Ethiopian TVET-System

MEDICAL LABORATORY

Level -III

Based on Apr.2018G.C. Occupational Standard

Module Title: Collect and Process Medical Samples

TTLM Code: HLT MLS4 TTLM 0919v1

This module includes the following Learning Guides

LG22: Apply concept of physiology and anatomy

LG23: Prepare to collect samples

LG24: Collect and handle sample

LG25: Transport and handle sample

LG26: Receive and log sample

LG27: Distribute samples

LG28: Prepare sample for testing.

LG29: Maintain safe work environment

LG22: Apply concept of physiology and anatomy

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described in number 5 to 11.
3. Read the information written in all Information Sheets. Try to understand what are being discussed. Ask you teacher for assistance if you have hard time understanding them.
4. Accomplish all Self-check according to learning session separately
5. Ask from your teacher the key to correction (key answers) or you can request your teacher 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 next Information Sheet. However, if your rating is unsatisfactory, see your teacher for further instructions or go back to pervious Learning Activity.
7. Submit your accomplished Self-check. This will form part of your training portfolio.
8. Try to understand what are being discussed. Ask you teacher for assistance if you have hard time understanding them.
9. Accomplish the all Self-checks.
10. After you accomplish self check proceed to operation sheet if available.
11. If you perform operation procedure correctly proceeds to LAP. test if available

Information Sheet-1	Apply concept of physiology and anatomy

Learning out comes (objectives):

At the end of this module the trainee will be able to:-

- Identify human anatomy and physiology
- Understand the type and nature of samples
- Identify the time of sample collection and collection sites

1.1. Concepts of human anatomy and physiology

1.1. What are Anatomy and Physiology?

- Anatomy: the word anatomy is derived from a Greek word "Anatome" meaning to cut up. It is the study of structures that make up the body and how those structures relate with each other.

  The study of anatomy includes many sub specialties. These are Gross anatomy, Microscopic anatomy, Developmental anatomy and Embryology.

  Gross anatomy studies body structure without microscope. Systemic anatomy studies functional relationships of organs within a system whereas Regional anatomy studies body part regionally. Both systemic and regional approaches may be used to study gross anatomy.
  Microscopic anatomy (Histology) requires the use of microscope to study tissues that form the various organs of the body.
  - ✓ Gross (macroscopic) anatomy: the study of structures large enough to be seen with the naked eye
  - ✓ Regional anatomy: all the body structures (muscles, bones, blood vessels, nerves, etc.) in a given body region , such as the abdomen or leg, are examined at the same time
  - ✓ Systemic anatomy: body is studied system by system
    - ✓ Example: when studying the cardiovascular system, you would examine the heart and the blood vessels of the entire body
  - ✓ Surface anatomy: internal body structures as they relate to the overlying skin
    - ✓ Used when identifying the bulging muscles beneath a bodybuilder's skin, and clinicians use it to locate appropriate blood vessels in which to feel pulses and draw blood
  - ✓ Microscopic anatomy: the study of structures that are too small to be seen with the naked eye
    -Cytology: study of individual cells
    -Histology: study of tissues
  - ✓ Developmental anatomy: the study of the change in body structures over the course of a lifetime
    - ✓ Embryology: concerns developmental changes that occur before birth
- Physiology: the word physiology derived from a Greek word for study of nature. It is the study of how the body and its part work or function.
  - ✓ Renal physiology: concerns kidney function and urine production
  - ✓ Neurophysiology: explains the workings of the nervous system
  - ✓ Cardiovascular physiology: examines the operation of the heart and blood vessels

  While anatomy provides us with a *static image of the body's architecture,* physiology *reveals the body's dynamic nature*

1.1.1. Levels of Structural Organization

- Chemical level is the simplest level of organization:
  - Atoms, tiny building blocks of matter, combine to form molecules such as water and proteins

  - Molecules combine in specific ways to form organelles, which are the basic unit of living cells
  - Cells are the smallest units of living things
    - All cells have some common functions, but individual cells vary widely in size and shape, reflecting their unique functions in the body.
- Cellular level: smallest unit of life, and varies widely in size and shape according to the cell's function
- Tissue level: groups of similar cells having a common function
  - Four basic tissue types: each tissue type has a characteristic role in the body
    - Epithelium: covers the body surface and lines its cavities
    - Muscle: provides movement
    - Connective: supports and protects body organs
    - Nervous: provides a means of rapid internal communication by transmitting electrical impulses
- Organ level: made up of discrete structures that are composed of a least two groups of tissues that work together to perform a specific function in the body

  - Stomach: epithelium lining, muscles, blood vessels, connective tissues, nerve fibers, etc.
- Organ system level: a group of organs that work closely together to accomplish a specific purpose

  - Respiratory and circulatory system, digestive and circulatory systems
- Organismal level: the total of all structures working together to promote life

  - The living human being

1.2. Maintaining Life

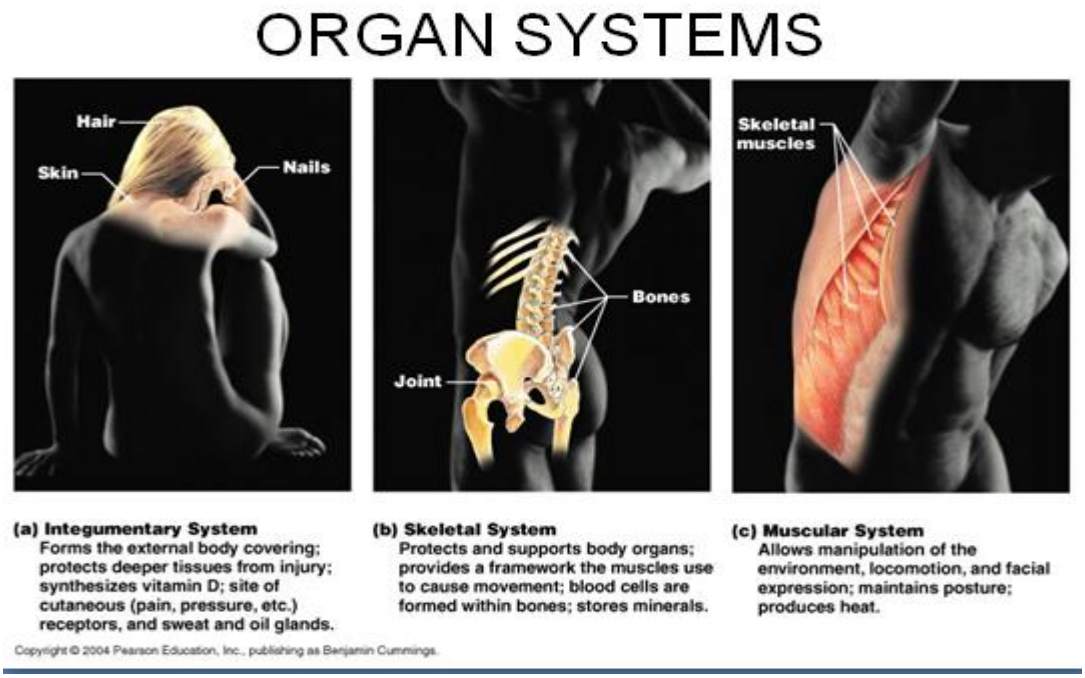
Necessary Life Functions

- Maintaining Boundaries: allows an organism to maintain separate internal and external environments, or separate internal chemical environments

  - Integumantary System or Skin
- Movement: allows the organism to travel through the environment, and allows transport of molecules within the organism

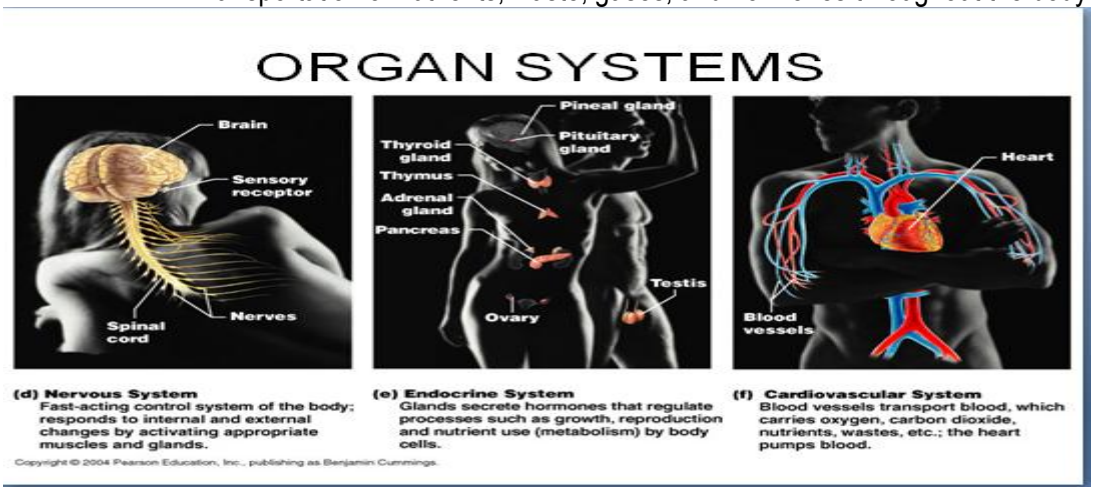
  - Skeletal, Circulatory, Muscular Systems
- Responsiveness: or irritability, is the ability to detect changes in the internal or external environment and respond to them

  - Muscular System



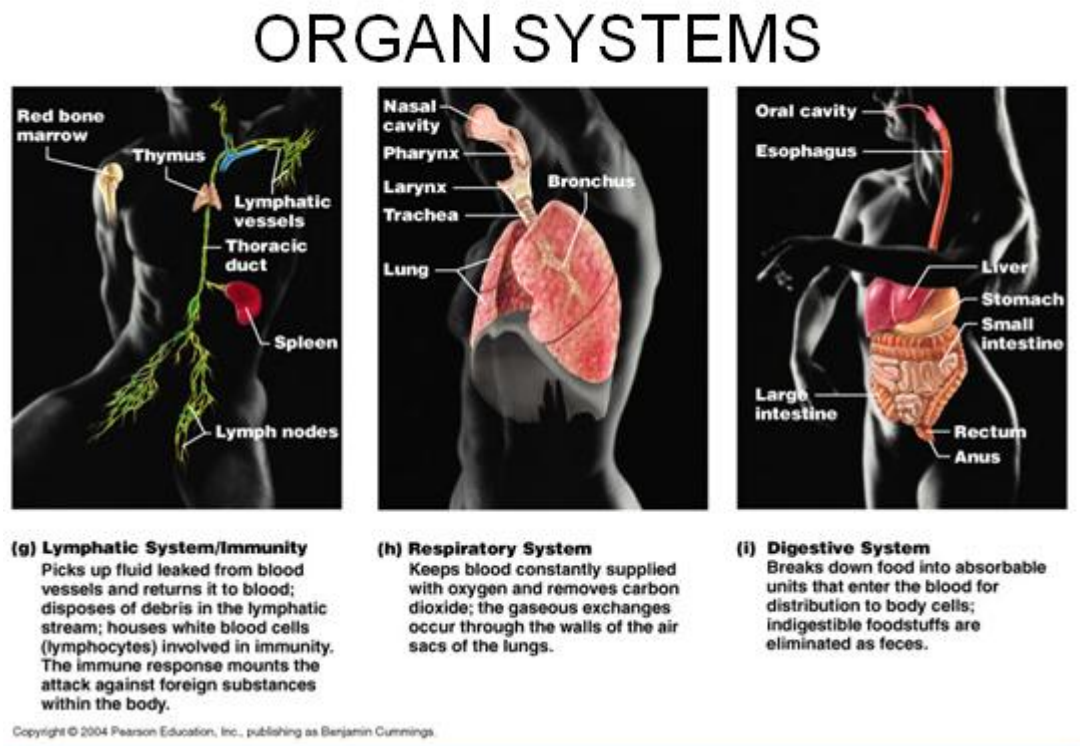
Fg. 1.1. Integumenatry **Fg. 1.2.skeletal** **Fg. 1.3. Muscularsystem**

- Nervous System:
  - Responsiveness to external and internal environments by activating muscles and glands
- Endocrine System:
  - Regulating body functions such as: growth, reproduction, and nutrition
- Cardiovascular System:
  - Transportation of nutrients, waste, gases, and hormones throughout the body



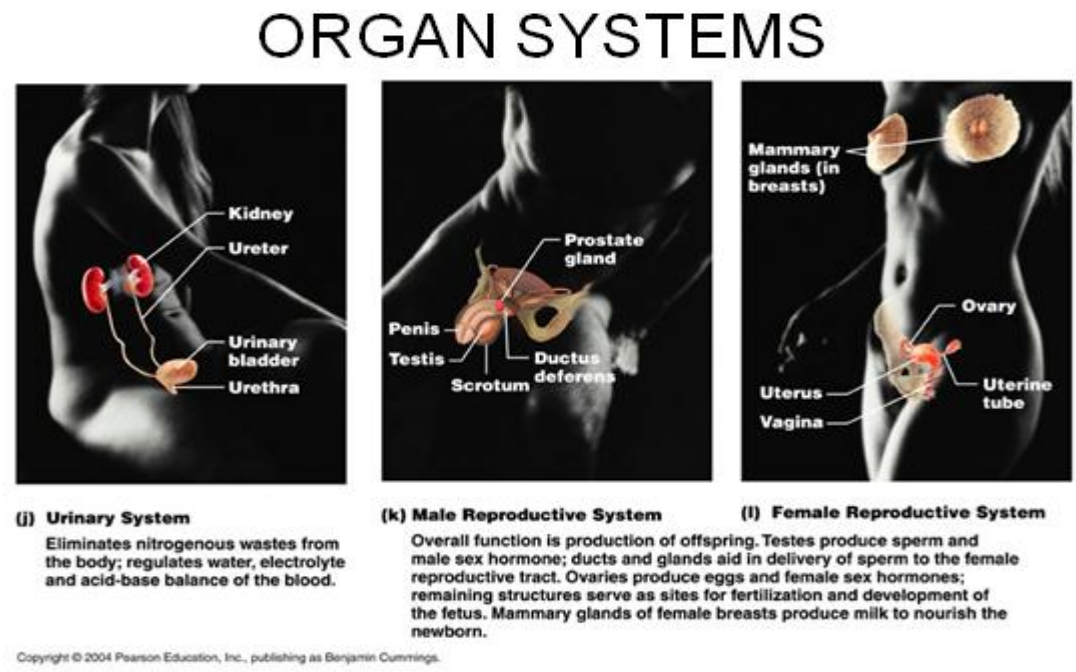
Fg. 1.4.Nervous **Fg. 1.5. Endocrine** **Fg. 1.6. Cardiovascular system**

- (Lymphatic System/Immunity:
  - Body defenses
- Respiratory System:
  - External and internal gas exchanges
- Digestive System:
  - Breakdown and absorption of nutrients



Fg. 1.7. (Lymphatic **Fg. 1.8.Respiratory** **Fg.1.9. Digestive system**

- Urinary System:
  - Absorption of waste from the blood and elimination
- (k): Male Reproductive System:
  - Production of sperm
- (l): Female reproductive System:
  - Production of eggs



Fg. 1.10.Urinary Fg. 1.11. Male reproductive Fg. 1.12. Female reproductivesystem

Self-Check 1	Written Test

Answer the Following Questions (2 point each):

1._____ is the science that study of structures that make up the body and how those structures relate with each other.

A. Anatomy
B. Physiology
C. Biology
D. Chemistry

2. The System allows the organism to travel through the environment, and allows transport of molecules within the organism

A. Urinary
B. Digestive
C. Nervous
D. Integumantary System or Skin

3.Groups of similar cells having a common function

A. Cell
B. Organ
C. Tissue
D. Organism

4. Types of science used for study of nature. It is the study of how the body and its part work or function

A. Anatomy
B. Physiology
C.A and B
D. None

5. List four basic tissue types

A. _____
B. _____
C. _____
D. _____

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

You can ask you teacher for the copy of the correct answers

Answer Sheet

Score _____
Rating _____

Name: _____ Date: _____

._____,_____,_____,_____

Information Sheet-2	Types of specimen and purpose of sample

1.2. Type and nature of samples are identified

1.2.1. Types of specimen

There are different types of common clinical specimen collected and/or analyzed in the diagnostic laboratory. These should include:

- Stool
- Urine
- Body discharges
- Blood
- Skin slip, skin slit and skin scrapping
- Cerebrospinal Fluid(CSF)
- Swabs (eg .throat swab**)**

COLLECTING SAMPLES FOR CLINICAL TESTING	SAMPLE TYPES
Routine clinical samples	Whole Blood Plasma Serum Red Blood Cells (RBC) Urine
Non-Routine Liquid Biological Samples	CSF Breast Milk Exudates Lavage Fluid Oral Fluid
Non-Routine Solid Biological Samples	Stool Meconium Hair Nails
Samples - Metals Analyses	Whole Blood Plasma Red Blood Cells (RBC) Serum Urine

Table 1.1. Types of specimen

Notes about Shipping Temperature: Ship specimens chilled unless indicated otherwise in the Labs Test procedure SOP.

Notes About Specimen Labeling: Please use water-resistant ink when labeling specimens. Include the following information on each specimen:

1. Name of the patient (subject, employee or patient)
2. ID# or case number
3. Specimen type (blood, serum, urine, hair, etc.)
4. Date and time specimen was obtained

Collecting Samples for Clinical Testing

The following are general considerations for specimen collection, appropriate collection containers for specific testing and guidelines for sample submission.

For trace element, volatile compound analysis, specimen types other than blood, serum, plasma or urine, read additional instructions.

Collecting Routine Clinical Specimens

Note: The use of serum/plasma separator tubes is not recommended for use when collecting specimens for testing to be performed at NMS Labs. The use of these tubes can compromise test results.

Whole Blood refers to whole blood drawn into evacuated tubes (e.g., Vacutainer® tube) containing anticoagulant.

Plasma should be obtained by drawing blood into an anticoagulant, evacuated tube. Invert tube at least eight times to mix, immediately centrifuge for approximately 10 minutes at 3000 rpm, and carefully transfer the supernatant plasma into a labeled plastic container (polyethylene vial).

Serum should be obtained by drawing blood into an evacuated tube containing no anticoagulant and with a non-coated interior. Allow 20 minutes for clotting. Immediately centrifuge for approximately 10 minutes at 3000 rpm and carefully transfer the supernatant serum into a labeled, plastic container (polyethylene vial).

- Red Blood Cells (RBC) should be prepared from whole blood using the procedure for plasma specimens. Transfer the plasma from the centrifuged red blood cell fraction and submit the red blood cells, labeling the specimen accordingly.
- Urine specimens should be collected in a plastic (polyethylene) bottle. Do not fill bottle past the shoulder. Close with a screw cap, which has a self-sealing liner (e.g., 50ml bottle and cap).

- Collecting Non-Routine Liquid Biological Specimens

While not all biological fluids are found in large volumes, make every effort to collect as much as possible. Place fluid into a labeled screw-capped plastic container for shipping.

- Collecting Non-Routine Solid Biological Specimens

  ✓ Stool: Collect an entire bowel movement and place into a clean, labeled 40 mL polyethylene bottle. Fill no more than 2/3 of the bottle. Write the total original weight on the label (mass or volume) of the specimen. Freeze. View frozen sample shipping instructions.

- ✓ Meconium: Collect at least 5 grams, approximately 1 tablespoon, of the black-tarry Meconium sample and place into a clean 40 ml polyethylene bottle. The sample may be combined several times from each evacuation up to approximately 72 hours or when the sample starts to turn yellowish-green.

- Collecting Samples for Metals Analyses

  Specimens collected for trace-metals analyses must be protected from contamination during collection. Conduct specimen collection in a clean, dust free environment using appropriate certified metal-free collection containers. To reduce specimen contamination, powder-free gloves are recommended during collection. It is recommended that unexpected elevated results be verified by testing another specimen. Blood, Plasma, or Red Blood Cells (RBC): To flush the collection device of metal contaminants, always draw a plain red top tube (no additive) first. Secondly, draw 7 mL of blood into a trace-metal free, EDTA Royal Blue Top Tube, unless otherwise indicated in the online test catalog specimen collection instructions. Always check the online test catalog for the most up to date collection requirements. Invert the Blue Top tube at least 8 times to ensure adequate mixing of the EDTA anticoagulant to prevent clotting. Discard the first red top tube appropriately unless being used for non-metals testing.

For RBC or Plasma samples, centrifuge the blood sample as soon as possible after collection for approximately 10 minutes at 3000 rpm. Place plasma into an acid washed plastic screw capped vial. Leave the RBCs in the original tube and replace stopper.

