerements: Paper, Pen, Telephone, Animal ID…
Requirements: PPE (Eye google, mouth mask, overall, Boots…), Broom, Container, Detergent…

Task-1 Perform chemical spill management

Task-2 Perform animal escape reporting

LG 84	LO #4. Follow correct storage, dispensary management and standard operating procedures

Instruction sheet

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:

- Storing medicines according to manufacturer's guideline
- Protecting medicines from environmental conditions
- Using Organizational operating guidelines in handling and dispensing of drugs.

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- Store medicines in accordance with the manufacturer's specification or datasheet
- Protect medicines from environmental conditions that may damage or degrade
- Using organizational operating guidelines in the handling and dispensing of drugs

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below.
3. Read the information written in the "Information Sheets". Try to understand what are being discussed. Ask your trainer for assistance if you have hard time understanding them.
4. Accomplish the "Self-checks" which are placed following all information sheets.
5. Ask from your trainer the key to correction (key answers) or you can request your trainer to correct your work. (You are to get the key answer only after you finished answering the Self-checks).
6. If you earned a satisfactory evaluation proceed to "Operation sheets
7. Perform "the Learning activity performance test" which is placed following "Operation sheets" ,
8. If your performance is satisfactory proceed to the next learning guide,
9. If your performance is unsatisfactory, see your trainer for further instructions or go back to "Operation sheets".

Information Sheet 1- Storing medicines

1.1. Introduction

Drug storage is among the pharmacist's most important responsibilities. Therefore, adequate methods to assure that these responsibilities are met must be developed and implemented. The pharmaceutical are to be stored under conditions that prevent contamination and, as far as possible, deterioration. The stability of product retain within the specified limit, throughout it period of storage and use. Precautions that should be taken in relation to the effects of the atmosphere, moisture, heat and light are indicated. During storage of the pharmaceutical products is one of the fundamental concerns in patient care.

The loss of potency during storage may influence the efficacy and safety of pharmaceuticals. Pharmaceutical products require controlled storage and transit conditions in order to ensure that their quality is not compromised. Storage is an important aspect of the total drug control system. Proper environmental control (i.e., proper temperature, light, and humidity, conditions of sanitation, ventilation, and segregation) must be maintained wherever drugs and supplies are stored in the premises.

1.2. Storing medicines

Different pharmaceutical product storage temperature on the basis of stability studies as given below:

Freezer: A place in which the temperature is maintained thermostatically between -25ºC and – 10ºC (-13 ºF and -14 ºF).

Cold: Any temperature not exceeding 8ºC (46 ºF). A refrigerator is a cold place in which the temperature is maintained thermostatically between 2ºC and 8ºC.

Cool: Any temperature between 8 ºC and 15 ºC. Any pharmaceutical products for which

storage in a cool place directed may, alternatively, be stored in a refrigerator, unless otherwise specified in the individual monograph.

Good storage practice (GSP) is applicable in all circumstances where pharmaceutical products are stored through the distribution processes.

Storage condition on label

Storage conditions for pharmaceutical products and materials should be in compliance with the labelling, which is based on the results of stability testing Storage conditions should be defined and described on the label of the product. All drugs should be stored according to the conditions described on the label. When specified on the label, controls for humidity, light, etc., should be in place. Storage areas should be designed or adapted to ensure good storage conditions. The label should specify any special storage conditions required for the product. Written procedures should be available describing the actions to be taken in the event of temperature excursions outside the labeled storage conditions. All excursions outside the labeled storage conditions must be appropriately investigated and the disposition of the stock in question must be evidence-based (for example, stability data and technical justification). Stability testing thus evaluates the effect of environmental factors on the quality of the a drug substance or a formulated product which is utilized for prediction of its shelf life, determine proper storage conditions and suggest labeling instructions.

Storage of Tablet

Storage on label:

- Store in a cool, protected from light and moisture.
- Store in a cool and dark place, protected from light and moisture.
- Keep in a dry dark place.
- Store in cool dry and dark place.

Storage of Capsule

Storage on label:

- Store in a cool and dry place, protected from light.