- ✓ Serum: To flush the collection device of metal contaminants, always draw a plain Red Top Tube (no additive) first. Secondly, draw 7 ml of blood into a trace-metal free, evacuated tube containing no anticoagulant. Refer to the online test catalog for the most up to date collection requirements. Allow the specimen to clot for at least twenty (20 minutes). Centrifuge for approximately 10 minutes at 3000 rpm and transfer all of the serum into an acid washed plastic screw capped vial. Discard the first red top tube appropriately unless being used for non-metals testing.
- ✓ Urine**:** Collect 20 mL of urine directly into a labeled trace-metal free (acid-washed, deionized water-rinsed, air-dried), polyethylene bottle with a plastic lined screw cap or an acid washed collection container. Always check the online test catalog for the most up to date collection requirements.
- ✓ Nails: Nail clippings may contain analytes of interest, which were deposited during the growth of the nail. Nail clippings (at least 0.5 g) from each finger or toe should be collected and packaged separately in acid washed plastic bottles. Each bottle should be labeled with the weight, if known, of the nail collected and its source, e.g., right index finger.

Self-Check 2	Written Test

Answer the Following Questions (2 point each):

1. List common clinical specimen used in laboratory
2. Types of blood specimens obtained by drawing blood into an anticoagulant_____
3. Specimen labeling include the information

_____,_____,_____,_____

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

You can ask you teacher for the copy of the correct answers

Answer Sheet

Score _____
Rating _____

Name: _____ Date: _____

Short Answer Question

1._____

2._____

3._____,_____,_____,____

Information Sheet-3	Time of sample collection and collection sites

1.3. Time of sample collection and collection site

1 .3.1.Time of collection:

The time of collection provide best chance of recovery of the causative agent .For sputum and urine the preferred time is early in the morning soon after the patients awaken.

For blood specimen the time of collection should be when the patient's temperature begins to rise.

- Collection of specimens before the administration of antimicrobial:

Because antimicrobials limits recovery of pathogens if specimen is collected after the administration of anti-microbial.

- Age of specimens:

Age of the specimen directly influences the recovery of protozoan organism

- Stage of the disease at which the specimen is collected

Enteric pathogens are present in great numbers during the acute or diarrheal stage of intestinal infection

1.3.2. Site selection consideration:

- Clinician should locate right anatomic site & select appropriate tests &specimens based on:
  - ✓ Physical examination (sign & symptoms)
  - ✓ Radiological examination
- Laboratory personnel should collect specimens from actual infection site with little external contamination by using aseptic technique and sterile container and should collect specimens from right site:
  - ✓ To prevent contamination of specimen &
  - ✓ To protect the patient from infection
- Sites of Infection where the Specimen is likely to become contaminated during collection

✓ Sample from lower respiratory tract can be contaminated from Oro-pharynx
✓ Sample from bladder can be contaminated from urethra
✓ Sample from cervix can be contaminated from vagina

Self-Check 3	Written Test

Answer the Following Questions (2 point each):

1. For sputum and urine the preferred time is specimen collection is
   A. Early in the morning soon after the patients awaken.
   B. At any time of the day
   C. Random

2. For blood specimen the time of collection should be when the patient's.
   A. Only at Early morning
   B. After treatment
   C. When body temperature begins to rise
   D. At any time

3. Why laboratory personnel should collect specimens from actual infection site?

Note: Satisfactory rating - 6 points Unsatisfactory - below 6 points
You can ask you teacher for the copy of the correct answers

Answer Sheet

Score _____

Rating _____

Name: _____ Date: _____

LG23:Prepare to collect samples

Learning out comes (objectives): At the end of this module the trainee will be able to:-

- Know the purpose, priority and scopes of sampling request
- Identify Site hazards and reviewing safety procedures
- Confirm type of sample, site of collection , time of collection and collection methods
- Assemble all specified sampling equipment, safety equipment, materials and containers
- Check pre-use and cleanliness of all items
- Check All items against given inventory and packed to ensure safe transport
- Confirm Handling sequence and any permit requirements
- Check Vehicle and communication devices are in working order
- Check Required transport containers and materials

Learning Instructions:

12. Read the specific objectives of this Learning Guide.
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17. If you earned a satisfactory evaluation proceed to next Information Sheet. However, if your rating is unsatisfactory, see your teacher for further instructions or go back to pervious Learning Activity.
18. Submit your accomplished Self-check. This will form part of your training portfolio.
19. Try to understand what are being discussed. Ask you teacher for assistance if you have hard time understanding them.
20. Accomplish the all Self-checks.
21. After you accomplish self check proceed to operation sheet if available.
22. If you perform operation procedure correctly proceeds to LAP. test if available

Information sheet-1	Prepare to collect samples

2.1.The purpose, priority and scopes of sampling request

2.1.1. Purpose of specimen

In the laboratory, patient disease condition can't be identified and confirmed without reliably analyzing specimen. Because of without the result of the specimen analysis, the treatment of patient relies on empirical treatment alone. Indeed, early detection and treatment of cases ensured by the help of analyzing appropriate specimen. Therefore analysis of specimen in the laboratory by competent laboratory professionals helps:

- To make a diagnosis of pathogen for the patients likely to receive the best possible care
- To identify source of disease correctly/confirm a clinical impressions
- To check epidemics and spread of major communicable diseases reliably/to screen for disease
- To rule out (R/o)a disease and diagnosis
- To provide prognostic information.
- Use properly valuable financial and human resource
- To identify patterns of emerging drug resistance /to reduce spread of resistance to essential drugs
- Drugs can be used more selectively.
- Side effects and progress are monitored.

2.1.2. Priority of sample request

- Time of collection:

The time of collection provide best chance of recovery of the causative agent .For sputum and urine the preferred time is early in the morning soon after the patients awaken.

For blood specimen the time of collection should be when the patient's temperature begins to rise.

- Collection of specimens before the administration of antimicrobial:

Because antimicrobials limits recovery of pathogens if specimen is collected after the administration of anti-microbial.

- Age of specimens:

Age of the specimen directly influences the recovery of protozoan organism

- Stage of the disease at which the specimen is collected

Enteric pathogens are present in great numbers during the acute or diarrheal stage of intestinal infection.

- Health and Safety Precautions

Use universal precautions when handling specimens containing blood or other potentially infectious material. Work areas contaminated with blood or serum must be disinfected immediately with 10% bleach (hypochlorite at 0.5% final concentration) or other approved disinfectant. (Referring from Occupational health and safety module)

- Patient preparation

Many tests require that the patient be prepared in some specific way to ensure useful results. The best analytical techniques provide results that are only as meaningful as the quality of the specimen that has been submitted for analysis. Our goal is to provide you with the most useful diagnostic information possible.

- Fasting requirements

For the majority of tests performed on serum, plasma or whole blood, a fasting specimen is preferred. Non-fasting specimens often contain fat particles that can interfere with many analytical procedures.

- Patient age

Age of the patient has a limiting factor to obtain enough volume of sample/ specimen required for analysis. Besides, It is helpful to indicate patient age and blood type so that appropriate reference ranges can be assigned for reporting purposes. On occasion, patient age will assist the technologists in choosing the appropriate initial sample dilution for the assay.

- Pediatric Specimens:

Special small conical tubes with screw caps with a holding capacity of up to 1.5 ml specimen should provided to prevent evaporation of small volume samples, better if Pediatric color-coded Vacutainer test tubes are provided to facilitate special handling. These tubes will hold up to 1.5 ml of specimen. Standard specimen transfer tubes should be used for larger volume samples. For urine specimens, use urine vials should also be used. We generally request 1 tube per test to avoid delays in processing and to expedite turnaround time. To minimize specimen volume requirements for small children, however, only one tube is required even when multiple tests are ordered. Bright orange, self-adhesive “Pediatric Sample” labels are provided. Please place one of these labels in a blank area of the Test Request Form. The Test Request Form, properly filled out and labeled, should be folded and inserted in the pediatric specimen bag.

- Provocation tests

Some tests require the patient to ingest a substance. The most common are the Glucose Tolerance Tests where the patient drinks a solution containing glucose, and blood specimens are obtained before and at various times after the drink, to measure the concentration of glucose in plasma or serum. In the standard Glucose Tolerance Tests, adults ingest 75 g (10 ounces) of a glucose solution (Glucola™). Children ingest an amount of glucose proportional to their body weight (1.75 grams of glucose per kilogram of body weight, up to 75 g of glucose).

Self-Check-1	Written Test

Answer the Following Questions (2 point each):

1. Analysis of specimen in the laboratory by competent laboratory professionals helps:-
   A. To rule out (R/o)a disease and diagnosis
   B. To provide prognostic information.
   C. Use properly valuable financial and human resource
   D. None
   E.
2. What is the to analysis of specimen in the laboratory by competent laboratory professionals
   A. To rule out (R/o)a disease and diagnosis
   B. To provide prognostic information.
   C. Use properly valuable financial and human resource
3. Before sample collection Priority of sample request given to the following condition except
   A. Patient preparation
   B. Pediatric patients
   C. Time of collection
   D. Height of patient

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

You can ask you teacher for the copy of the correct answers

Answer Sheet

Score _____

Rating _____

Name: _____ Date: _____

Answer Sheet

1._____

2._____

3._____

Information sheet-2	Identifying Site hazards and reviewing safety procedures

2.2. Identifying Site hazards and reviewing safety procedures

2.2.1. Approaches to avoid contamination:

Careful patient education - There are occasions when patients participate actively in specimen collection (e.g. sputum, urine). -

Therefore, they must be given full instructions & cooperation by the care giver

- Educating by the clinicians
- How to collect & transport specimens through written document & make available at every patient care unit.

Obtaining a specimen involves the collection of tissue or fluids for laboratory analysis or near-patient testing, and may be the first step in determining a diagnosis and treatment. The procedure used to collect a specimen must minimize the risk of introducing error and protect the health and safety of both the patient and the staff who handle the sample.

- Specimens are an important part of a holistic assessment and can help to:

✓ Build a clinical picture of the patient;
✓ Confirm a diagnosis;
✓ Inform a treatment plan.

Laboratory personnel frequently collect specimens including urine, stool and sputum. They may also perform vein puncture to collect blood samples and support patients through complex procedures to collect specimens, such as biopsies.

An accurate specimen collection technique is essential to reduce the risk of contamination, which can lead to inaccurate results and inappropriate treatment and can result in a longer length of hospital stay.

Specimens must be collected at the right time, using the correct technique and equipment, and be delivered to the laboratory as quickly as possible.

- **Specimen collection: good-practice principles**

The specimen must be:

- ✓ Appropriate to the patient's clinical presentation
- ✓ Collected at the right time
- ✓ Collected in a way that minimizes contamination
- ✓ Collected in a way that reduces health and safety risk to all staff handling the specimen (including laboratory staff)
- ✓ Collected using the correct equipment
- ✓ Documented clearly using appropriate forms
- ✓ Stored/transported appropriately
- Collecting tissue/body fluids: precautions to take

The collection of any tissue/fluid carries a risk to staff from splash or inoculation injury, so standard infection prevention and control precautions should be followed.
These include adhering to:

- ✓ Hospital environmental hygiene principles
- ✓ Hand hygiene principles
- ✓ Use of personal protective equipment
- ✓ Safe use and disposal of sharps

Criteria for Specimen rejection include:

- Specimen collected in the wrong tube, container, preservative, or media.
- Specimen inappropriately handled with respect to temperature, timing, or storage requirements.
- Quantity not sufficient – QNS.
- Lipemic or grossly hemolyzed specimens may be rejected depending on test requested. e) Specimens with IV fluid or other peripheral line contamination.
- Specimen collection device past expiry dates.

Self-Check-2	Written Test

Answer the Following Questions (2 point each):

1. **Which of the following is/are good practice of Specimen collection?**

   A. Collected at the right time
   B. Collected in a way that minimizes contamination
   C. Collected using the correct equipment
   D. Documented clearly using appropriate forms E. All

2. Write Criteria for Specimen rejection.

Note: Satisfactory rating–4 points Unsatisfactory–below-4 points

You can ask you teacher for the copy of the correct answers

Answer Sheet

Score _____
Rating _____

Name: _____ Date: _____

1._____
2._____

_____

_____

_____

_____

_____

_____

2.3. Confirming type of sample, site of collection, time of collection and collection methods

2.3.1. Introduction to anatomy and physiology of digestive system

Two groups of organs compose the digestive system: the gastrointestinal (GI) tract and the accessory digestive organs. The gastrointestinal (GI) tract, or alimentary canal (alimentary nourishment), is a continuous tube that extends from the mouth to the anus through the thoracic and abdomen pelvic cavities. - Organs of the gastrointestinal tract include the mouth, most of the pharynx, esophagus, stomach, small intestine, and large intestine. - The length of the GI tract is about 5-7 meters (16.5-23 ft) in human being.

The accessory digestive organs include the teeth, tongue, salivary glands, liver, gallbladder, and pancreas;

- Teeth aid in the physical breakdown of food, and the
- Tongue assists in chewing and swallowing
- Salivary glands, liver, gallbladder, and pancreas do not have direct contact with food but produce or store secretions that flow into the GI tract through ducts; the secretions aid in the chemical breakdown of food (dear trainee, read this accessory digestive organs function in relation to food digestion)

The GI tract contains food from the time it is eaten until it is digested and absorbed or eliminated. Muscular contractions in the wall of the GI tract physically break down the food by churning it and propel the food along the tract, from the esophagus to the anus. The contractions also help to dissolve foods by mixing them with fluids secreted into the tract. Enzymes secreted by accessory digestive organs and cells that line the tract break down the food chemically. Functions gastrointestinal tract:

- ✓ Ingestion: taking food into the mouth.
- ✓ Secretion: release of water, acid, buffers, and enzymes into the lumen of the GI tract.
- ✓ Mixing and propulsion: churning and propulsion of food through the GI tract.
- ✓ Digestion: mechanical and chemical breakdown of food.
- ✓ Absorption: passage of digested products from the GI tract into the blood and lymph.
- ✓ Defecation: the elimination of feces from the GI tract

2.3.3. Stool specimen collection and materials

Patients usually collect this sample themselves during toileting, following instructions to prevent the sample from becoming contaminated from other material in the toilet bowl. Patients may also be told to avoid certain foods during the test period. Depending on the test, patients may be instructed to collect the sample in a container, scoop a small portion into a vial, or smear a small amount on special test paper. Wash your hands well after handling the sample.

Stool specimens are collected aseptically and submitted to the laboratory for the diagnosis of intestinal problem – intestinal bleeding (occult blood), parasitic infection, bacterial dysentery (shigellosis), enteric fever (Salmonellosis), diarrhea, GIT problem or abnormalities in the function of pancreas. Stool containers- Various containers are used in collecting stool

- A waxed cardboard box

- An empty tin with a lid
- A light plastic box
- Match boxes

Collection of sufficient quantity is important to permit detection of parasites and to prevent rapid drying. The stool specimen should contain at least 4 ml.

Once the specimen collected; If possible, process:

- Liquid stool: < 30 minutes of passage at Room Temperature.
- Semi-formed stool: < 1 hour of passage at Room Temperature.
- Formed stool: < 24 hours of passage, 4 0C.

If delay is unavoidable, place in suitable preservative or transport medium

✓ Macroscopic Examination

Stool specimen is examined with the naked eye for:

✓ Presence of worms: - may have adult helminthes or segments Example: Ascaris, Taenia species, E.vermicularis and gravid Taenia species.

✓ Consistency (degree of moisture)

It varies in diet but certain clinical conditions associated with parasite presence may be suggested by particular consistencies.

It will be described as hard, formed, semi-formed and diarrheic (watery).

✓ Color: - any abnormal color e.g., pale yellowish passed in steatorrhoeac conditions such as giardiasis, dark or black stools occur when iron or bismuth is taken or when there is intestinal hemorrhage

✓ Pathologic odor Offensive, non-offensive

✓ Abnormal features seen (composition): mucus, blood or fat globules.

Microscopic Examination preparation

The detection and identification of species of parasites require microscopic examination of specimens

1. Direct Microscopic Examination of stool Specimen with Physiological Saline and Dobell's Iodine Solutions

   Routine microscopic examination of stool specimen with physiological saline and Dobell's iodine solution helps to detect and identify the stages of some parasitic organisms.

   Material and Methods
   Wooden applicator sticks
   Microscopic slides
   Cover slips

Dropping bottles containing physiological saline (0.85%w/v) and Dobell's Iodine solutions Microscope Pasture pipette Procedure

1. Place a drop of physiological saline (0.85%w/v) in the center of the left half of the slide and place a drop of Dodell's Iodine solution in the center of the right half of the slide.

2. With an applicator stick, pick up a small portion of the feces (Approximately 2mg which is about the size of a match head) and put on the drop of saline. Add a similar portion of stool sample to the drop of iodine.

3. Mix the feces with the drops to form homogeneous suspensions.

4. Cover each drop with a cover slip by holding the cover slip at an angle of 300, touching the edge of the drop, and gently lowering the cover slip onto the slide so that air bubbles are not produced.

5. Examine the saline preparations using the 10X objective for motile forms, cyst and oocyte of intestinal protozoa and for any ova or larva of helminthes.

6. Examine the iodine solution preparation using 40X objective to identify the cyst stages of protozoa. The iodine will stain the nuclei and the glycogen mass of the cyst

2.3.4. Collection of urine sample

- ✓ Anatomy and physiology of urinary system

The kidneys do the major work of the urinary system. The other parts of the system are mainly passageways and storage areas. Nephrons are the functional units of the kidneys. Each nephron consists of two parts: a renal corpuscle (tiny body), where blood plasma is filtered, and a renal tubule into which the filtered fluid passes.

To produce urine, nephrons and collecting ducts perform three basic processes

Glomerular filtration: - the first step of urine production,

- ✓ water and most solutes in blood plasma filtered and move across the wall of glomerular capillaries into the glomerular capsule

Tubular re-absorption; - the filtered fluid flows along the renal tubule

- ✓ through the collecting duct, tubule cells reabsorb about 99% of the filtered water and many useful solutes
- ✓ The water and solutes return to the blood as it flows through

Tubular secretion: - the collecting duct, the tubule and duct cells secrete other materials, such as wastes, drugs, and excess ions into the fluid.

- ✓ Urine sample collection and necessary materials

A urine specimen is collected and submitted to the lab in case of possible renal problems or metabolic disorders of the body. A volume of urine specimen required for routine urinalysis is 15to 33 ml. The urine specimen can be referred to urinalysis, clinical chemistry, and Bacteriology and Parasitology labs.

Most urine specimens are collected by having the patient urinate into a container or receptacle. To keep the sample from becoming contaminated by materials outside the urinary tract, patients are given instructions on how to clean the genital area and void a bit of urine before collecting the specimen into the container. (If a urinary catheter is required, a health practitioner is usually responsible for insertion.) Collecting the urine specimen is awkward but not in itself uncomfortable (An infection, however, can create a burning sensation during urination.). For certain tests, 24-hour urine samples are collected at home and must be refrigerated during the collection process. Remember to wash hands well after collecting the specimen.

- For urine collected in the laboratory use a:

- ✓ Clean conical urine jar
- ✓ Any clean glass container or bottle
- ✓ Container should be clean, dry, leak-proof and free from disinfectants.
    - ✓ Collection of urine specimen

When urine sample is received with request to find urinary parasites and urine sediment, the method to use is described below. This will concentrate most of the parasite and urinary materials.

1. Collect random urine sample, preferably at midday, into a clean container.

2. Centrifuge 10ml of urine at 1500RPM for 2 min. to deposit the ova of the parasite and sediments

3. Decant the supernatant and Place a drop of deposit onto a microscope slide and cover with a cover slip. Make ready for microscopic examination

To make a permanent preparation, make a smear of the urine sediment on a slide, allow it to dry and fix it in methanol

The collected urine sample should process as much as possible early otherwise it would preserve with appropriate physical or chemical preservatives.

Urine preservative methods, advantages and disadvantages

	Methods	Advantages	Disadvantages
Physical	Refrigeration	This method prevents bacterial growth, and so avoids changes that occur due to the growth of bacteria. No chemical is used	The urine sample at 2-60c .used for short period of time, usually from 6to 8 hours preservation
	Freezing	Keeping the urine sample below -200c this method good for preserving bilirubin andUrobilinogen.	Destroys formed elements. It is also not suitable for physical examination, because of turbidity. Urine preserved bydeep freezing, will increase its specific gravity
Chemical	Toluene (Till it forms thin layer over the urine)	Preserves acetone, Reducing Substances, protein	Flammable
	Thymole(small crystal 5mm diameter/100ml urine)	Preserves most constituents	Can cause false positives for proteins.
	Chloroform (1 tablet/60ml urine)	Preserves urine aldosterole level	Settles to the bottom of the urine containers
	Formaldehyde (1 drop/30 ml urine)	Preserves formed elements	Interferes with glucose evaluation
	HCL (1 drop/15 ml urine)	Stabilizes steroids, catecola mines	Formed elements are destroyed,
	Boric acid	Preserves chemicals and formed elements	Precipitate uric acid
	Sodium Carbonate	Preserves porphyries and urobilinogen	Interfere with other urine constituents

Table -2.1. Urine preservative methods, advantages and disadvantages

2.3.5. Blood sample collection

Blood samples can be collected from blood vessels (capillaries, veins, and sometimes arteries) by trained phlebotomists or medical personnel. The sample is obtained by needle puncture and withdrawn by suction through the needle into a special collection tube. Some specimens may be obtained by a finger puncture that produces a drop of blood, such as that used for glucose testing. The procedure usually takes just a few minutes and hurts just a bit, typically when the needle is inserted or from the puncture of a lancet.

- ✓ *Introduction to Cardiovascular system*

Cardiovascular system consists of three interrelated components: blood, the heart, and blood vessels. Blood contributes to homeostasis by transporting oxygen, carbon dioxide, nutrients, and hormones to and from your body's cells. It helps regulate body pH and temperature, and provides protection against disease through phagocytosis and the production of antibodies. Blood constitutes about 20% of extracellular fluid, amounting to 8% of the total body mass. The blood volume is 5-6 liters (1.5gal) in an average-sized adult male and 4-5liters (1.2 gal) in an average sized adult female. The difference in volume is due to differences in body size.

Blood vessels: The three main types of blood vessels are arteries, capillaries and veins. Arteries- carry blood away from the heart to other organs

Capillaries- branched and numerous tiny vessels which allow the exchange of substances between the blood and body tissues. Veins- are the blood vessels that convey blood from the tissues back to the heart

- ✓ Blood collection site

Blood samples for laboratory testing may be obtained in several ways. The most common procedures are vein puncture, capillary finger or heel prick and arterial puncture.

Vein puncture - withdrawal of blood from a vein using a needle and collecting tube which contains various additives.

A tourniquet is wrapped around the arm above the vein puncture site, which causes blood to accumulate in the vein

This increased blood volume makes the vein stand out. Opening and closing the fist further causes it to stand out, making the vein puncture more successful.

A common site for vein puncture is the median cubital vein anterior to the elbow (see Figure below).

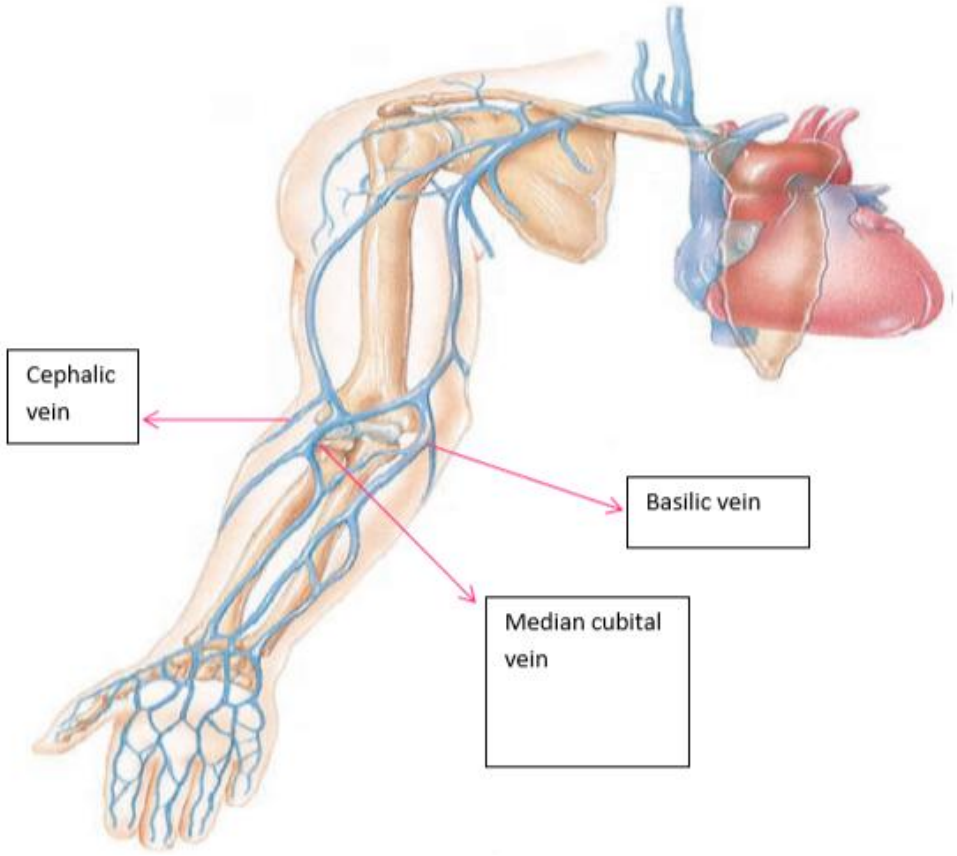

Fig.2.1. Vein pucture site for venous blood collection

Capillary finger or heel prick- this collection is used when small blood is required

- ✓ It is often used for drawing blood from infants and children.

Arterial puncture- blood is withdrawn from an artery

- ✓ this test is used to determine the level of oxygen in oxygenated blood

Blood collection materials and procedure

- ✓ Vein puncture

The volume of blood obtained by vein puncture is sufficient to carry out multiple tests. Vein puncture can be done either by the syringe method or vacuum tube method .the latter is disposable and is not popular in developing countries because of the high cost.

Anticoagulants: -

Anticoagulants are chemical substances that are added to blood to prevent coagulation. A number of different anticoagulants are available which have different function but EDTA and citrate are mostly useful. The venous blood can be collected either in anticoagulant or without anticoagulant test tube based on the need of the blood collected.
Blood collection Procedure by syringe method:

1. Assemble all the things required during blood

2. Read carefully the patients form, identify the patient and decide patient and decide the total amount of blood needed for the entire test.

3. Select the blood collection container and label them with the patients' identification number.

4. Introduce yourself to the patient.

- ✓ Ask the patient to sit alongside the table used for taking blood.
- ✓ Lay his arm on the table, palm upwards.
- ✓ For indoor patients lying in bed, lay patients arm in an outstretched position.
- ✓ The procedure of blood collection should be explained by the vein-puncturist to the patient to minimize apprehension.

Never draw blood from standing patient or patient sitting on a high stool.

The vein-puncturist should be prepared for the occasional patient who may faint and should be trained to administer first aid techniques should this occur.

5. Select the puncture site carefully after inspecting both arms. If necessary apply the tourniquet to select the puncture site and then release the tourniquet to proceed with the next step.

6. Re- apply the tourniquet as described earlier before drawing blood. The tourniquet should not be left in place unless the technician is ready to proceed immediately with the vein puncture.

7. using the index figure of your left hand, feel for the vein where you will introduce the needle.

8. Disinfect the sin with a swab dipped in methanol or 70% alcohol. Rub the vein puncture site thoroughly.

9. Remove the syringe from the protective warp or test tube used during sterilization and the needle from the sterilized vial, assemble them and see the needle is fixed tightly. Do not touch the tip of the needle or wall of the position.

10. With the patient cooperation, grasp the elbow with your left hand and hold the arm fully extended.

11. Tae the syringe in the right hand holding your index finger against the base of the needle. Position the needle with the bevel uppermost and push the needle firmly and steadily, without hesitation, in to the center of the vein. Try to enter the sin first and then the vein at a 30 to 40^{o} angle

12. As the needle enters the vein there is a sudden loss of resistance. Push the needle along the line of the vein to a depth of 1 to 1.5 cm.

13. With your left hand slightly pull back the position. Blood should appear in the barrel. Continue with draw the position and fill the syringe with the request amount of blood.

14. Release the tourniquet by pooling on the looped end. Ideally this should be released once the needle has been inserted in to the skin but it can also be released after the blood is drawn.

15. Place a swab of cotton wool over the hidden point of the needle. With draw the needle in one rapid movement from under the swab.

16. Ask the patient to firm on the cotton wool swab for 3 to 5 minutes. This stops bleeding from the wound. Do not bend the arm, this may cause hematoma.

17. Remove the needle from the syringe and gently expel the blood in to appropriate container.

18. Mix the blood immediately and thoroughly but gently with the anti-coagulant. Label the bottle clearly with the name of the patient, date, sex and registration number.

19. Immediately rinse the syringe and the needle with cold water. This will prevent clotting of blood in to the syringe or lumen of the needle. The syringe and the needle are left in the water with a mild detergent and later washed thoroughly prior to sterilization.

20. Before the patient leaves, re inspect the vein puncture site to ascertain that the bleeding has stopped. If the bleeding has stopped, apply an adhesive tape over the cotton wool swab on the wound; otherwise continue to apply pressure until the bleeding stops.

Do not leave the patient until the bleeding stops.

2.2. Venous blood specimen collection

- ✓ Capillary pucture materials and procedure

The capillary blood is obtained by skin puncture and anticoagulant is not required. It provides only small quantities of blood specimen for making a blood smear (differential count), cell count or Hematocrit determination. Skin puncture specimen is preferred over vein puncture specimen for the study of blood smear and differential count. Procedure:

1. Assemble the necessary materials: lancet, alcohol pad, dry surgical gauze, capillary tube, microscope, slide and other supplies (glass, marking pencil, lead pencil, etc.).

2. Be sure that the patient is seated comfortably.

3. Find a spot on the middle or ring finger of the left hand. The spot is located on the side of the figure, which is less sensitive than the tip.

4. Clean the site with a sterile cotton wool swab dipped in 70% alcohol, and then removes the alcohol with a dry sterile cotton wool swab. These remove dirt, and epithelial debris. Warm up the part chosen for pricking, increase the blood circulation and leave the area relatively sterile.

5. Grasp the figure firmly and make a quick, firm puncture with a sterile lancet (sharp pointed blade). The puncture should be 2-3 millimeter deep at the pre-located spot on the side of the figure in line with the figure print striations. If a good puncture has been made, the blood will flow freely. If it does not, use gentle pressure to make the blood form a round drop. Excessive squeezing will cause dilution of blood with tissue fluid. Discard the lancet in the appropriate disposal container. Used lancets should never be left lying on the work area.

6. Wipe away the first drop of blood with sterile cotton wool. The first drop of blood is contaminated with tissue fluid and will interfere with the laboratory result if used. The succeeding drops are used for test.

7. Collect the specimen by holding a capillary tube to the blood drop (for Hematocrit determination), or for blood count, or by touching the drop to the glass slide for preparing blood smear.

Blood film: Microscopic examination of the peripheral blood and hematological parasite are most often done by preparing, staining, and examining a thin film (smear) thick film of blood on glass slide. A great deal of information can be obtained from the examination of a blood film.

Blood film preparation

- A small drop of blood (2µl) is placed in the center line of a slide about 1-2cm from one end. Another slide, the spreading slide placed in front of the drop of blood at an angle of 30^{O}- $45^{O}$to the slide and then is moved back to make contact with the drop. The drop will spread out quickly along the line of contact of the spreader with the slide.
- Once the blood has spread completely, the spreader is moved forward smoothly and with a moderate speed. The drop should be of such size that the film is 3-4cm in length (approx. 3/4th of the length of the slide). It is essential that the slide used as a spreaderhave a smooth edge and should be narrower in breadth than the slide on which the film is prepared so that the edges of the film can be readily examined.
- Once the slide is dry, the name of the patient and date or a reference number is written on the head of the film using a lead pencil or graphite. If these are not

Available, writing can be done by scratching with the edge of a slide. A paper label should be affixed to the slide after staining.

2.3.6. Collection of Sputum

Anatomy and physiology of respiratory system

The respiratory system consists of the nose, pharynx (throat), larynx (voice box), trachea (windpipe), bronchi, and lungs. Its parts can be classified according to either structure or function. Structurally, the respiratory system consists of two parts:

(1) The upper respiratory system includes the nose, pharynx, and associated structures

(2) The lower respiratory system includes the larynx, trachea, bronchi, and lungs

Functionally, the respiratory system also consists of two parts:

(1) The conducting zone consists of a series of interconnecting cavities and tubes both outside and within the lung include the nose, pharynx, larynx, trachea, bronchi, bronchioles and terminal bronchioles; their function is to filter, warm, and moisten air and conduct it into the lungs.

(2) The respiratory zone consists of tissues within the lungs where gas exchange occurs include the respiratory bronchioles, alveolar ducts, alveolar sacs, and alveoli; they are the main sites of gas exchange between air and blood

To diagnose the respiratory system impairment, sputum sample is an appropriate

Sputum collection and necessary materials

Patients are instructed to cough up sputum from as far down in the lungs as possible.

(A health practitioner may assist the patient in some situations.) This is best accomplished first thing in the morning before eating or drinking, by taking several deep breaths before expectorating into the collection cup. Sputum should be relatively thick and not as watery as seen when producing saliva.

Sputum is usually examined to determine the presence of disease of the lungs or of the upper respiratory tract. Careful! sputum to be collected should not be saliva.

Saliva: - is secreted by the salivary glands and is limited in the oral region.

Sputum: - is the material coughed up from the throat and lungs.

Collection Method

Provide the patient with a sterile wide- mouthed glass bottle of about 50 ml capacities with a screw top.

- Two samples required :Spot–Spot

  WHO/IUATLD Recommendation

- 1st Spot -initial visit to the clinic
- 2nd Spot-after 30`-1hr of 1st spot collection on the same day.

The laboratory technician or the nurse should be present when the sample is taken.

First, the patient should be standing, if possible. Then, he/she should take a very deep breath, filling his/her lungs.

She/he should empty his/her lungs in one breath, coughing as hand and deeply as she/he can. She/he should spit what he brings up into the jar.

After Collection: Check that a sufficient amount of sputum has been produced. The sputum of an infected person usually contains:

- Thick mucus with air bubbles
- Threads of fibrin
- Patches of pus
- Occasional brownish streaks of blood

N.B- The first sputum coughed out in the early morning is the most desirable specimen for the laboratory investigation.

- Liquid frothy saliva and secretions from the nose and pharynx are not acceptable expectations. Have the patient produce another specimen.

Blood sputum is also not accepted for Gene X-pert technique

Fig.2.3.-Collecting sputum sample

2.3.7. Collection of body fluids and discharges

A sample of cerebrospinal fluid is obtained by lumbar puncture, often called a spinal tap. It is a special but relatively routine procedure. It is performed while the person is lying on their side in a curled up, fetal position or sometimes in a sitting position. The back is cleaned with an antiseptic and a local anesthetic is injected under the skin. A special needle is inserted through the skin, between two vertebrae, and into the spinal canal. The health practitioner collects a small amount of CSF in multiple sterile vials; the needle is withdrawn and a sterile dressing and pressure are applied to the puncture site. The patient will then be asked to lie quietly in a flat position, without lifting their head, for one or more hours to avoid a potential post-test spinal headache. The lumbar puncture procedure usually takes less than half an hour. Discomfort levels can vary greatly. The most common sensation is a feeling of pressure when the needle is introduced. Let your healthcare provider know if you experience a headache or any abnormal sensations, such as pain, numbness, or tingling in your legs, or pain at the puncture site.

- ✓ Formation and Physiology

Cerebrospinal fluid (CSF) is a major fluid of the body. CSF provides a physiologic system to supply nutrients to the nervous tissue, remove metabolic wastes, and produce a mechanical barrier to cushion the brain and spinal cord against trauma. The brain and spinal cord are lined by the meninges, which consists of three layers:

- The dura mater, arachnoid, and pia mater. The outer layer is the dura mater that lines the skull and vertebral canal.
- The arachnoid is a filamentous (spiderlike) inner membrane.
- The pia mater is a thin membrane lining the surfaces of the brain and spinal cord. Cerebrospinal fluid is produced in the choroid plexuses of the two lumbar ventricles and the third and fourth ventricles. In adults, approximately 20 ml of fluid is produced every hour.The fluid flows through the subarachnoid space located

between the arachnoid and pia mater To maintain a volume of 90 to 150 ml in adults and 10 to 60 ml in neonates, the circulating fluid is reabsorbed back into the blood capillaries in the arachnoid granulations/villae at a rate equal to its production. The cells of the arachnoid granulations act as one-way valves that respond to pressure within the central nervous system (CNS) and prevent reflux of the fluid. CSF Collected in three sequentially labeled tubes:

Tube 1 .Chemical and immunologic tests

Tube 2 .Microbiology Tube

3. Hematology (gross examination, total white blood cell &differential)

This is the list likely to contain cells introduced by the puncture procedure

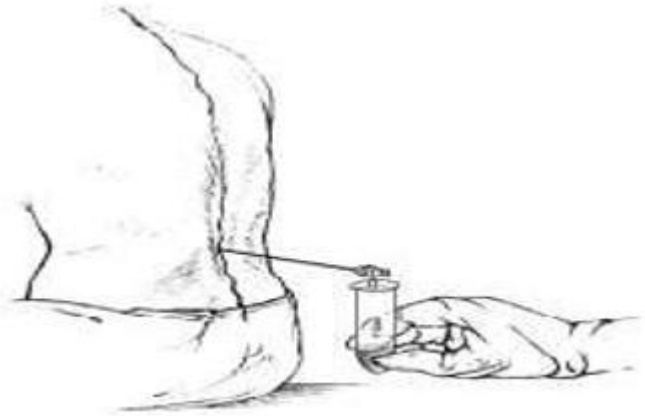

Fig.2.4. Synovial fluid collection

Synovial fluid, often referred to as "joint fluid," is a viscous liquid found in the cavities of the movable joints (diarthroses) or synovial joints.

The bones in the synovial joints are lined with smooth articular cartilage and separated by a cavity containing the synovial fluid. The joint is enclosed in a fibrous joint capsule lined by the synovial membrane.

The synovial membrane contains specialized cells called synoviocytes. The smooth articular cartilage and synovial fluid reduce friction between the bones during joint movement. In addition to providing lubrication in the joints, synovial fluid provides nutrients to the articular cartilage and lessens the shock of joint compression that occurs during activities such as walking and jogging.

Sample collection:

Joint fluid aspiration (arthrocentesis) should be confined to patients with an undiagnosed effusion. It should be performed by an experienced operator using good sterile technique. Large joints (knee) normally contain< 4.0 ml of synovial small sample size is common unless effusion is present.

- Uro-genital and semen samples collection
  - ✓ Uro-genital collection

The organs of the female reproductive system include the ovaries , the uterine (fallopian) tubes or oviducts , the uterus, the vagina and the external organs.

Uro-genital specimens should be collected by a medical officer or an experienced nurse. Amies medium is the most efficient medium for transporting urethral, cervical and vaginal swabs. Specimen should be transported in a cool box.

- Semen collection

Male patients ejaculate into a specimen container, avoiding lubricants, condoms, or any other potentially contaminating materials. Usually, men need to refrain from ejaculating for at least 2 days prior but less than 7 days before collecting the specimen. The specimen must not be refrigerated but kept as close to body temperature as possible by placing the container in a pocket and delivering it to the laboratory within 60 minutes.

The testes or testicles are paired oval glands in the scrotum measuring about 5 cm (2 in.) long and 2.5 cm (1 in.) in diameter. Each testis (singular) has a mass of 10–15 grams. The testes develop near the kidneys, in the posterior portion of the abdomen, and they usually begin their descent into the scrotum through the inguinal canals (passageways in the anterior abdominal wall during the latter half of the seventh month of fetal development.

Functions of the Male Reproductive System:

1. The testes produce sperm and the male sex hormone testosterone.

2. The ducts transport, store, and assist in maturation of sperm.

3. The accessory sex glands secrete most of the liquid portion of semen.

4. The penis contains the urethra, a passageway for ejaculation of semen and excretion of urine.

Summary of semen production

Summary of Semen Production

Seminiferous tubules of testes	Spermatogenesis
Epididymis	Sperm maturation
Ductus deferens	Propel sperm to ejaculatory ducts
Seminal vesicles	Provide nutrients for sperm and fluid
Prostate gland	Provide enzymes and proteins for coagulation and liquefaction
Bulbourethral glands	Add alkaline mucus to neutralize prostatic acid and vaginal acidity

- Semen analysis:
  - ✓ Used in the evaluation of reproductive dysfunction (infertility) in the male

- ✓ Used to select donors for therapeutic insemination
- ✓ Is a cost-effective and relatively simple procedure.
- ✓ Consists of microscopic and macroscopic components

- Collection and transport of semen
  - ✓ Give the person a clean, dry, leak-proof container
  - ✓ request him to collect a specimen of semen at home following 3 days of sexual abstinence
  - ✓ Condom is used to collect the fluid; this must be well-washed to remove the powder which coats the rubber.
  - ✓ It must be dried completely before being used
- *How to Collect a Semen Sample for Your Lab Test*

Read all of the instructions before collecting a semen sample. It's important to follow the instructions so the sample is collected in the right way. This will help your test results be correct. You will need to bring your test request form from your health care provider.

- Before You Collect a Sample

✓ You should not have sexual activity for 2 to 5 days before collecting a semen sample. It should be more than 2 days from your last ejaculation but not more than 7 to 10 days.

✓ If you are collecting the sample at home, please pick up a clean container at the lab. You will need to make an appointment to return the sample. Call the scheduling line for the location at which you wish to return the sample.

✓ The sample must be collected within 1 hour of your appointment for your test results to be correct.

- How to Collect Your Sample

✓ Clean the head of your penis with wet, soapy to welettes or cotton balls.

✓ If you are not circumcised, pull back your foreskin and cleanse.

✓ Rinse the cleansed area with a new towelette or cotton ball that is wet with plain water.

✓ Dry your penis well before you collect the sample.

✓ Remove the lid from the collection container.

✓ Make sure the container is clean and dry.

✓ The sample should be collected by masturbation into the container.

✓ Lubricants or condoms should not be used while collecting the sample.