Storage of Emulsion

An emulsion should be stored in air tight container, protected from light, high temperature or freezing. The emulsions are required to be in cool place

Storage of Suspension

Suspension should be stored in a cool place but not be kept in a refrigerator. Freezing at a very low temperature should be avoided which may lead to aggregation of the suspended particles.

Storage on label:

- Store in cool and dry place, protect from heat and light.
- Store in a cool and dark place, protect from direct sun light.
- Keep in dry place at a temperature not exceeding 30 ºC. keep the bottle tightly closed.
- Store below 25 ºC, protected from moisture.
- Store at temperature not exceeding 30 ºC, protect from light.

Storage of Ointment

Ointment should be stored in well closed container so as to prevent the loss of volatile constituents. The ointment should be protected from high temperature or direct sunlight.

Storage on label:

- Keep in a cool place.

Storage of Paste

The paste should be stored in well closed container and in a cool place so as to prevent evaporation of moisture present.

Storage of syrup

The syrup should be stored in well closed and stopper bottle in a cool dark place. The syrup should be stored at a temperature not exceeding 25 ºC.

Storage on label:

- Store in cool, dry and dark place.
- Store in a cool and dry place, protected from light.
- Store in a cool place, protected from direct sunlight.

Storage of Oral Drop

Storage on label:

- Store at temperature not exceeding 30 ºC.
- Store in cool, dry place and protected from light.
- Store at temperature not exceeding 30 ºC, protect from direct sunlight.
- Keep in a dry place, dark place.
- Store in a dry place, away from light.

Storage of injection

Storage on label:

- Store below 30 ºC, protected from light.
- Store below 25 ºC, protected from light.

Vaccine storage

Vaccines are expensive and fragile, and storing them at the proper temperature is essential to providing effective immunizations. The vaccines should always be stored in their original packaging until point of use to protect them from light. The vaccine temperature must be maintained in an insulated container between +2ºC to +8ºC at all times. Vaccine storage and handling are key components in maintaining the efficacy of immunization programs. Cold chain refers to the process used to maintain optimal conditions during the transport, storage, and handling of vaccines, starting at the manufacturer and with administration of the vaccine. The optimum temperature for refrigerated vaccines is between 2°C and 8°C. For frozen vaccines the optimum temperature is –15°C or In addition, protection from light is a necessary condition for some vaccines.

Cold chain equipment

All cold chain equipment has to comply with a set of performance standards defined by the WHO or national policy. Only proven methods should be used to transport or store vaccines: for example, insulated containers proven through electronic temperature logging as reliable in maintaining the recommended temperature (solid wall transport containers, double walled transport containers and polystyrene containers).

The recommended equipment typically used for vaccine storage are :

- Cold rooms,
- Refrigerators
- Freezers.

For transporting vaccines equipment such as are commonly used.

- Cold boxes,
- Vaccine carriers and
- International containers

Self-check 1

Name_____ **ID**_____ **Date**_____

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I Short answer questions (3 point each).

1. What is the appropriate storing temperature of medicines
2. Describe equipment used for transporting vaccine.

Note: Satisfactory rating - 3 points Unsatisfactory - below 3 points

Information Sheet 2- Protecting medicines

2.1. Protecting medicines

Pharmaceutical products should be packed in a well closed container that protects the contents from contamination by extraneous solids, liquids or vapors and the loss of the products under normal conditions of handling and storage. The following factors to be taken in consideration for proper storage and protection of medicines:

1) Sanitation
2) Temperature
3) Light
4) Moisture
5) Ventilation
6) Segregation

Defined storage instructions

Drug products that must be stored under defined conditions require appropriate storage instructions. Unless otherwise specifically stated (e.g. continuous maintenance of cold storage) deviation may be tolerated only during short-term interruptions, for example, during local transportation.

Table 7. The use of the following labelling instructions are recommended:

On the label	Means
“Do not store over 30 °C”	from +2 °C to +30°C
“Do not store over 25 °C”	from +2 °C to +25°C
“Do not store over 15 °C”	from +2 °C to +15°C
“Do not store over 8 °C”	from +2 °C to +8°C
“Do not store below 8 °C”	from +8 °C to +25°C
“Protect from moisture”	no more than 60% relative humidity in normal storage conditions; to be provided to the patient in a moistureresistant container.
“Protect from light”:-	to be provided to the patient in a light-resistant container.