✓ They can kill the sperm and affect your test results.

✓ If you need to collect the sample with intercourse

- — You can buy a nontoxic condom (one that won't kill your sperm) from the lab. After you are finished, seal the condom with the twist tie and put it in a clean container.
- — make sure intercourse is not interrupted. This may harm the first part of the ejaculate and affect your test results.

✓ If a pubic hair or thread from your clothing falls into the container, do not take it out. The lab will take it out using a clean tool.

✓ Put the lid back on the container.

✓ Make sure it is closed tightly.

- After Collecting Your Sample

- ✓ Write the following information on the container with a pen or marker that will not run if the ink gets wet:
  - Full name
  - Date of birth
  - Date and time of collection.
- ✓ Wrap the container in a dry towel and place it in a paper sack. Keep it at room temperature.

- Other body Fluid

Other body fluids such as synovial fluid, peritoneal fluid, pleural fluid, and pericardial fluid are collected using procedures similar to that used for CSF in that they require aspiration of a sample of the fluid through a needle into a collection vessel. These are generally more complex type of collections and often require some patient preparation, use of a local anesthetic, and a resting period following sample collection. For details, see the descriptions for arthrocentesis, paracentesis, thoracentesis, and pericardiocentesis.

2.3.8. Collection of skin sample

- Anatomy and physiology of integumentary system

The skin (also known as the cutaneous membrane or integument) covers the external surface of the body and it is the largest organ of the body in both surface area and weight. In adults, the skin covers an area of about 2 square meters (22 square feet) and weighs 4.5–5 kg (10–11 lb), about 16% of total body weight. It ranges in thickness from 0.5 mm (0.02 in.) on the eyelids to 4.0mm (0.16 in.) on the heels. However, over most of the body it is 1–2 mm (0.04–0.08 in.) thick. Structurally, the skin consists of two main parts.

- Epidermis- superficial and thinner portion
  - composed of epithelial tissue, is the

- Dermis- deeper and thicker connective tissue portion of the skin. Functions of the skin: • Regulates body temperature.
• Stores blood.
• Protects body from external environment.
• Detects cutaneous sensations.
• Excretes and absorbs substances.
• Synthesizes vitamin D.

- Collection of ulcer and skin Specimens

Most skin specimens should be collected by a medical officer or an experienced nurse.

- ✓ Ulcer: Using a sterile dry cotton wool swab Collect a sample of discharge from the infected tissue. If there is no discharge use a swab moistened with sterile physiological saline to collect a specimen. Insert the swab in a sterile tube. - If the tissue is deeply ulcerated, aspirate a sample of infected material from the sidewall of the ulcer using a sterile needle and syringe - Collect a drop of the exudates directly on a clean cover glass and invert on clean slide. Deliver immediately the specimen to the laboratory for examination by dark-field microscope
- ✓ Collection of skin and hair specimen

a- cleanse the affected area with 70% v/v ethanol
b- Collection skin scales, crusts, pieces of nail or hairs
Skin scales: - collect by scraping the surface of the margin of the lesion using a sterile scalpel blade.
Crust: - collect by removing part of the crust nearest to healthy skin using sterile scissors and sweezers

Nail pieces: - collect by taking snippiness of the infected part of the nail using sterile scissors &sweezer
Hairs: - collected by removing dull broken hairs from the margin of the lesion using sterile tweezers After collecting the specimens fold the paper to form a flat packet, label the patients name and number source of material, and the date collected.

Skin snip collection: -

The skin snip materials are surgical blade, swap, adhesive plaster, lancet and PPE - The collection procedures are as below pictures

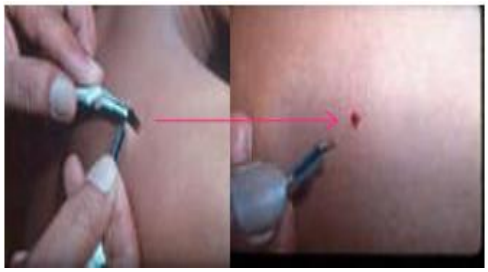

Fig.2.5.Technique of skin snip collection

Self-Check-3	Written Test

Answer the Following Questions (2 point each):

1. Blood sample for diagnosis of malaria parasite is best if collected ___.

A.

when the body temperature rises

B. when the body temperature falls

C. when the patient is at convalescence period

D. when the patient is at recovery period

2. The suitable site/s for venous blood collection site for adults is/are_____

A. The femoral veins

B. the veins of the legs

C. The jugular vein

D. The veins of the forearm

3. The most concentrated and bladder incubated urine specimen used for most urinalysis test procedures _____

A. random urine sample

B. 24 urine sample

C. postprandial urine specimen

D. Early morning urine

4. The recommended sputum specimen for AFB detection is ____

A. Morning-Morning-Morning

B. Spot-Spot

C. Spot-Spot-Morning

D. Morning-Spot-Spot

5. The three main types of blood vessels are_____,_____,_____

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

You can ask you teacher for the copy of the correct answers

Answer Sheet

1_____

2._____

3._____

4._____

5._____,_____,_____

Operation sheet-1	Selecting and using the required *sampling tools and equipment*

Purpose: The purpose of this activity is to enable trainees to practice the skills necessary to perform Identifying equipment to obtain a representative Sample

N	Materials		Reagent
	• TTLM (i.e. Laboratory manual, Log book,...) • Leak proof sample container • Wooden applicator stick • Microscope slide • Slide cover sip • Wool cotton • Filter paper • Surgical blade • Cotton tip applicator stick	• Reagent bottles • screw cupped container • Packing paper • Test tubes (different size • Diamond pencils • Lead pencils • Adhesive plaster • Strong cup board (wooden box) • Scotch tape • Nonabsorbent cotton • Test tubes holder (wooden) • Applicator steak • Pasteur pipits	Laboratory reagents to obtain representative samples, Eg. Sample preservatives, anticoagulants, sample diluting solutions…

Ser. No	Steps/Tasks	Needs improvemen	Competentl y performed	Proficiently Performed	Remark
	Get ready				
1.	Wearing gown				
2.	Washing your hand with soap and water				
3.	Wearing glove				
4.	Cleaning the working area				
5.	Ensure presence of full pack first aid kit				
6.	Confirming the working area fit for purpose(i.e. safe to work)				
7.	Observe materials for sampling				
8.	Perform log sample				
9.	Conduct sampling procedure to obtain representative sample • Blood Sample • Urine Sample • Stool Sample • Sputum Sample				
10.					
11.					
12.					
13.	Review SOP s for sample representativeness				
14.	Worn out your gown and gloves before leaving Laboratory				
15.	Assure that materials are placed in their appropriate place				
16.	Discarded waste produce appropriately & wash your hands before leaving laboratory				

2.4. Assembling all specified sampling equipment, safety equipment, materials and containers

2.4.1. LABORATORY SAFETY RELATED TO SPECIMEN COLLECTION, PREPARATION AND STORAGE

All staff involved in handling of laboratory specimens should receive specimen management training and be covered by appropriate vaccinations.

- Use personnel protective equipment when processing biological specimens.
- Take precautions to prevent injuries caused by needles, scalpels, and other sharp instruments.
- Do not recap, bend or break needles by hand or remove needles from disposable syringes.
- Discard all sharp instruments in puncture-resistant sharp containers located close to the work area.
- Secure lids immediately to avoid spillage and contamination during transport.
- Place all liquid specimens in containers that will prevent leakage during transport.
- Preferably use vacutainer tube with needle rather than ordinary (syringe with needle) Do not overfill specimen containers, as they can 'explode' upon opening.
- If hands or other skin surfaces become contaminated with blood or other body fluids, wash them immediately and thoroughly with soap and water.
- Remove gloves and wash hands with soap and water upon completion of processing after contact with each patient.
- Use a biological safety cabinet for procedures that have a high potential for generating droplets.
- Use mechanical pipette devices to manipulate all liquids in the laboratory.
- Decontaminate laboratory work surface area daily and after any spill of potentially dangerous materials with a freshly prepared household bleach (0.5% NaHCl).
- Disinfect refrigerators and centrifuge component primary by 1:10 dilution of household bleach then clean with water finally wipe with 70% ethanol. Autoclave or soak racks in 1:10 dilution of household bleach for Ten minutes and then rinse thoroughly with water.
- Dispose biological waste& disinfect all non disposable components with 1:10 dilution bleach and wipe with 70% ethanol.
- Allow disinfectant to remain in contact with surfaces for at least ten minutes at an ambient temperature for optimal effectiveness against dried blood or serum.
- If equipment needs maintenance, clean and decontaminate them in the laboratory before transporting to repair/maintenance.
- Incinerate or autoclave all waste before disposal in a sanitary landfill. Solutions containing bleach may corrode the autoclave; therefore, these solutions may be poured down a drain connected to a sanitary sewer.
- After decontaminating, carefully pour down a drain connected to a sanitary sewer bulk blood, suctioned fluids, excretions, and secretions.

2.4.2. STANDARD PRECAUTIONS

Universal Precautions Rules of universal precautions

Consider ALL patients potentially infectious.

Assume ALL blood and body fluids and tissue to be potentially infectious.

Assume ALL unsterile needles and other sharps to be similarly contaminated.

Standard Precautions

These precautions should be followed in all patient care situations. All staff should be informed of the need to report exposure to blood or potentially infectious body fluids to the duty doctor without any delay.

Certain standard precautions should be taken in all healthcare settings as given below:

- Wash hands before and after all patient or specimen contact.
- Handle the blood of all patients as potentially infectious.
- Wear gloves for potential contact with blood and body fluids.
- Prevent needle stick/sharp injuries.
- Wear personal protective equipment (PPE) while handling blood or body fluids.
- Handle all linen soiled with blood and/or body secretion as potentially infectious.
- Process all laboratory specimens as potentially infectious.
- Wear a mask for TB and other contagious respiratory infections (HIV is not air-borne).
- Correctly process instruments and patient care equipment.
- Maintain environmental cleanliness.
- Follow proper waste disposal practices.

Self-Check—4	Written Test

Answer the Following Questions (2 point each).

1. List personnel protective equipment in specimen collection.
2. What are the standard precautions should be taken in Laboratory specimen collection

Note: Satisfactory rating - 4 points Unsatisfactory below -6 points

You can ask you teacher for the copy of the correct answers

Answer Sheet

Score _____
Rating _____

Name: _____ Date: _____

Short Answer Question

1._____

_____

_____

_____

2._____

Information sheet-5	Cleaning of work area pre-use of all items

2.5. Cleaning of work area pre-use of all items

2.5.1. Cleaning and disinfecting work area and equipment after use

Laboratory work area and equipment should make free of contamination to minimize hazards of:

• Handling

• Collecting,

• Transporting

• Disposing of left over samples and unnecessary other biological materials

• Minimize hazard effect to the environment.

All left over samples and unnecessary other biological materials shall be discarded in a containers specifically designed, planned and marked for disposal of hazard wastes. Biological waste containers should not fill beyond their designed capacity. Sharps including needle, lancets, scalpels, glass and metals discarded directly to the puncture resistance containers. Rubbish and other laboratory wastes shall not allow accumulate. Filled containers shall be removed on a regular base from work area. They shall be held in a designated secure place, normally with in the laboratory area, prior to decontamination or disposal.

Self-Check—5	Written Test

Answer the Following Questions(5point).

1. Laboratory work area and equipment should make free of contamination to minimize hazards of:
   _____
   _____
   _____
   _____

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

You can ask you teacher for the copy of the correct answers

Answer Sheet

Score _____

Rating _____

Name: _____ Date: _____

Information sheet-6	Packaging Specimens for Transportation

2.6. Packaging Specimens for Transportation

2.6.1. Triple Packaging System

Referral testing requires proper packaging and shipping of patient specimens to preserve their integrity and suitability and to protect all persons involved in their transportation.

- Proper specimen packaging and shipping is important to ensure quality results and the safety of laboratory and courier personnel.
- The three factors necessary for specimen packaging and shipping are:
  - ✓ The right packaging
  - ✓ The right temperature
  - ✓ The right timeframe
- Regardless of the sophistication of the packaging materials, it is possible to properly package and ship specimens for referral testing.
- A well-collected, properly labeled, and properly stored specimen, with a matching test requisition form, must be forwarded to a referral testing site in a timely manner to ensure the viability of specimens for testing.
- Some specimens are of critical importance to patient health and the late arrival of specimens at the testing site, and failure to package and ship them intact or at the appropriate temperature may result in the need for another specimen to be drawn and an unnecessary (and perhaps costly) delay in the patient's treatment.
- Drivers and couriers must be trained in the biosafety practices relevant to their job. The training should be documented and included in the personnel file.
- Laboratory specimens must be tracked. The sending site should retain a copy of the requisition. The specimen referral log should be kept current and reviewed weekly to follow-up on any outstanding results. Link this to the activity, tracking a Referral Specimen.
- A communicative process between the sending and referral laboratory should be established. Areas that should be addressed are critical result notification, specimen rejection notification, specimen receipt verification, adding additional test confirmation, and result report transmission.
- The referral testing laboratory should provide a laboratory handbook as part of its customer service for the sending laboratory. The handbook should include instructions and guidelines that address such areas as: specimen collection and processing by test, available testing menu, expected turn-around-times, and required specimen identification and test information.

✓ Specimen Collection and Processing:

Packaging Specimens for Shipment

Primary Receptacles

- Contains the specimen
- Must be watertight and leak proof
- Must be appropriately labeled as to content.
- Wrapped in enough absorbent material to absorb all fluid in case of breakage or leakage.

Secondary Packaging

- Encloses and protects the primary receptacle
- Must be watertight and leak proof
- Several wrapped primary receptacles may be placed in a single secondary packaging.

Outer Packaging (Tertiary)

- Protects secondary packaging from physical damage while in transit
- Contains specimen data forms, letters, and other types of information that identify or describe the specimen and identify the shipper and receiver, and any other documentation required.
- Must be a sturdy container with a latch or able to be taped shut

Specimen Packaging and Shipping

- Utilize PPE when packaging specimens.
- Ensure specimens are in the appropriate transport media (primary containers) for the specimen collected and the test requested (primary containers). Ensure that primary containers will not leak
- Determine the requirements temperature (ambient temperature vs refrigerated) and the referral timeframe (i.e., 6 hours) for the specimen collect and the test requested.
- Consult the driver/courier schedule to ensure that the sample will reach the referral center within the necessary referral timeframe.
- Place cool packs on the bottom of a secure leak-proof secondary container to properly preserve the specimens during shipping (specimens shipped at ambient temperature may not require cool packs, although it is often still advisable in warm climates.)
- Place the primary container(s) in the secondary container with sufficient absorbent material
  —paper towels, cotton balls, commercial product
  —to absorb the entire contents of the primary containers.
  – Ambient temperature specimens can be transported in the same secondary packaging as refrigerated specimens, but should be packed as far away from the cool pack as possible and be insulated by at least one layer of absorbent material.
- Ensure secondary container(s) is labeled properly with a biohazard sticker or stamp.
- Place secondary container(s) in an outer shipping container that can be secured with a screw top, latch mechanism or sealed with tape.
- Place test requisition forms in a plastic sheath (if possible) inside the outer shipping container with specimen tracking form.
- Confirm that the contact information for the laboratory is clearly marked on the outer shipping packaging and/or in paperwork inside the outer packaging
- Note the date and time of pick-up on the specimen tracking form and/or the driver/courier logbook.
- Ensure that the drivers/couriers have received basic safety training in the transportation of specimens.
- Disinfect the bench where the specimens were packaged.

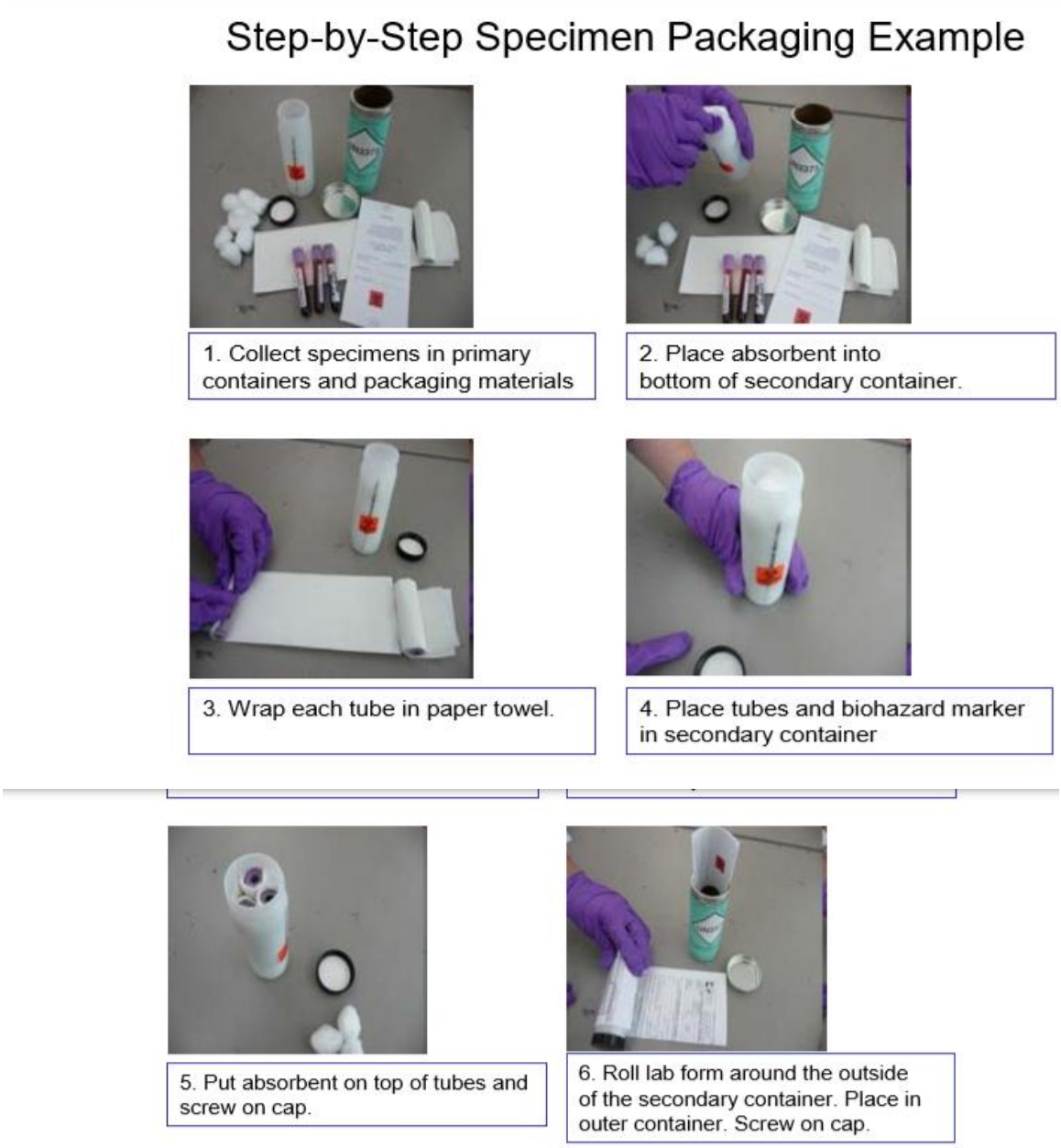

Fig.7-Specimen Packaging Procedure

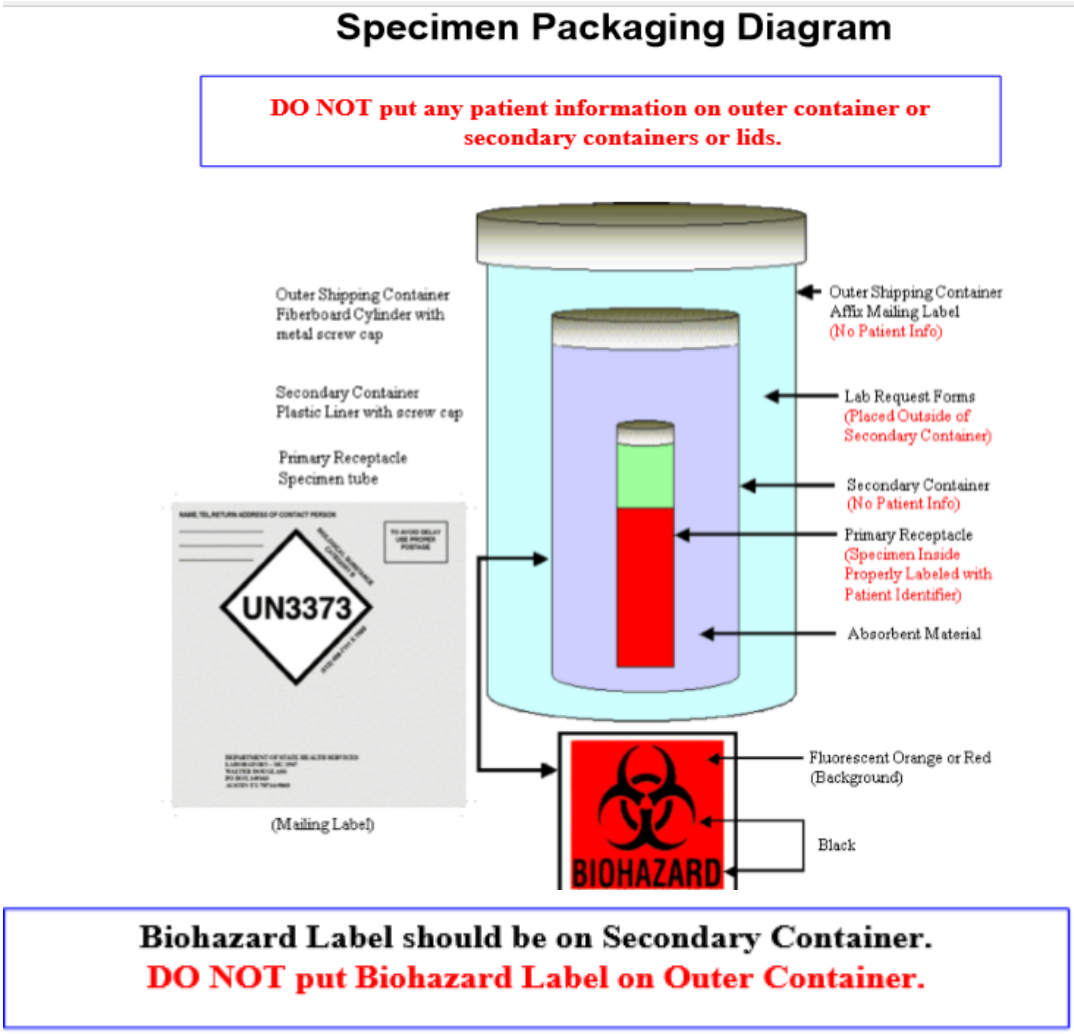

Fig.8.1.Specimen packing program

Cross Section of Refrigerated Specimen Packaging

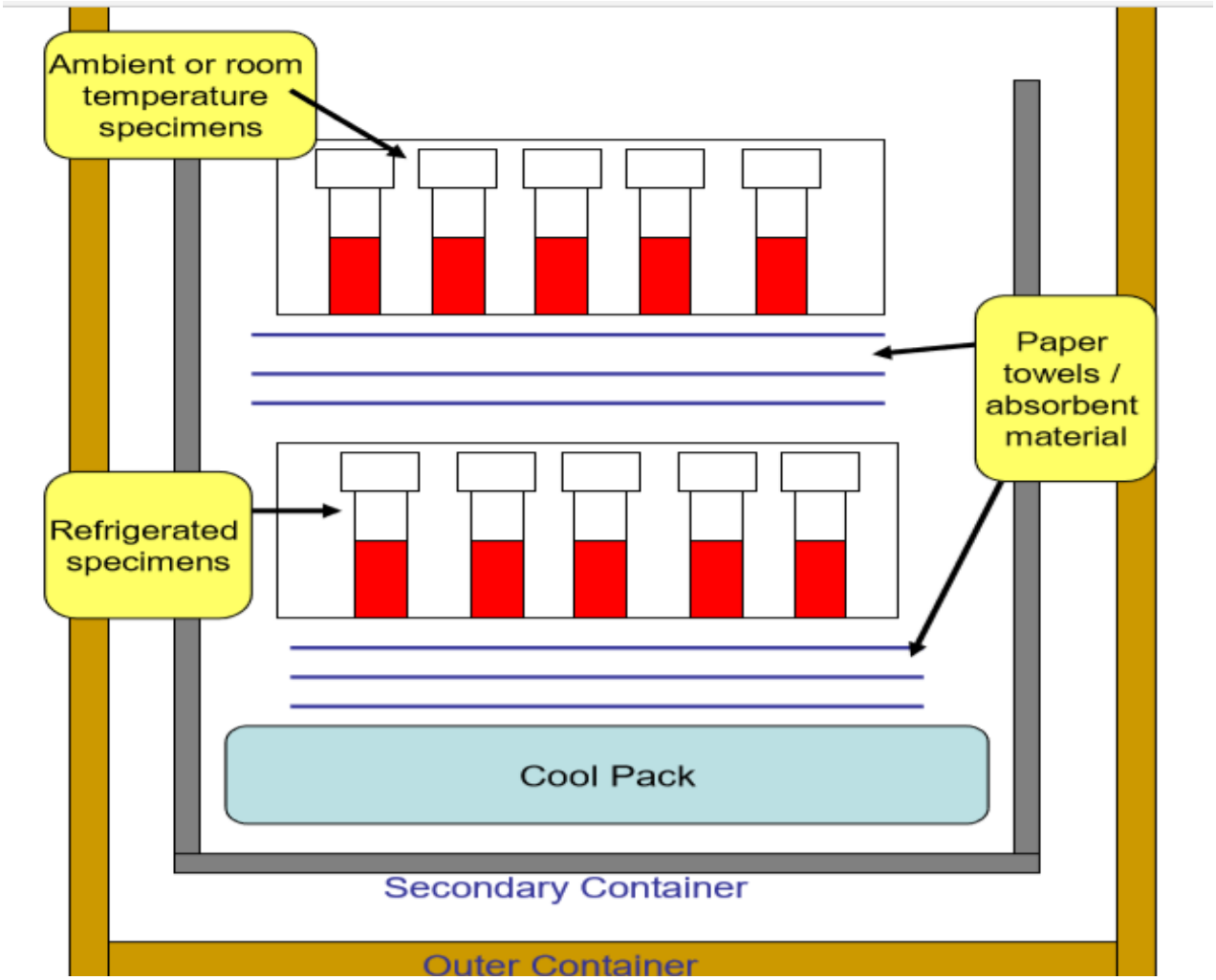

Fig.8.2.Specimen packing program

Ambient temperature specimens can be transported in the same secondary packaging as refrigerated specimens, but should be packed as far away from the cool pack as possible and be insulated by at least one layer of absorbent material.

Self-Check—6	Written Test

Answer the Following Questions(2point each).

1. What are the three factors necessary for specimen packaging and transporting?

2. What does triple packing of sample means?

Note: Satisfactory rating - 4 points Unsatisfactory below -4 points

You can ask you teacher for the copy of the correct answers

Answer Sheet

Score _____
Rating _____

Name: _____ Date: _____

1._____

_____

_____

2._____

_____

_____

_____

_____

Information sheet-7	Requirements permitted for handling specimen

2.7. Requirements permitted for handling specimen

2.7.1. HANDLERS' INSTRUCTIONS

Improper collection, transport, storage and handling of specimens between the laboratories carry a risk of infection to the personnel involved and the environment.

As a result, it is important to strictly follow the rules of general laboratory safety:

- Ensure that containers are leak-proof with a screw cap so that no material remains on the outside of the container. To avoid cracking or bending this container, never use mechanical devices to tighten the cap.
- Avoid spills and splashes during the opening and closing of tubes by using appropriate materials such as paper towel (absorbent pad), gauze, etc.
- When applicable, ensure that the outer part of triple package is large enough to hold the containers.
- Label containers to facilitate identification; do not wrap request or specification forms around the containers.
- To avoid accidental leakage or spillage, use secondary metal or plastic containers fitted with racks so that the containers remain upright. The secondary containers should be autoclavable or resistant to the action of chemical disinfectants and should be regularly decontaminated.
- For laboratories that receive large numbers of specimens, designate a particular room or area for this purpose.
- Shipping cartons or carriers must be immediately unpacked in a designated area equipped with a discard container (infectious, non infectious and sharps), alcohol swabs and paper towels.
- Use a Class II biosafety cabinet to limit exposure of laboratory staff to potential pathogens.
- If a biosafety cabinet is not available, use a clean workbench that can be easily disinfected using common laboratory disinfectants; this should be located away from areas used for other laboratory activities.
- Open the package safely and record and maintain all related documents:
- If there is linkage, broken container and contaminated paper manage it according to universal safety precaution.
- For blood specimen, ensure that appropriate safety measures are adopted to prevent laboratory infections; the handling of patient's blood and arthropods is particularly hazardous because the specimens are suspected to contain infectious agents.

Self-Check—7	Written Test

Answer the Following Questions(5point).

1. What are general laboratory safety rule that are followed by the laboratory Personnel?

_____

_____

_____

_____

_____

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

You can ask you teacher for the copy of the correct answers

Answer Sheet

Score _____
Rating _____

Name: _____ Date: _____

1._____

_____

_____

_____

_____

Information sheet-8	Make available Vehicle and communication devices are in working order

2.8. Make available Vehicle and communication devices are in working order

2.8.1.laboratory specimen couriers

- Transport the specimen(s) properly and safely from referring to referral laboratories and return results back to referring laboratories in a timely manner(per established TAT)
- Ensure the quality and/or safety of the specimen, environment and all parties involved in the process including keeping bio-security.
- Ensure that the required documentation is available and maintained
- Maintain Communicate with referring and referral laboratories
- Follow the memorandum of understanding and SOP.
- Must report any incident based on the incident report form
- 2.8.2. REFERRAL/RECEIVING LABORATORIES
- Check for integrity and safety of specimen.
- Ensure that all the formats are properly filled, that complete documentation is provided to the appropriate authorities and that all information is appropriate and adequate
- Inspect the packaging and transportation process as per the SOP
- Perform the requested test analysis using the referred specimens and provide timely results back to referring laboratories
- Establish and communicate TAT to referring laboratories
- Dispose of leftover specimen(s) appropriately
- Maintain proper reporting documentation
- Maintain early notification and proper communication with referring laboratories and couriers.

Self-Check—8	Written Test

Answer the Following Questions

1. When transporting specimen what is the currier should check
   A. Ensure that the required documentation is available and maintained
   B. Maintain Communicate with referring and referral laboratories
   C. Follow the memorandum of understanding and SOP.
   D. Must report any incident based on the incident report form
   E. All
2. What are the conditions of specimen Referral/receiving laboratories should check.

   _____

   _____

   _____

   _____etc.

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

You can ask you teacher for the copy of the correct answers

Answer Sheet

Score _____
Rating _____

Name: _____ Date: _____

1._____
_____
_____
_____
_____

Information sheet-9	Identifying Required transport containers and materials

2.9. Identifying Required transport containers and materials

Referral testing requires proper packaging and shaping of patient sediment to preserve their integrity and suitability and to protect all persons involved in their transportation.

- Primary receptacle
- Paper towel
- Secondary receptacle (packaging)
- Absorbent
- Outer receptacle (packaging)
- Biohazard marker

Special Safety Precautions

- Use universal precaution (PPE) when packaging specimen or infectious materials
- Disinfect the bench where the specimens were packaged.
- Wash hands after packaging specimens.

Procedural Notes

1. Make sure that the lab request & specimen forms are filled properly.
2. Note the date and time of pick-up on the specimen referral log form.
3. Make certain that the test-tube labeled properly and clearly
4. Determine the requirements temperature (ambient temperature vs. refrigerated) and the referral timeframe (i.e., 6 hours) for the specimen collect and the test requested.
5. Ambient temperature specimens can be transported in the same secondary packaging as refrigerated specimens, but should be packed as far away from the cool pack as possible and be insulated by at least one layer of absorbent material.

6. Ensure that the outside of the specimen container is clean and uncontaminated
7. Check if the test tube /container/ closed tightly so that its contents do not leak during transportation.
8. Place test tube into test tube rack aseptically in appropriate manner.
9 Check if vaccine carrier cool box is large enough to hold sufficient specimen container.
10. Each test tube rack must be individually protected by absorbent materials
(absorptive paper, cotton or cloth/ to reduce cotton or cloth/ to reduce shake or prevent breakage.
11. Place test-tube rack in to cold box or sample packaging box.
12.Place the dry ice packs at the bottom of the box and along the sides, place specimen in the center, and then place more ice packs on top in order to keep the temp at 2-8^{O}C.
N.B. Specimens shipped at ambient temperature may not require cool packs, although it is often still advisable in warm climates
13. Close the cold box tightly.
14. If the external temp is high, the samples should be shipped cool (not frozen) packs.
15.Ensure that the drivers/couriers have received basic safety training in the transportation of specimens.
16. Arrange for immediate transport of the sample to testing laboratory.
17. Disinfect the bench where the specimens were packaged.

18. Wash hands after sample handling and Packaging.

Self-Check—9	Written Test

Answer the Following Questions(5-points)

1. What is Special Safety Precautions should be taken in specimen packing for transportation?

Note: Satisfactory rating - 4 points Unsatisfactory below -4 points

You can ask you teacher for the copy of the correct answers

Answer Sheet

Score _____

Rating _____

Name: _____ Date: _____

Short Answer Question

1._____

_____

_____

_____

LAP- test	Conduct sampling procedure to obtain representative sample

Task-1 Collect Capillary Blood Sampleand prepare thin blood film
Task-2 Collect Capillary Blood Sample and prepare thin blood film
Task-3 Collect Urine Sample
Task-4 Collect Stool Sample
Task-5 Collect Sputum Sample

LG24-Collect and handle sample

Learning Instructions:

23. Read the specific objectives of this Learning Guide.
24. Follow the instructions described in number 5 to 11.
25. Read the information written in all Information Sheets. Try to understand what are being discussed. Ask you teacher for assistance if you have hard time understanding them.
26. Accomplish all Self-check according to learning session separately
27. Ask from your teacher the key to correction (key answers) or you can request your teacher to correct your work. (You are to get the key answer only after you finished answering the Self-checks).
28. If you earned a satisfactory evaluation proceed to next Information Sheet. However, if your rating is unsatisfactory, see your teacher for further instructions or go back to pervious Learning Activity.
29. Submit your accomplished Self-check. This will form part of your training portfolio.
30. Try to understand what are being discussed. Ask you teacher for assistance if you have hard time understanding them.
31. Accomplish the all Self-checks.
32. After you accomplish self check proceed to operation sheet if available.
33. If you perform operation procedure correctly proceeds to LAP. test if available

Information sheet-1	Collect and handle sample

Learning out comes (objectives): At the end of this module the trainee will be able to:-

- Locate Sampling points and services at the site
- Remove Security devices, such as locks and covers
- Modify the procedures if the required samples cannot be collected
- Select and using the required *sampling tools and equipment*
- Follow Sampling procedures closely
- Record Labeling information
- Collect the desired type and quantity of samples
- Record factors that may impact on sample integrity
- Maintain Sample integrity and confidentiality
- Deliver Samples/Items to each laboratory department

3.1. Locating Sampling points and services at the site

3.1.1. The laboratory work area

The clinical laboratory is a complex operation that must smoothly integrate all three phases of the testing process: pre-analysis, analysis, and post-analysis.

- Pre-analysis refers to all the activities that take place before testing, such as test ordering and sample collection
- Analysis stage -the analysis stage consists of the laboratory activities that actually produce a result, such as running a sample on an automated analyzer.
- Post-analysis comprises patient reporting and result interpretation.

The laboratory work area

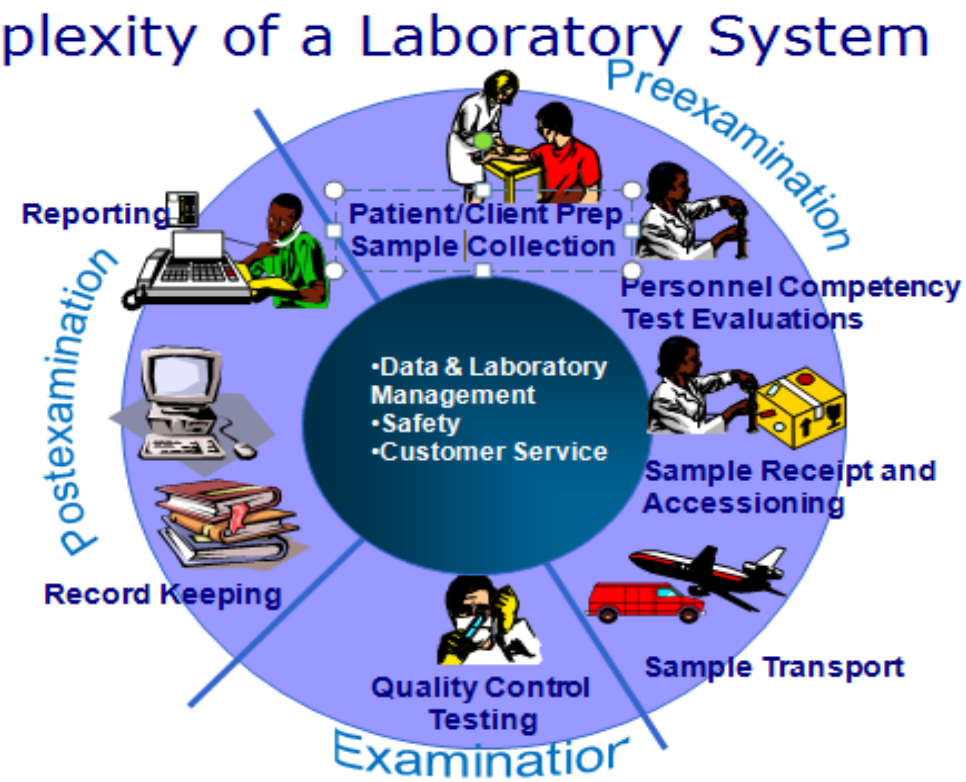

Fig.3.1. Complexity of a laboratory system

3.1.2. Transporting specimens from wards or OPD clinics

- When hand-carrying, place the specimens upright in racks in a closed container
- The racks and carrying container should be made of plastic so that they can be easily disinfected and washed between uses.
- The request forms should be placed in a plastic bag that can be sealed (grip type).
- During the hot season, an insulated container should be used to transport the specimens.

3.1.3. Transporting specimens between laboratories

- Make sure the specimen container is tightly closed and the cap is not leaking
- Wrap each specimen insufficient absorbent material to absorb it if the containers break.
- Place it individually or with others in a carton or strong plastic bag.
- Make sure there insufficient packing material around the specimens to prevent them moving in the container or bag.
- Pack the container or bag of specimens with the sealed plastic bag containing the request forms in a suitable insulated container which will with stands hock and weight pressure.
- Insert a freezer pack(s) or ice cubes around the container of specimens
- Label the outer container 'Biological specimens
  - ✓ Infectious substance, preferably using the biohazard symbol shown
- The words 'KEEP COOL'
- Should also be importantly displayed on the container.
- Fix a clearly written delivery address label to the outer container.
- Cover the labels with clear adhesive tape.

Self-Check-1	Written Test

Answer the Following Questions (2 point each):

1. Laboratory activities that take place before testing, such as test ordering and sample collection
   A. Post-analysis
   B. Analysis
   C. Pre-analysis
   D. None
2. Quality control testing and sample test running is categorized at _____phase of laboratory activity.
   A. Post-analysis
   B. Pre-analysis
   C. Analysis
   D. None

Note: Satisfactory rating - 4 points Unsatisfactory below -4 points

You can ask you teacher for the copy of the correct answers

Answer Sheet

Score _____

Rating _____

Name: _____ Date: _____

Short Answer Question

1._____

2._____

Information sheet-2	Removing Security devices, such as locks and covers

3.2. Removing Security devices, such as locks and covers

3.2.1. It is important to establish a means to protect against loss of data. For paper based systems, this will involve using safe materials for recording and storing the records properly. For computerized systems, scheduled or regular backup processes become very important.

It is of utmost importance to safeguard a patient's privacy and, in this regard, security measures must be taken to protect the confidentiality of laboratory data. Laboratory directors are responsible for putting policies and procedures in place to ensure confidentiality of patient information is protected.

Self-Check-2	Written Test

Answer the Following Questions (5point):

1. How can you protect the security of patient clinical data/patient test result?

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

You can ask you teacher for the copy of the correct answers

Answer Sheet

Score _____
Rating _____

Name: _____ Date: _____

1. _____
   _____
   _____
   _____
   _____

Information sheet-3	

3.3. Modifying the procedures if the required samples cannot be collected

When the patient is Infant rectal swab is collected. These should only be used for infants or acutely ill patient when a stool is not available for culture. Rectal swabs are also submitted for the detection of Neisseria Gonorrhae or anal carriage of streptococcus pyogens.
In infants and children, microanalysis techniques allow sampling of capillary blood through micropipettes or capillary tubes. This technique is used when the patient is an infant/child or has severe burns and/or has absolutely no useable veins to draw from.

Self-Check-3	Written Test

Answer the Following Questions (5 point each):

1. At what condition collection of stool specimen is modified?

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

You can ask you teacher for the copy of the correct answers

Answer Sheet

Score _____
Rating _____

Name: _____ Date: _____

1. _____
   _____
   _____
   _____
   _____

Information sheet-4	Selecting and usingthe required *sampling tools and equipment*

3.4. Selecting and usingthe required *sampling tools and equipment*

3.4.1. Containers for stool specimen

The following types of container are suitable for the collection of stool specimen

- ✓ waxed cardboard box
- ✓ empty tin with a lid
- ✓ lightplastic box
- ✓ Glass jar specially designed for stool collection, with a spoon attached to stopper.

3.4.2. Urine specimen container.

Urine use clean, dry, wide-mouthed Erlenmeyer flasks of 250-ml capacity or clean wide mouthed bottles. Urine sample collected for bacteriological culture requires sterile containers.