Self-check 2

Name_____ **ID**_____ **Date**_____

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I Short answer question

1. What are the factors should be considered for proper storage and protection of medicines?

Note: Satisfactory rating – 2.5 points Unsatisfactory - below 2.5 points

Information Sheet 3- Using Organizational Operating Guidelines Handling and Dispensing of Drugs

3.1. Introduction

Dispensing refers to the process of preparing and supplying medicines to a named person together with clear instructions, advice and counselling where necessary on the use of those medicines. It involves the correct interpretation of the order for prescribed medicines and accurate preparation and labelling of medicines for use by the patient. The dispensing process includes all activities that occur between the time the prescription or request for medicine is presented up to the time the medicines or other prescribed items are issued to the patient.

Good Dispensing Practice ensures that the right medicines of desired quality are delivered correctly to the right patient with the right dose, strength, frequency, dosage form and quantity, together with clear instructions, both written and verbal and with appropriate packaging suitable for maintaining the quality and efficacy of the medicine

.

Definition of terms

Dispenser: Any person who is licensed or authorized by the appropriate body to dispense medicines and/or medical supplies.

Dispensing: The act of preparing medicines and/or medical supplies and distributing to users with adequate information, counseling and appropriate follow up.

3.1. Handling and Dispensing of Drugs

A safe, clean and organized working environment provides the basis for good dispensing practice. The dispensing environment includes:

1) Qualified / trained staff
2) Appropriate physical surroundings
3) Adequate shelving and storage areas

4) Proper work surfaces
5) Suitable equipment
6) Necessary packaging materials

Responsibility for the accuracy and quality of the medicines supplied lies on the persons overseeing the dispensing process. It is important that the staff dispensing medicines are trained and equipped with the technical knowledge and the skills necessary to dispense the range of medicines prescribed and to communicate effectively with patients/ caregivers.

Handling drug in safe manner

- Make sure that you know how to take the medicine. For instance, note whether you should swallow it, put it under your tongue, chew it, inhale it, apply it externally, or insert it as a suppository. It's important to apply the medication correctly.
- Read the medicine's label and instructions carefully. Take note of the dosage, ingredients, indications, warnings, and side effects, in order to avoid undesirable results. For example, some medicines become poisonous if combined with alcohol.
- Don't take medicines in the dark in order to avoid a mistake.
- Don't take more than one kind of medication at a time unless under a doctor's instructions. Otherwise you may experience harmful drug interaction.
- If you develop a rash, stomachache, headache, or other reactions after taken medication, stop taking it immediately and consult your doctor.
- When giving medicine to children, don't refer to it as 'candy'.
- Children should be supervised when taking any medicine, with extra care taken when using medicines that come in the form of soft gel capsules. Parents and caregivers should follow the instructions for use for all medicines given to children.
- Pregnant and breastfeeding women should not use or take medicines unless instructed by a doctor, as some medicines may pass into the placenta or breast milk and pose adverse impacts to the fetus or the infant.
- Seek medical advice as soon as possible if you experience any serious side effects suspected to be related to your drugs.

- Most orally taken medications such as tablets should be swallowed whole with water. Tablet should not be broken into pieces or crushed before taking unless as directed by doctor or healthcare professionals such as pharmacist have been consulted.

Dispensing Process

Adherence to good dispensing procedures is vital in ensuring that medicines are dispensed correctly and any potential/ real errors which may occur during the dispensing process are detected and rectified before medicines reach the patient.