3.4.3. Materials and reagents for collection of blood::

- For disinfecting the skin:
  - ✓ cotton wool
  - ✓ 70% ethanol or tincture of Iodine
- For the vein puncture
  - ✓ gloves
  - ✓ a tourniquet of soft rubber tubing 2-3mm bore
  - ✓ needles, 30–40mm,20guage,19guage.20guage and medium level

- Bottles and test-tubes for collecting blood specimens
  - ✓ Without anticoagulant

    The best type of test-tube to use for blood specimens is one that can be centrifuged: this avoids excessive handling of the specimen. Use clean dry test-tubes of 5–20 ml capacity, depending on requirements.
  - ✓ With anticoagulant for hematological tests
  - ✓ EDTA1 dipotassium salt

    Put 0.5 ml of EDTA dipotassium salt, 10% solution into each of a series of 5-ml bottles (or use 0.2 ml in 2-ml bottles). Place the open bottles in an incubator at 37 °C or leave them to dry at room temperature, if no incubator is available. Now days there is already
- EDTA Coated anticoagulated test tubes are available which is Use these bottles for:
  - ✓ Blood cell counts
  - ✓ Hemoglobin estimation.
  - ✓ Heparinized tubes:
- Heparin is an expensive anticoagulant that is not very stable in hot climates. Heparinized tubes are usually obtained commercially or prepared by central laboratories and are already marked to show the level to which the blood should be added.
- Trisodium citrate. Trisodium citrate, 3.8% solution is used for the determination of the erythrocyte sedimentation rate. Use 1 ml of trisodium citrate solution per 4 ml of Blood. Important: Never carry out a blood cell count on citrated blood.
- Sodium fluoride (NaF) is the anticoagulant normally used for biochemical tests.

Use 10 mg of sodium fluoride powder per 10 ml of blood, or 2 mg per 2 ml of blood.
Use for: — blood glucose estimation — blood urea estimation (certain techniques).
Warning: Sodium fluoride is a poison. Precautions to be taken when using anticoagulants Mix as soon as the blood is collected by inverting the bottle several times gently and evenly. Do not shake.

- ✓ ● Use clean bottles. Dry before adding anticoagulant. Warning: Traces of detergent will dissolve the erythrocytes. Ensure that the bottles are rinsed thoroughly before drying.
- ✓ ● Store bottles containing anticoagulants in a dry place. EDTA dipotassium salt solution and sodium fluoride are stable at room temperature but trisodium citrate solution and heparin must be kept in the refrigerator.
- ✓ ● Use the correct proportions. Use bottles and tubes with a graduation mark, or stick on a label so that its upper edge corresponds to the required amount of blood.

3.4.4. Materials and reagents for collection of skin puncture for Microfilaria:

- Microscope
- Microscope slides
- Cover slips
- Pasteur pipette
- Needle (for intramuscular or subcutaneous injection), 22-gauge
- Scalpel or razor blade
- Sodium chloride, 0.85% solution
- 70% Ethanol.

3.4.5. Containers for collection of Sputum specimens

- Sputum containers
- Slides
- Burning spirit
- Lead pencil

Self-Check-4	Written Test

Answer the Following Questions (2 point each):

1. List types of container and reagents which are suitable for the collection of stool specimen
2. List types of container which are suitable for the collection of Urine specimen
3. List types of container and materials which are suitable for the collection of sputum specimen
4. List types of container and reagents which are suitable for the collection of blood specimen

Note: Satisfactory rating - 4 points Unsatisfactory below -4 points

You can ask you teacher for the copy of the correct answers

Answer Sheet

Score _____
Rating _____

Name: _____ Date: _____

1._____2._____
_____3._____
_____4._____
_____

Operation sheet-1	Selecting and usingthe required *sampling tools and equipment*

Purpose: The purpose of this activity is to enable trainees to practice the skills necessary to perform Identifying equipment to obtain a representative Sample

N	Materials		Reagent
	• TTLM • Reagent bottles • Screwed cupped container • Packing paper • Test tubes (different size) • Diamond pencils • Lead pencils • Adhesive plaster • Nonabsorbent cotton • Test tubes holder	• Leak proof sample container • Wooden applicator stick • Microscope slide • Slide cover sip • Wool cotton • Filter paper • Surgical blade • Cotton tip applicator stick	Laboratory reagents to obtain representative samples, Eg. Sample preservatives, anticoagulants, sample diluting solutions…

Ser. No	Steps/Tasks	Needs improveme	Competent ly	Proficientl y	Remark
	Get ready				
17.	Wearing gown				
18.	Washing your hand with soap and water				
19.	Wearing glove				
20.	Cleaning the working area				
21.	Ensure presence of full pack first aid kit				
22.	Confirming the working area fit for purpose(i.e. safe to work)				
23.	Observe & identify materials for sampling				
24.	Identify Sample containers for different sample types				
25.	Cross cheek the information on request form with that of Sample container label				
26.	Identify sample information is complete				
27.	Review procedures for sample representativeness				
28.	Worn out your gown and gloves before leaving Laboratory				
29.	Assure that materials are placed in their appropriate place				
30.	Discarded waste produce appropriately & wash your handsbefore leaving laboratory				

Information sheet-5	Follow Sampling procedures closely

3.5. Follow Sampling procedures closely

3.5.1. Definition of terminologies

- Representative Sample/specimen: Representative Specimen is a part which its integrity is maintained & taken to determine the character of the whole

Purpose of representative sample

The representative specimen is of utmost importance if the laboratory results are to be relevant to the clinical situation of a patient. When materials collected for the purpose of monitoring and control of treatment of patients, or to obtain correct epidemiological figure.

- Conditions to be considered to obtain a representative sample

✓ The physiological state of the patient (e.g. the reference ranges of certain indicators vary with age and sex)

✓ The appropriate preparation of patients for specimen collection (e.g. blood for the measurement of fasting glucose and lipids should be taken in the morning from a patient who has fasted for 12 hours, (because their concentrations are elevated after a meal)

✓ The appropriate tools for specimen collection (e.g. blood for cell counting should be collected in tubes containing EDTA dipotassium salt to avoid plasma coagulation and platelet aggregation)

✓ The appropriate site for specimen collection (e.g. the concentration of glucose is different in arterial and venous blood. for the diagnosis of certain bacterial and parasitic disease needs taking sample from specific area of body parts) Example, mycobacterium leprae, Oncoserca Microfilaria.

✓ Laboratory personnel Should collect specimens from actual infection site with little external contamination by using aseptic technique and sterile container, should collect specimens from right site: this helps

- To prevent contamination of specimen &
- To protect the patient from infection
- To actual diagnoses of the disease

✓ Sites of Infection where the Specimen is Likely to become Contaminated

✓ During Collection

- Sample from lower respiratory tract can be contaminated from Oro-pharynx
- Sample from bladder can be contaminated from urethra
- Sample from cervix can be contaminated from vagina

✓ Volume of specimens: Collecting & processing too little specimen will give us lower sensitivity. Collecting adequate volume:

- Enhance recovery of the pathogen.
- Enable to perform all procedures required or to permit complete examination.

• For example;

for sputum: 5 -10 ml for mycobacterium examination.

- For blood: for serological tests: the minimum volume is 2 - 3 ml.

-For culture: the minimum volume is 10 – 20 ml (adult) & 1-5ml (infant).

- for CSF: 5 – 10 ml - for urine: the minimum volume for urinalysis is 15 ml

- Time of collection: To ensure that the most useful specimen is obtained, sample should always be collected at the appropriate time. Random collection should be limited to emergency situations .For example sputum specimens for the detection of tubercle bacilli should be collected in theearly morning, while urine for the

diagnosis of schistosomiasis and other conditions should be collected as a “terminal” urine specimen. For chemical and Microscopic examination early morning collected Urine is best sample. Blood specimen to diagnoses malaria parasite in the blood, the time of collection should be when the patient’s temperature begins to rise (when the patient is at febrile stage).

Self-Check-5	Written Test

Answer the Following Questions (2 point each):

1. _____Specimen is a part which its integrity is maintained & taken to determine the character of the whole.

A. Representative Sample/specimen
B. Representative Sample/specimen
C. Whole specimen
D. None

2. Collection of specimens from right site of infection helps for:-
   A. To prevent contamination of specimen
   B. To protect the patient from infection
   C. To actual diagnoses of the disease
   D. None
3. At what time the Blood specimen collected to diagnoses malaria parasite in the blood specimen?_____

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

You can ask you teacher for the copy of the correct answers

Answer Sheet

Score _____

Rating _____

Name: _____ Date: _____

1._____
2._____3._____

Information sheet-6	Record Labeling information

3.6. Record Labeling information

3.6.1. Reporting and recording test results

Laboratory staff should provide as much relevant information as possible to assist those requesting tests to interpret the results of tests correctly and use the information in the best possible way to benefit patients and the community. Reports should be clearly and neatly written (particularly figures).

- Standardization in reporting test results

  Standardization in the presentation of reports and use of units is important because it helps in the interpretation and comparison of results, contributes to the efficiency of a laboratory service, and is of value when patients are referred from one health unit or hospital to another.

  The use of SI units in the reporting of test results are important

- Recording results in the laboratory

In district laboratories, records of test results can be kept by retaining carbon copies of reports, using work sheets, or recording test results in registers (Laboratory test result registration Book). Whichever system is used it must be reliable and enable patients' results to be found quickly. Test records are also required when preparing work reports and estimating the workload of the laboratory. If carbon copies or work sheets are used these must be dated and filed systematically each day. If registers are used, backing cards which are headed and ruled can be placed behind pages to avoid having to rule and head each page separately. The cards must be heavily ruled with a marker pen so that the lines can be seen clearly. Separate registers, each with its own cards, can be prepared to record the results of hematological, microbiological, clinical chemistry, urine and faecal tests. In smaller district laboratories the registers can also be used to record daily quality control information, e.g. reading of a hemoglobin control. Daily checks on the performance of equipment, e.g. temperature readings should be recorded in a quality control (QC) book or on separate sheets as part of equipment control procedures.

3.6.2. Definitions of terms

Labeling: -putting information on sample container for sample identification.

- Sample Labeling

This achieved when specimens are correctly labeled. All specimens should be labeled at the time of collection with at least two patient identifiers.

- ✓ The patient's name (full last name, then full first name or initial) or a unique ID code is always required.
- ✓ The second patient identifier may be one of the following:
- ✓ Date of birth (month/date/year)
- ✓ Other unique patient identifier that is also on the test requisition, e.g. hospital or office ID code or file number

NOTE: Location-based identifiers are NOT acceptable, e.g. hospital room number

- Each specimen must have a securely affixed label with the following information:
  - ✓ Patient name(written exactly as written on the request)
  - ✓ Unique identification number
  - ✓ Patient demographic information
  - ✓ Specimen collection date

- ✓ Specimen collection location
- ✓ Diagnostic test results

If the label is hand-written, use a ballpoint pen–do not use a felt tip pen. If glass slides are submitted, use a pencil for labeling the frosted end–two identifiers are preferred although patient's name alone is acceptable

When using an electronically generated test requisition, place the label lengthwise on the tube. When submitting a specimen in a container other than the tube used to draw the sample (e.g., transfer vials), also indicate specimen type on the label (e.g., serum, plasma, urine, etc.). When submitting specimens for microbiological testing (e.g.cultures, bacterial antigen, microscopic examination), the nature and anatomic source of the sample and the specific organism (s) to be detected, if any, should be specified.

Note: during Labeling:

- ✓ Make sure that container label & the requisition match
- ✓ Label should be on the container not on the lid, since the lid can be mistakenly placed on a different container. Ensure the labels on the containers are adherent under refrigerated conditions.

Self-Check-6	Written Test

Answer the Following Questions (2 point each):

1. Mention at least two patient identifiers when you labeled at the time of specimen collection

2. _____is putting information on sample container for sample identification.

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

You can ask you teacher for the copy of the correct answers

Answer Sheet

Score _____
Rating _____

Name: _____ Date: _____

1._____
_____
_____

2._____

Information sheet-7	Collect the desired type and quantity of samples

3.7. Collect the desired type and quantity of samples

Quantity of Samples

The amount of the sample needed depends upon many factors. Each lab is different in the amount of blood or other body fluid or tissue required to perform the analysis. Generally speaking, if the blood is run using modern automated analyzers, the amount of blood may be 10 ml or less for each test. If the tests are run individually, or if the tests are complicated, larger quantities of blood may be needed.

The quantity of the sample usually dictates the method of collection or collection procedure. The overall goal is to get the required amount of blood with only one vein puncture. Multiple vein punctures are avoided if possible, even when gathering large amounts of blood. A single glass or disposable plastic needle and syringe may be used to obtain a small sample of 10-20 ml of whole blood. This amount is usually sufficient to perform one or two tests. However, for a series of tests, more blood is needed.

In order to avoid multiple vein punctures, it is usually best to use an evacuated blood tube system such as the "Vacutainer" or "Corvac" collection systems. These systems are very popular for drawing multiple samples of blood. They use blood tubes with a rubber stopper and a vacuum inside the tube. These tubes are manufactured in a variety of sizes and with a variety of additives in the evacuated tubes. Color-coded tubes indicate the different additives in the tube. The vacuum in the tube causes just the correct volume of blood to be drawn into the tube. The tubes are consecutively used to draw blood from one vein puncture site, thereby negating the use of multiple punctures. This, of course, is under ideal conditions. We assume that correct technique is being used. We also assume that the patient's vein will support multiple samples being drawn at one time from one location. These tubes hold 2-20ml of blood in each tube. In infants and children, microanalysis techniques allow sampling of capillary blood through micropipettes or capillary tubes. This technique is used when the patient is an infant/child or has severe burns and/or has absolutely no useable veins to draw from. This technique is time-consuming and very expensive. Therefore, if possible, the multiple-sample technique is preferred. Micro-pipettes hold from 30 µl to 50 µl of serum or plasma.

- ✓ Volume of specimens: Collecting & processing too little specimen will give us lower sensitivity. Collecting adequate volume:
  - Enhance recovery of the pathogen.
  - Enable to perform all procedures required or to permit complete examination.

  • For example;

  For sputum: 5 -10 ml for mycobacterium examination.

  - For blood: for serological tests: the minimum volume is 2 - 3 ml.

  -For culture: the minimum volume is 10 – 20 ml (adult) & 1-5ml (infant).

  - For CSF: 5 – 10 ml - for urine: the minimum volume for urinalysis is 15 ml

Self-Check-7	Written Test

Say true or false (2 point each):

1. If the blood is run using modern automated analyzers the amount of sample needed is less than manual method.
2. The volume/quantity of specimen is changed depending on technique we use.

Note: Satisfactory rating - 4 points Unsatisfactory below -4 points

You can ask you teacher for the copy of the correct answers

Answer Sheet

Score _____
Rating _____

Name: _____ Date: _____

1._____
2._____

Information sheet-8	Record factors that may impact on sample integrity

3.8. Record factors that may impact on sample integrity

3.8.1. Definitions of Terms

Sample register or Log

The laboratory should keep a register (log) of all incoming samples. A master register may be kept, or each specialty laboratory may keep its own sample register. Assign the sample a laboratory identification number write the number on the sample and the requisition form. If computers are used for reports, enter the information into the computer. The register should include:

- Date and time of collection
- Tests to be performed.
- Date and time the sample was received in the laboratory
- Sample type
- Patient name and demographics, as required
- Laboratory assigned identification (e.g. number 276_01_06_2009) The laboratory needs a system to allow for tracking a sample throughout the laboratory from the time it is received until results are reported. This can be done manually by careful keeping of records as follows. Confirm receipt of samples and include date and time. Label samples appropriately and keep with the test requisition until laboratory identification is assigned. Track aliquots they should be traceable to the original sample. If computers are available, maintain a database for tracking. The following information about each sample should be entered into the database:
- Identification number
- Patient information
- Collection date and time
- Type of sample (e.g. urine, throat, cerebrospinal fluid for culture)
- Tests to be performed
- Name of ordering physician (or other health care provider)
- Location of patient (e.g. ward, clinic, outpatient)
- Diagnostic test results
- Time and date results are reported.

Self-Check-8	Written Test

- Answer the following questions (2 point each):

1. What is the information about each sample should be entered into the database when electronic recording of patients take place?
   A. Identification number
   B. Patient information
   C. Collection date and time
   D. Type of sample
   E. All

2. What the necessary information that the laboratory register/Log book should contain?

Note: Satisfactory rating - 4 points Unsatisfactory below -4 points

You can ask you teacher for the copy of the correct answers

Answer Sheet

Score _____
Rating _____

Name: _____ Date: _____

1._____
2._____
_____
_____
_____

Information sheet-9	Maintain Sample integrity and confidentiality

3.9. Maintain Sample integrity and confidentiality

3.9.1. Collection Site Security

The collection site must be secure to prevent unauthorized access to specimens, collection supplies, and collection site records. A permanent site that is used solely for specimen collections must be secured at all times. At facilities that are not dedicated specimen collection sites, the area of the site used for specimen collections must be secured during the time a specimen is collected.

A collector must

- Prohibit unauthorized personnel from entering the collection site during the collection;
- Perform only one specimen collection at a time;
- Restrict access to collection supplies before and during the collection;
- Ensure that only the collector and the donor are allowed to handle the unsealed specimen;
- Ensure that chain of specimen is maintained and documented throughout the collection procedure
- Ensurethat specimens are transported to the test facility in a sealed and secure shipping container to eliminate the possibility of damage during shipment and to prevent undetected tampering

3.9.2. Sample integrity:

It is the specific specimen requirements. Which should include information such as

- specimen volume
- collection containers
- transport containers
- transport temperature

If additional information is needed for the interpretation of the test results or there are specific instructions for patient preparation, they are listed along with specimen requirements. It is critical that an adequate specimen volume is submitted for analysis. The volume requested in one order should be enough for initial analysis as well as for any confirmatory tests that must be performed. If an inadequate specimen is submitted, we may not be able to perform the initial test or required confirmatory procedures.

If repeat or confirmatory tests cannot be performed, the report will indicate that the specimen quantity submitted was “QNS” (Quantity Not Sufficient) for additional testing.

When serum or plasma is to be submitted for analysis, it is good practice to collect a volume of blood that is 2 to2.5 times the volume of serum or plasma needed for the test. As an example, if 4 ml of serum or plasma is needed for a test, collect 8 to 10 ml of blood.

If you have confirmed that the specimen collected has no feature of specimen rejection criteria and believed that integrity of the specimen is maintained correctly, it will be recorded on specimen accession list record format.

Specimen accession list

Accession list is a record of all the specimens received by the laboratory for analysis and is prepared by the laboratory at the time of specimen receipt. It is records of the patient's identity including name, age, sex, location in the hospital/ medical facility, name of referring physician, investigations requested, date and time of receipt of specimen and condition of the specimen at receipt. The laboratory assigns a unique laboratory number to

register each specimen received, which can be used to trace the specimen in the laboratory. The test results and remarks if any are also entered in the accession list. In laboratories handling a very large number of specimens, the accession list may be computer generated and the condition of specimen at receipt may not be recorded unless it has been rejected.

Self-Check-9	Written Test

Answer the following questions (5point):

1. What are requirements that is used to monitor Sample integrity

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

You can ask you teacher for the copy of the correct answers

Answer Sheet

Score _____

Rating _____

Name: _____ Date: _____

1._____
2._____

Information sheet-10	Delivering Samples/Items to each laboratory department

3.10. Delivering Samples/Items to each laboratory department

- Specimen transportation is required when:
  - ✓ Specimens are to be sent to referral laboratory
  - ✓ For teaching purpose.
  - ✓ For Quality assurance.
  - ✓ Unavailability of trained personnel around the collection site.
  - ✓ Specimens are collected in the field.
  - ✓ Lack of time to examine within the recommended time due to laboratory workload
- Transporting specimens from wards or OPD clinics
  - ✓ When hand-carrying, place the specimens upright in racks in a closed container
  - ✓ The racks and carrying container should be made of plastic so that they can be easily disinfected and washed between uses.
  - ✓ The request forms should be placed in a plastic bag that can be sealed (grip type).
  - ✓ During the hot season, an insulated container should be used to transport the specimens.
- Transporting specimens between laboratories

✓ Make sure the specimen container is tightly closed and the cap is not leaking
✓ Wrap each specimen insufficient absorbent material to absorb it if the containers break.
✓ Place it individually or with others in a carton or strong plastic bag.
✓ Make sure there insufficient packing material around the specimens to prevent them moving in the container or bag.
✓ Pack the container or bag of specimens with the sealed plastic bag containing the request forms in a suitable insulated container which will with stand shock and weight pressure.
✓ Insert a freezer pack(s) or ice cubes around the container of specimens
✓ Label the outer container 'Biological specimens
– Infectious substance, preferably using the biohazard symbol shown
✓ The words 'KEEP COOL' should also be importantly displayed on the container.
✓ Fix a clearly written delivery address label to the outer container.
✓ Cover the labels with clear adhesive tape.

Self-Check-10	Written Test

Answer the following questions (2 point each):

1. _____ is a record of all the specimens received by the laboratory for analysis and is prepared by the laboratory at the time of specimen receipt.

A. Accession list
B. Specimen rejection record format
C. Equipment inventory record
D. Test Requisition format

2. Which of the following information should not be located on accession list record?

A. Investigations requested
B. Date and time of receipt of specimen
C. condition of the specimen at receipt
D. Patient marital status

3. One of the following couldn't be the specific specimen requirements to maintain sample integrity?

A. specimen volume
B. collection containers
C. transport containers and transport temperature
D. None

LAP test	Select and usingthe required *sampling tools and equipment*

Task-1.Selectthe required *sampling tools and equipment used for blood collection*
Task-2. Select the required *sampling tools and equipment used for Urine collection*
Task-3. Select the required *sampling tools and equipment used for Sputum collection*
Task-4. Select the required *sampling tools and equipment used for stool collection*

LG25:Transport and handle sample

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described in number 5 to 11.
3. Read the information written in all Information Sheets. Try to understand what are being discussed. Ask you teacher for assistance if you have hard time understanding them.
4. Accomplish all Self-check according to learning session separately
5. Ask from your teacher the key to correction (key answers) or you can request your teacher 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 next Information Sheet. However, if your rating is unsatisfactory, see your teacher for further instructions or go back to pervious Learning Activity.
7. Submit your accomplished Self-check. This will form part of your training portfolio.
8. Try to understand what are being discussed. Ask you teacher for assistance if you have hard time understanding them.
9. Accomplish the all Self-checks.
10. After you accomplish self check proceed to operation sheet if available.
11. If you perform operation procedure correctly proceeds to LAP. test if available

Information sheet-1	Confirm the number and nature of samples/items to be handled on arrival

Learning out comes (objectives): At the end of this module the trainee will be able to:-

4.1. Confirm the number and nature of samples/items to be handled on arrival

Collection of sufficient quantity is important to permit detection of parasites and to prevent rapid drying.
The stool specimen should contain at least 4 ml. Once the specimen collected; If possible, process:

- Liquid stool: < 30 minutes of passage at Room Temperature.
- Semi-formed stool: < 1 hour of passage at Room Temperature.
- Formed stool: < 24 hours of passage, $4C^{O}$

If delay is unavoidable, place in suitable preservative or transport medium

4.1.1. Macroscopic Examination

- Stool specimen is examined with the naked eye for:
- Presence of worms**:-** may have adult helminthes or segments Example: Ascaris, Taenia species, E.vermicularis and gravid Taenia species.
- Consistency (degree of moisture**)-** It varies in diet but certain clinical conditions associated with parasite presence may be suggested by particular consistencies. - It will be described as hard, formed, semi-formed and diarrheic (watery).
- Color: - any abnormal color E.g., pale yellowish passed in steatorrhoeac conditions such as giardiasis, dark or black stools occur when iron or bismuth is taken or when there is intestinal hemorrhage
- Pathologic odour Offensive, non-offensive
- Abnormal features seen (composition): mucus, blood or fat globules.
  Up on arrival the physical examination of urine usually gives hint for the subsequent urinalysis.
- Volume:-Normally, 600 – 2000 ml of urine is voided per 24 hr.
- Odor:-Normally fresh voided urine from healthy individuals has faint aromatic odor, which comes from volatile acids, normally found in urine, mostly, ammonia.
- Foam:**-**Normally when urine specimen is voided in a container, it produces small amount of white foam.
- Color: - Normally color of urine may vary within a day; in the morning it has dark yellow color while in the afternoon or evening, the color ranges from light yellow to colorless. Normal urine color varies from straw (light yellow color) to dark amber (dark yellow)
  - Appearance (Transparency):-Fresh voided urine specimen is normally clear and transparent. On long standing, due to chemical changes that occur in normal constituents of urine through time, as described in the introduction part of this lecture note, it becomes turbid.

PH:**-**A test that determine acidity, neutrality or alkalinity of a solution.
PH =7 indicates neutrality.
PH < 7 indicate acidity.
PH > 7 indicates alkalinity.

Normally, freshly voided urine pH range from 5-7 in healthy individuals, and average is pH 6**.**

Specific Gravity of Urine: **-** Specific gravity is defined as the ratio of the weight of a fixed volume of solution to that of the same volume of water at a specified temperature.

Self-Check 1	Written Test

Answer the Following Questions (2 point each)

1. Macroscopic/Physical Examination Stool specimen includes all the except

A. Presence of worms
B. Consistency (degree of moisture)
C. Pathologic odour
D. Types of parasite

2. Which of the following is not true about urine specimen?

A. Normally, freshly voided urine color is straw to dark amber.
B. It is straw (light yellow color) in the morning
C. It is dark amber (dark yellow) at afternoon.
D. None

Note: Satisfactory rating - 4 points Un satisfactory below-4 points

You can ask you teacher for the copy of the correct answers

Answer Sheet

Score _____
Rating _____

Name: _____ Date: _____

Short Answer Question

1._____
2._____

Information sheet-2	Ensure samples are matched to request format

4.2. Ensure samples are matched to request format

- Test requisition

The collection of appropriate and optimum samples is the responsibility of the laboratory, even though the actual collection process is often carried out by persons who are not part of the laboratory staff. The sample may be collected at the bedside by a nurse if the patient is being managed in a hospital. The health care provider may collect a sample in a clinic setting.

The laboratory can help to ensure good samples by providing collection information to health care personnel at the collection site, making sure that appropriate containers and collection supplies are available, defining a good labeling system and checking all samples carefully when they arrive in the laboratory.

The first step in the process of obtaining the sample is the request for testing. The laboratory must make available a test request form that specifies all the information that will be needed for proper handling and reporting.

- Essential information for the test request form includes:

✓ Patient identification;
✓ Tests requested;
✓ Time and date of the sample collection;
✓ Source of the sample, when appropriate;
✓ Clinical data, when indicated;
✓ Contact information for the health care provider requesting the test.

Collection of samples in the field for epidemiological studies should be accompanied by a form that includes the patient's name, a unique identification number, demographic information, and the patient's health status. The additional information is necessary to assist in identifying the source of an infection, and finding potential contacts.

Self-Check-2	Written Test

Answer the Following Questions (5point)

1. In laboratory sample collection what are essential information for the test request form?

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

You can ask you teacher for the copy of the correct answers

Answer Sheet

Score _____
Rating _____

Name: _____ Date: _____

Short Answer Question

1._____
_____
_____
_____
_____
_____
_____
_____

4. Apply the requirements of sample transport

4.3.1. Packaging requirements

All three categories of samples have specific packaging instructions and labeling requirements depending on their classification. All potentially hazardous material requires triple packaging.

- The primary container is a tube or vial containing the sample; it is made with either glass, or metal, or plastic. It must have a leak-proof seal; if necessary it can be wrapped with waterproof tape. The tube or vial must be labeled with a permanent marker.
- The secondary container is a watertight polyethylene box intended to protect the primary container. It is supplied with cardboard or bubble-wrap or a vial holder in which several primary containers can be placed in order to protect them. Absorbent material (gauze, absorbent paper) must be added in a sufficient quantity to absorb the fluid completely in case of breakage.
- The outer container is a strengthened cardboard box used to protect the secondary container. Both the secondary and outer containers are reusable as long as they are intact, but old labels must be removed.

4.3.2. Managing sample transport

Assure that all regulations and requirements are met when transporting samples; be aware of any national requirements that apply to samples transported by hospital or laboratory vehicles.

All personnel who package or who drive transport vehicles should be trained in the proper procedures, both for safety and for good maintenance of samples. If ICAO regulations must be met, staff must have specific training in packaging of dangerous goods.

When transporting locally, whether by ambulance, or by clinic or laboratory staff, it is important to maintain sample integrity. Assure that temperatures are controlled, using ice boxes or air conditioning, set an acceptable transport time, and monitor compliance.

There is specific packaging for samples requiring shipment on dry-ice

3. Being alert to any special needs are identified on documents accompanying the Samples/ items

4.4.1. Why Is Safety Important?

- Coming in contact with human blood or blood products is potentially hazardous.
- Safety involves taking precautions to protect you and the client against infection.
- Other people who may come in contact with testing by-products
- Protect integrity of test products
- Protect environment from hazardous material

NB:-Every specimen should be treated as though it is infectious

4.4.2. Apply Safety Practices throughout the Testing Process

- Before Testing (Pre-analytical)
  - Specimen collection
  - Specimen preparation
  - Specimen transport
- Testing (Analytical)
  - Testing
- After Testing (Post-analytical)
  - Disposal

4.4.3. Develop Personal Safe Work Habits

- Wash hands before and after testing each patient
- Wear a fresh pair of gloves with each patient
- Wear lab coat or apron
- Dispose of contaminated sharps and waste immediately after testing
- Pipetting by mouth is *strictly forbidden*
- Never eat, drink or smoke at the test site
- Keep food out of the laboratory/testing site refrigerator
- Keep work areas uncluttered and clean
- Disinfect work surfaces daily

- Restrict or limit access when working
- Keep supplies locked in a safe and secure area
- Keep emergency eye wash units in working order and within expiry date

Self-Check-4	Written Test

Answer the Following Questions (2point each)

1. Why safety is important in potentially hazardous material packaging?
   A. Protect integrity of test products
   B. Protect environment from hazardous material
   C. Other people who may come in contact with testing by-products
   D. All
2. Which of the following good Personal Safe Work Habits?
   A. Wash hands before and after testing each patient
   B. Wear a fresh pair of gloves with each patient
   C. Wear lab coat or apron

Note: Satisfactory rating -4points unsatisfactory below-4 points

You can ask you teacher for the copy of the correct answers

Answer Sheet

Score _____

Rating _____

Name: _____ Date: _____

Short Answer Question

1. _____
2. _____

4.5. Complete required documentation at handling point

4.5.1. Sample collection requirements

Sample collection and preservation will vary, depending on the test and the type of sample to be collected. The laboratory must carefully define a sample collection process for all tests it performs. The following should be considered when preparing instructions:

- Patient preparation—some tests require that the patient be fasting. There may also be special timing issues for tests such as blood glucose, drug levels, and hormone tests.
- Patient identification—the person collecting the sample must accurately identify the patient. This might be done by questioning the patient, by questioning an accompanying family member, or by the use of an identifying wrist band or other device.
- Type of sample required—Blood tests might require serum, plasma, or whole blood. Other tests might require urine or saliva. Microbiology testing deals with a variety of sample types, so specific information as to what is required for the test is needed.
- Type of container—the container for the sample is often very important, as it will affect volume and any needed additives such as anti-coagulants and preservatives. If the container does not control volume, for example as with Vacutainer tubes, this will need to be clearly specified. Some microbiology samples will require specific transport media to preserve microorganisms.
- Sample labeling—all requirements for labeling of the sample at the time of collection will need to be explained in detail in the instructions for collection.
- Special handling—some samples may require special handling, such as immediate refrigeration, protection from light or prompt delivery to the laboratory. Any important safety precautions should be explained.

Patient samples are sometimes collected by the patient themselves, for example, faecal parasitology samples. It is important that the laboratories have set protocols to ensure that appropriate collection kits with instructions for collection, safety precautions, and labeling are available for their patients. It is suggested that instructions for the patients be in the languages for the community the laboratory is serving or presented as simple easy-to-understand graphics.

Self-Check-5	Written Test

Answer the Following Questions (2point each)

1. What is the condition to be fulfilled before sample collection?

A. Patient preparation
B. Patient identification
C. Identification of types of sample
D. All

2. It is suggested that instructions of specimen collection for the patients should be in the languages for the community the laboratory is serving(True/False)

Note: Satisfactory rating -4points unsatisfactory below-4 points

You can ask you teacher for the copy of the correct answers

Answer Sheet

Score _____
Rating _____

Name: _____ Date: _____

Short Answer Question

1. _____
2. _____

Information sheet-6	Pack the samples in the specified transport containers and under the required conditions

4.6. Pack the samples in the specified transport containers and under the required conditions.

4.6.1. Need for transport

Frequently, samples are collected outside the laboratory and must be transported for subsequent processing and testing. Transport may be for a short distance, but sometimes a distant clinic or collection site requires the use of vehicles or airplanes. In addition, it may be necessary for the laboratory to ship samples to referral laboratories. In all cases, transport must be managed carefully in order to maintain integrity of the sample, giving attention to temperature, preservation needs, special transport containers and time limitations. It is also important to ensure the safety of those handling the material before, during and after transport.

4.6.2. Safety requirements

Laboratories that mail or transport samples by air, sea, rail or road between local, regional and reference laboratories, or between laboratories in other countries, must adhere to a number of regulations. These regulations are designed to deal with transportation accidents and spills, reduce biohazards and keep samples intact for testing.

4.6.3. Regulations

Regulations for transporting samples come from several sources, including:

- national transport regulations;
- International Civil Aviation Organization (ICAO), as conveyed by the International Air Transport Association;
- rail and road traffic agencies;
- Postal services.

Private courier companies may have their own requirements.

Compliance with industry standards and regulations is mandatory. Heavy fines may be imposed on personnel who violate these regulations. At risk is the safety of courier, carrier and laboratory personnel, as well as passengers.

The United Nations committee of experts, consisting of voting representatives from over 30 countries and nonvoting advisers from various organizations, makes recommendations for the transport of dangerous goods. Many countries adopt the United Nations regulations in their entirety to stand as their national dangerous goods regulations. Some countries apply variations. National authorities should provide details of their own national requirements.

4.6.4. Classification

Sample transport requirements are based on the category of samples being transported.

Infectious substances are classified as Category A or Category B. There is no direct relationship between Risk Groups and Categories A and B.

- Category A: Infectious substances capable of causing permanent disability or life-threatening or fatal disease to humans or animals.

These are assigned the following proper shipping name and UN number:

- ✓ Infectious substance affecting humans, UN 2814.
- ✓ Infectious substance affecting animals only, UN 2900.

- Category B: Infectious substances that do not meet the criteria for inclusion in Category A. They are assigned the proper shipping name Biological substance, Category B, and UN number UN 3373.

Medical or clinical wastes that contain infectious substances also need to be classified as Category A or B, depending on the infectious material and whether it is present in the culture.

- Exemptions: The United Nations Model Regulations for the Transport of Infectious Substances includes a list of exemptions, which are samples that have a minimal likelihood that pathogens are present. They do not have the same requirements for packaging and shipping as Categories A and B.

4.6.5. Packaging requirements

All three categories of samples have specific packaging instructions and labeling requirements depending on their Classification. All potentially hazardous material requires triple packaging.

- The primary container is a tube or vial containing the sample; it is made of glass, metal or plastic. It must have a leak-proof seal; if necessary it can be wrapped with waterproof tape. The tube or vial must be labeled with a permanent marker.
- The secondary container is a watertight polyethylene box intended to protect the primary container. It is supplied with cardboard or bubble-wrap, or a vial holder in which several primary containers can be placed in order to protect them. Absorbent material (gauze, absorbent paper) must be added in a sufficient quantity to absorb the fluid completely in case of breakage.
- The outer container is a strengthened cardboard box used to protect the secondary container. Both the secondary and outer containers are reusable as long as they are intact, but old labels must be removed.

Ensure that all regulations and requirements are met when transporting samples; be aware of any national requirements that apply to samples transported by hospital or laboratory vehicles.

4.6.6. Managing sample transport

All personnel who package samples or who drive transport vehicles should be trained in the proper procedures for safety and good maintenance of samples. If ICAO regulations must be met, staff must have specific training in packaging of dangerous goods.

When transporting locally, whether by ambulance, or by clinic or laboratory staff, it is important to maintain sample integrity. Ensure that temperatures are controlled, using ice boxes or air-conditioning, set an acceptable transport time and monitor compliance.

Self-Check-5	Written Test

Answer the Following Questions (2point each**)**

1. Infectious substances category capable of causing permanent disability or life-threatening or fatal disease to humans or animals.
   A. Category B
   B. Category A
   C. Category c
   D. None
2. According to United Nations Model Regulations for the Transport of Infectious Substances affecting humans sample should be coded with:-
   A. UN 2814.
   B. UN 2900
   C. Both And B
   D. None

Note: Satisfactory rating -4points unsatisfactory below-4 points

You can ask you teacher for the copy of the correct answers

Answer Sheet

Score _____
Rating _____

Name: _____ Date: _____

Short Answer Question

1. _____
2. _____

Information sheet-7	Maintain Sample integrity at all time

4. Maintain Sample integrity at all time

4.7.1. General Specimen rejection criteria

Specimen rejection is deciding not to accept specimen if the integrity of specimen is not maintained and if the information about the specific client identifiers missed on labeling .In order to maintain specimen integrity you should first identify specimen rejection criteria. Accordingly the specimen rejection criteria include:

- Unlabelled Specimens
  - ✓ Common specimen like blood, urine, swabs, sputum, stool, can be easily recollected.
  - ✓ Less common specimens like CSF, fluids, tissues, etc. are more difficult to recollect.
  - ✓ Call the person who collected it for the identification of the specimen.
  - ✓ If he/he is unable to identify the specimen, the ordering physician will be notified.
- Incorrectly labeled (mislabeled) specimens
- Use same criteria as for Unlabeled Specimens.
  - ✓ Incorrect container or Preservative
- Specimens received in an incorrect container, or without appropriate preservative, will require recollection.
- So the patient will be contacted to arrange for recollection of the specimen.
- Insufficient specimen for procedure
  - ✓ If insufficient, recollect (urine, stool, sputum, blood, etc.)
  - ✓ If the specimen is not re-collectable (CSF, fluids, etc.), the physician will be contacted to establish a priority order of tests.

Unsuitable Specimen for Procedures

- ✓ Specimens which are unsuitable for the procedure requested saliva for sputum test or specimen too long for a valid result.
- ✓ Finally, when an inappropriate specimen or unclear test request has been submitted and no option to overcome the problem it must be rejected and recorded on specimen rejection record.

4.7.2. Sample integrity

It is the specific specimen requirements. Which should include information such as?

- ✓ Specimen volume
- ✓ Collection containers
- ✓ Transport containers
- ✓ Transport temperature

If additional information is needed for the interpretation of the test results or there are specific instructions for patient preparation, they are listed along with specimen requirements. It is critical that an adequate specimen volume is submitted for analysis. The volume requested in one order should be enough for initial analysis as well as for any confirmatory tests that must be performed. If an inadequate specimen is submitted, we may not be able to perform the initial test or required confirmatory procedures. If repeat or confirmatory tests cannot be performed, the report will indicate that the specimen quantity submitted was “QNS” (Quantity Not Sufficient) for additional testing. When serum or plasma is to be submitted for analysis, it is good practice to collect a volume of blood that is 2 to2.5 times the volume of serum or plasma needed for the test. As an example, if 4 ml of serum or plasma is needed for a test, collect 8 to 10 ml of blood. If you have confirmed that the specimen collected has no

feature of specimen rejection criteria and believed that integrity of the specimen is maintained correctly, it will be recorded on specimen accession list record format. (Observe the table below)

4.7.3. Specimen accession list

Accession list is a record of all the specimens received by the laboratory for analysis and is prepared by the laboratory at the time of specimen receipt. It is records of the patient's identity including name, age, sex, location in the hospital/ medical facility, name of referring physician, investigations requested, date and time of receipt of specimen and condition of the specimen at receipt. The laboratory assigns a unique laboratory number to register each specimen received, which can be used to trace the specimen in the laboratory. The test results and remarks if any are also entered in the accession list. In laboratories handling a very large number of specimens, the accession list may be computer generated and the condition of specimen at receipt may not be recorded unless it has been rejected.

Self-Check-7	Written Test

Answer the Following Questions (2point each)

1. Which of the following is specimen is not rejection criteria?
   A. Specimens received in an incorrect container
   B. Specimen without appropriate preservative
   C. If insufficient Volume
   D. If color of specimen changed
2. Records of the patient's identity accession list including
   _____
   _____
   _____
   _____
   _____

Note: Satisfactory rating -4points unsatisfactory below-4 points

You can ask you teacher for the copy of the correct answers

Answer Sheet

Score _____

Rating _____

Name: _____ Date: _____

Short Answer Question

1. _____
2. _____

Information sheet-8	Deliver Samples to reception point

4.8. Deliver Samples to reception point

Samples are collected regularly in collection point by the Laboratory courier service and taken to the Sample processing/ Analytical Reception.

Routine samples should be delivered to the reception at all times.

NB: Urgent hospital samples including on-call requests must be sent to emergency Reception via taxi or blood bike. This is arranged by Leazes Reception staff. For out of hour's samples, these must be taken to these referral points as soon as possible after contacting the on-call Laboratory personnel.

- **Specimens from external Trusts and other organizations**

Samples from external service users can be delivered in person sent by Royal Mail or courier service.

- **High Risk Samples**

The Laboratory **must** be made aware when a specimen is high risk by labeling **both** the request form, where submitted, and sample container with a biohazard label.

It is not necessary for safety reasons to identify the patient's condition on the request form, although it will aid diagnosis, **except** in the case of known or suspected Transmissible.