Who should be involved in the process of dispensing?

a) Screening of prescription: Healthcare professional (Registered medical practitioner/ registered dentist/ pharmacist)
b) Preparation of Medicines: Pharmacist, registered medical practitioner or a person under immediate supervision of a pharmacist/ medical practitioner
c) Supplying the Medicines: Registered medical practitioner, registered dentist or pharmacist
d) Counselling: By healthcare professional

Dispensing Procedures

The various activities involved in dispensing process are:

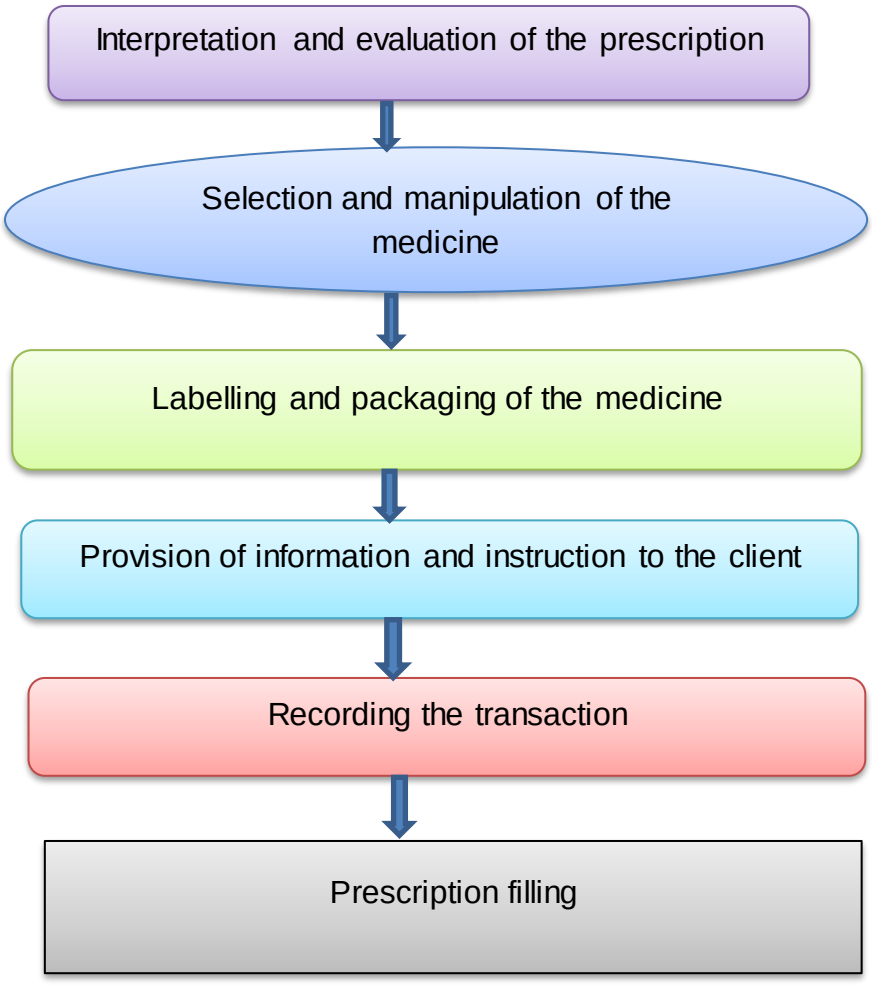

Diagram 5. Drug dispensing process

Self-check 3

Name_____ **ID**_____ **Date**_____

Directions: Answer all the questions listed below. Examples may be necessary to aid some explanations/answers.

Test I Short answer question (2 point each)

1. What is drug dispensing mea? Expain it.
2. Who should be involved in the process of dispensing?
3. What are the consideration into account during drug dispensing?

Note: Satisfactory rating - 3 points Unsatisfactory - below 3 points

Operation Sheet Drug Dispensing Procedures

Step of drug dispensing procedures

Step 1 Interpretation and evaluation of the prescription

Step 2 Selection and manipulation of the medicine

Step 3 Labelling and packaging of the medicine

Step 4 Provision of information and instruction to the client

Step 5 Recording the transaction

Step 6 Prescription filling

LAP TEST Drug dispensing procedures

Name_____ ID_____
Date_____
Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within 30 minutes. The project is expected from each student to do it.

During your work: You can ask all the necessary tools and equipment
Requirments: Paper, Pen, Drugs…
Lap Test Title: Drug dispensing procedurs

Follow the following step to dispense drugs

Task Perform drug dispensing procedures

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