Note that infectious specimens are safe to be transported by Hopper, courier or taxi when correctly packed in the UN approved triple packaging, as for other diagnostic specimens, but in this instance the outer pack must display a UN2814 'Infectious Substance' biohazard label (often pre-printed on the outer box).

All samples must be transported in compliance with the National Road Transport policy for the 'Transport of clinical specimens.

Acceptance and Rejection of specimens

The complete Sample Acceptance and Rejection Policy of medical laboratory Trust can be viewed here

Samples must be labeled promptly in close vicinity to the patient e.g. bedside or out-patient phlebotomy room.

- Essential information for the sample label:

✓ Patient's Full Name
✓ Date of birth
✓ Hospital Number or NHS number or other agreed unique identifier
✓ If known biohazard, a biohazard sticker or other alert must be attached to both request and sample.

- A single unique identifier is permitted only for specific agreed services where prior arrangements have been made with and agreed by the laboratory, such as for:

✓ Sexual health
✓ Health Surveys
✓ Clinical Research and Trials

- ✓ Unknown Patients that are emergency admissions – a specifically generated number is allowed for unknown unidentified patients seen in emergency departments. The label and request details should state 'Unknown male' or 'unknown female' together with the unique and specific emergency number.

- Essential information for the request – electronic or paper:

- ✓ Patient's Full Name
- ✓ Date of birth
- ✓ Hospital Number or other agreed unique identifier.
- ✓ Sex of patient
- ✓ Date of sample
- ✓ Patient's location
- ✓ Responsible Consultant
- ✓ Name of requesting Medical Officer/practitioner
- ✓ Relevant clinical details
- ✓ Investigations required
- ✓ If known biohazard, a biohazard sticker or other alert must be attached to both request and sample.

- **Rejection Criteria**

- ✓ Minimum essential information missing from sample or request
- ✓ Sample / request mismatch
- ✓ Unlabelled sample
- ✓ Leaking sample
- ✓ Inappropriate container
- ✓ No test requested
- ✓ Not routinely cultured (for further information check Test Directory)

- NB: When samples are rejected due to insufficient information, a report will be issued through the laboratory information system, stating that the sample has not been processed and giving details.

Samples will be stored in the laboratory for up to one week to allow the requesting practitioner time to get in touch.In such cases, a senior member of the laboratory staff will be responsible for deciding if the analysis is justified. The requesting medical officer/practitioner will be contacted to determine the necessary details.Where the missing information includes the Patient's Consultant and/or the GP Patient's location and destination for report, a printed report may be delayed or unavailable. In this case, the report may be issued to a default source (Unknown Consultant/Unknown Location) on the laboratory information system. Samples that have been rejected and not processed may be stored in the laboratory for up to one week to allow the requesting practitioner time to get in touch. This storage will be at the discretion of individual departments.

For unrepeatable samples e.g. CSF, blood culture, biopsies, aspirates, these will be processed at the discretion of a sample member of the laboratory staff. Responsibility for precious samples lacking relevant information lies with the sender. The report will include a clear disclaimer detailing the shortcomings of the sample and/or request.

Self-Check-8	Written Test

Answer the Following Questions (2point each)

Say true or false for the following questions.

1. If known biohazard, a biohazard sticker or other alert must be attached to request only but not on sample.
2. **Urgent hospital samples requests must be sent to Routinereception.**

Note: Satisfactory rating -4points unsatisfactory below-4 points

You can ask you teacher for the copy of the correct answers

Answer Sheet

Score _____

Rating _____

Name: _____ Date: _____

1. _____
2. _____

Information sheet-9	Maintain Vehicle

4.9.Maintain Vehicle

Ensure that all regulations and requirements are met when transporting samples; be aware of any national requirements that apply to samples transported by hospital or laboratory vehicles. All personnel who package samples or who drive transport vehicles should be trained in the proper procedures for safety and good maintenance of samples. If ICAO regulations must be met, staff must have specific training in packaging of dangerous goods. When transporting locally, whether by ambulance, or by clinic or laboratory staff, it is important to maintain sample integrity. Ensure that temperatures are controlled, using ice boxes or air-conditioning, set an acceptable transport time and monitor compliance.

Self-Check-8	Written Test

Answer the Following Questions (2point each)

Say true or false for the following questions.

1. Transporting of sample can be by ambulance, or by clinic or laboratory staff from collection to Diagnostic Laboratory.
2. personnel who samples drive transport vehicles should no need of training in the proper procedures for safety and good maintenance of samples

Note: Satisfactory rating -4points unsatisfactory below-4 points

You can ask you teacher for the copy of the correct answers

Answer Sheet

Score _____
Rating _____

Name: _____ Date: _____

Short Answer Question

1. _____
2. _____

4.10. Maintain Confidentiality

What is the source of health care giver duty to maintain patient confidentiality?
What is its nature and extent?

Today health care giver duty of confidentiality is outlined by the GMC. With regard to confidentiality they say 'Patients have a right to expect that information about them be held in confidence by their doctors. Confidentiality is central to trust between doctors and patients. The principles of confidentiality in modern medical practice are ethical. In order to maintain trust in the health care giver patient relationship confidentiality should be maintained unless disclosure can be justified by an interest which outweighs the patient's interest in confidentiality being maintained. Confidentiality is at the heart of the code of ethics for medicine. The GMC is predominantly concerned with a doctor's ethical duty of confidentiality but deals with breaches of confidentiality and determines whether they amount to serious professional misconduct.

From an individual point of view it is extremely important to maintain confidentiality. If confidentiality is not maintained the individual may be subjected to discrimination due to certain details of their past medical history, for example by insurers or employers. Aside from this confidentiality is at the heart of medical ethics and is essential in maintaining trust in the health professional-patient relationship. If patients are able to trust their health care giver they are more likely to seek medical help when they need it.

- Keep all client/patient information private and confidential
- Secure all records(electronic and paper records)/log books
- Restrict access to testing rooms
- When issuing the results to the clients, they should be put in a closed envelope addressed to requesting client
- Reports to the referring Lab should also be enclosed in an envelope.
- If need arises for results to be released directly to the patients, the case will be handled by the deprt heads or Designee.
- Critical results can only be communicated through the telephone to the authorized clients.

Self-Check-10	Written Test

Answer the Following Questions (2point each)

Say true or false for the following questions.

3. If confidentiality is maintained the individual may be subjected to discrimination
4. With regard to confidentiality they say Patients have a right to expect that information about them be held in confidence by their health care giver.

Note: Satisfactory rating -4points unsatisfactory below-4 points

You can ask you teacher for the copy of the correct answers

Answer Sheet

Score _____
Rating _____

Name: _____ Date: _____

Short Answer Question

1. _____
2. _____

4.11. Maintain State of transport containers

- Specimen Storage

The laboratory specimens should store at appropriate condition before, during and after transportation.

- ✓ Urine can be stored at freezer or refrigerator at +4c^{o}.
- ✓ Blood samples should be kept at +4 c^{o}.
- ✓ Serum & plasma can be stored either frozen or at +4c^{o}

Self-Check-10	Written Test

Answer the Following Questions (2point each)

Say true or false for the following questions.

1. All specimens can be stored in room temperature.
2. Serum & plasma can be stored either frozen or at +14c^{o}

Note: Satisfactory rating -4points unsatisfactory below-4 points

You can ask you teacher for the copy of the correct answers

Answer Sheet

Score _____
Rating _____

Name: _____ Date: _____

Short Answer Question

1. _____
2. _____

4.12. Request Stocks of consumable materials

4.12.1.How can a laboratory determine how much of any particular item to order?

- Quantification is a very important process that can help calculate how much is required of any particular item for a given period of time, and it is an essential part of a successful inventory management programme.
- Accurate quantification will:
  - ✓ ensure essential supplies will be available when needed
  - ✓ Prevent overstocking, which can lead to wastage of expensive materials.
- Quantification provides information for:
  - ✓ estimating annual budget requirements;
  - ✓ allowing for better planning;
  - ✓ Making decisions and monitoring performance of the inventory management system.
- Quantification is performed when making annual plans for the laboratory and this planning will take into account the usual usage of supplies and reagents.

There are times when it is important to consider how new demands on the laboratory will create a need for greater testing volume. This often occurs when new health programmes are being implemented, and in preparation for epidemics, either identified or potential.

- ✓ Consumption-based quantification

Laboratories most frequently use the consumption-based method, drawing on their experience over time. This method is based on actual consumption, so there are a number of factors to consider. For example, to determine the actual usage, it is important to also estimate how much wastage has occurred and how many expired or spoiled reagents and supplies have been discarded.

For planning, it is a good idea to consider whether any supplies or reagents have been out of stock for more than 15 days during any time of the year. This may mean that supplies are not ordered in sufficient quantities, or that the wastage or expiry is higher than predicted.

- ✓ Morbidity-based quantification

In using the morbidity-based quantification method (shown below), the laboratory must take into account the actual number of episodes, illnesses and health problems that require laboratory testing. In other words, the laboratory needs to estimate an expected frequency of the disease in question—how many cases will occur per unit of population (per 1000, per 10 000, etc.) Then, considering how many people the laboratory serves, it can estimate the total number of cases the community might reasonably expect to observe. Using standard guidelines for diagnosis and treatment, and considering how well health care providers adhere to these guidelines can help to estimate how many laboratory tests will be performed.

A good morbidity-based quantification method is more accurate than the quantification by consumption method, but it depends on accurate

4.12.2. Replenish Stocks of collecting equipment at collection centers

- Equipment and Supplies

Laboratory procedures and sampling plans should have all equipment (sampling devices) necessary to take a consistent representative sample. The lab must also have procedures on cleaning the equipment or dedicated sampling disposal devices. The cleaning procedures must effectively eliminate carryover by removing any analyte of

interest regardless of concentration of the analyte. This cleaning procedure must be validated initially and validated at any time the procedure, materials, or analyte of interest change, or there is evidence of contamination in samples.
Sampling equipment such as spoons, spatulas, forceps, syringe or transfer pipettes, or other matrix specific tools:

- Gloves (powder-free, nitrile, sterile)
- Sodium Hypochlorite (bleach) – for surface cleaning sampling tools for microbiology
- 70% Isopropyl alcohol – for surface cleaning sampling tools.
- Amber Glass containers
- Balance
- Calibrated Verification Weights appropriate to verify balance Chain of
  - ✓ Sample Labels
  - ✓ Sample Cooler/Ice (if thermal preservation required)
  - ✓ Permanent Ink Pen
  - ✓ Equipment Logbook

4.12.3. Follow the procedures for the cleaning/decontamination of equipment and vehicles

- Safety and decontamination procedures

Safety and decontamination measures protect the specimen collector and colleagues, laboratory personnel, and the patient from risks associated with specimen collection. They also reduce the risk of contaminating the samples. Universal safety precautions require that workers should handle all clinical specimens as if they were infectious. Protective equipment (gloves, eye protection, mask) should be worn and safe work practices followed to reduce exposure to potentially infective material. Proper packaging methods also ensure the safety of personnel from collection site to laboratory, even if damage occurs during transit. A first aid kit is essential, and should be readily accessible at the site of specimen collection.

Protective clothing, work premises, equipment, and materials may all become contaminated in the laboratory. Disinfection of work areas and decontamination of spills of blood or infectious body fluids is generally achieved by chemical disinfection with chlorine based solutions. As incompletely 'sterilized' material may expose both the participants in the investigation and the general public to a real risk of infection, the re-use of contaminated equipment or materials such as gloves or clothing is not recommended. Incineration or burning is the preferred method for disposing of contaminated material. Prior to disposal highly infectious equipment and materials must be disinfected. Combustible materials should be completely burned to render sterile ash, which is then buried in a deep pit.

Self-Check-10	Written Test

Choose the correct answer (2point each)

1. In requesting Stocks of consumable materials accurate quantification is important for:-
   A. Ensure essential supplies will be available when needed
   B. Prevent overstocking, which can lead to wastage of expensive materials.
   C. Allowing for better planning;
   D. All
2. A good quantification method is more accurate method if an accurate data is available
   A. morbidity-based
   B. Consumption-based
   C. Both are equal
   D. None
3. Who is protected if Safety and decontamination measures take placefrom risks associated with specimen collection..
   A. The specimen collector
   B. Laboratory personnel
   C. The patient
   D. All

LG26: Receive and log sample

Learning out comes (objectives): At the end of this module the trainee will be able to:-

- Confirm the number and nature of received *samples/items*
- Check and matching Samples with request forms before accepted
- Complete the Required documentation at handling point
- Record Date and time of samples arrival
- Enter Samples into the Laboratory Information Management System (LIMS)./log sheet
- Apply Required document tracking mechanisms
- Process 'Urgent' test requests according to enterprise requirement
- Ensuring the Security and traceability of all information, laboratory data and records
- Check pre-use and cleanliness of all items.

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described in number 5 to 11.
3. Read the information written in all Information Sheets. Try to understand what are being discussed. Ask you teacher for assistance if you have hard time understanding them.
4. Accomplish all Self-check according to learning session separately
5. Ask from your teacher the key to correction (key answers) or you can request your teacher 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 next Information Sheet. However, if your rating is unsatisfactory, see your teacher for further instructions or go back to pervious Learning Activity.
7. Submit your accomplished Self-check. This will form part of your training portfolio.
8. Try to understand what are being discussed. Ask you teacher for assistance if you have hard time understanding them.
9. Accomplish the all Self-checks.
10. After you accomplish self check proceed to operation sheet if available.
11. If you perform operation procedure correctly proceeds to LAP. test if available

Information sheet-1	Confirm the number and nature of received *samples/items*

5.1. Confirm the number and nature of received *samples/items*

The first step in the process of obtaining the sample is the request for testing. The laboratory must make available a test request form that specifies all the information that will be needed for proper handling and reporting.

- Essential information for the test request form includes:

✓ Patient identification;
✓ Tests requested;
✓ Time and date of the sample collection;
✓ Source of the sample, when appropriate;
✓ Clinical data, when indicated;
✓ Contact information for the health care provider requesting the test.

Collection of samples in the field for epidemiological studies should be accompanied by a form that includes the patient's name, a unique identification number, demographic information, and the patient's health status. The additional information is necessary to assist in identifying the source of an infection, and finding potential contacts

Information sheet-2	Record Date and time of samples arrival

5.2. Record Date and time of samples arrival

- Sample register or Log

The laboratory should keep a register (log) of all incoming samples. A master register may be kept, or each specialty laboratory may keep its own sample register. Assign the sample a laboratory identification number write the number on the sample and the requisition form. If computers are used for reports, enter the information into the computer.

- The register should include:
- ✓ Date and time of collection
- ✓ Tests to be performed.
- ✓ Date and time the sample was received in the laboratory
- ✓ Sample type
- ✓ Patient name and demographics, as required
- ✓ Laboratory assigned identification (e.g. number 276_01_09_2019)

The laboratory needs a system to allow for tracking a sample throughout the laboratory from the time it is received until results are reported. This can be done manually by careful keeping of records as follows. Confirm receipt of samples and include date and time. Label samples appropriately and keep with the test requisition until laboratory identification is assigned. Track aliquots they should be traceable to the original sample. If computers are available, maintain a database for tracking. The following information about each sample should be entered into the database:

Identification number

- Patient information
- ✓ Collection date and time
- ✓ Type of sample (e.g. urine, throat, cerebrospinal fluid for culture)
- ✓ Tests to be performed
- ✓ Name of ordering physician (or other health care provider)
- ✓ Location of patient (e.g. ward, clinic, outpatient)
- ✓ Diagnostic test results
- ✓ Time and date results are reported.

5.3. Enter Samples into the Laboratory Information Management System (LIMS)./log sheet

Register or log

The laboratory should keep a register (log) of all incoming samples. A master register may be kept, or each specialty laboratory may keep its own sample register.

Assign the sample a laboratory identification number – write the number on the sample and the requisition form. If computers are used for reports, enter the information into the computer.

- The register should include:
  - ✓ Date and time of collection;
  - ✓ Date and time the sample was received in laboratory;
  - ✓ Sample type;
  - ✓ Patient name and demographics, as required;
  - ✓ Laboratory assigned identification (e.g., number 276_01_09_2019);
  - ✓ Tests to be performed.

5.4. Apply Required document tracking mechanisms

5.4.1. Tracking system

The laboratory needs a system to allow for tracking a sample throughout the laboratory from the time it is received until results are reported.

This can be done manually by careful keeping of records.

- Confirm receipt of samples, include date and time;
- Label samples appropriately; keep with the test requisition until laboratory ID is assigned;
- Track aliquots–traceable to the original sample.

If computers are available, maintain a database for tracking. The following information about each sample should be entered into the database:

- Identification number;
- Patient information;
- Collection date and time;
- Type of sample: for example, urine, throat, cerebrospinal fluid for culture;
- Tests to be performed;
- Name of ordering physician (or other health care provider);
- Location of patient, such as ward, clinic, outpatient;
- Diagnostic test results;
- Time and date results are reported

Information sheet-5	Process 'Urgent' test requests according to enterprise requirement

5.5. Process 'Urgent' test requests according to enterprise requirement

5.5.1. Emergency (STAT) Services and Tests

Specified STAT services are available at all times. STAT laboratory tests and services are those that are needed immediately in order to manage medical emergencies. STAT test requests are given the highest priority by the Clinical Laboratory for processing, analysis and reporting. If less urgent tests are also ordered STAT, a backlog may develop and each specimen will be processed in order of receipt, thereby delaying the reports for true emergencies. A CRITICAL laboratory test is a test that is vital to patient management, requiring adherence to a defined rapid turnaround time from test ordering to results reporting. Results are reported to a responsible, licensed care giver. A critical laboratory test is distinguished from a CRITICAL VALUE or CRITICAL RESULT, which is defined as a test result that exceeds reference limits to an extreme degree that may indicate a life-threatening condition.

- Each test on the requisition and the biohazard bag containing the specimen must be marked “STAT.” In unusually critical circumstances, it is best to hand deliver the specimen to the laboratory.
- STAT specimens and specimens collected when regular messenger service is unavailable must be delivered by a ward employee, physician or special messenger.
- In order to ensure STAT processing, STAT specimens must be delivered to the STAT window. The Laboratory cannot guarantee STAT processing for STAT specimens dropped off at the ROUTINE window.
- STAT results will be telephoned to any patient-care unit lacking a computer terminal. A written record of test results telephoned to patient care areas must be made by the physician, nurse or other individual who receives the report. “Read-back” (with confirmation) of all critical results (including both stat and critical values) reported verbally or by telephone is required to verify values and assure accuracy, in accordance with Joint Commission’s *National Patient Safety Goals*.
- LabCorp defines critical values (or panic values) as laboratory test results that exceed established limit(s) (high or low) as defined by the laboratory for certain analytes as listed in the Critical (Panic) Limits. Critical results are considered life-threatening and require immediate notification of the physician, the physician's representative, the ordering entity, or other clinical personnel responsible for the patient's care.
- **Note:** Abnormal results are **not** considered critical values. Results that are outside the laboratory's established reference intervals may be considered abnormal, but the terms "abnormal" and "critical" should not be used interchangeably

Information sheet-6	Ensuring the Security and traceability of all information, laboratory data and records

5.6. Ensuring the Security and traceability of all information, laboratory data and records

5.6.1. Data Security

It is important to establish a means to protect against loss of data. For paper based systems, this will involve using safe materials for recording and storing the records properly. For computerized systems, scheduled or regular backup processes become very important.

It is of utmost importance to safeguard a patient's privacy and, in this regard, security measures must be taken to protect the confidentiality of laboratory data. Laboratory directors are responsible for putting policies and procedures in place to ensure

Confidentiality of patient information is protected.

5.6.2. Data traceability

Information management is a system that incorporates all the processes needed for effectively managing data—both incoming and outgoing patient information. The information management system may be entirely paper-based, computer-based, or a combination of both. Whatever technology is employed, information management is another of the essentials of a quality system, and is closely related to documents and records.

Remember that data, and in particular test results, are the final product of the laboratory. Laboratory directors need to ensure that the laboratory has an effective information management system in place in order to achieve accessibility, accuracy, timeliness, security, confidentiality and privacy of patient information.

When planning and developing an information management system, whether it is a manual, paper-based system, or an electronic system, there are some important elements to consider:

Important Elements

- Unique identifiers for patients and samples.
- Standardized test request forms (requisitions)
- Logs and worksheets
- Checking processes to assure accuracy of data recording and transmission
- Protection against loss of data
- Protection of patient confidentiality and privacy
- Effective reporting systems
- Effective and timely communication.

5.6.3. Laboratory Data and Records

Logs that allow for recording data at the time of arrival of the sample in the laboratory are very important, as are worksheets that document which patient samples are being tested during a given procedure. In a paper-based system, this will be a written record, usually in a bound book. For an electronic system, logs and worksheets may be generated from the computer. Thought should be given as to what information should be recorded.

There are certain points in data handling where it is easy for errors to occur, such as during manual transfer of patient data from requisition forms to logs, keyboard electronic entry of data into a computerized information system, or transcription from worksheets to reports. The laboratory should put processes in place to safeguard against errors at these points. Sometimes it may be necessary to adopt formal checking processes to ensure the accuracy of data recording and transmission of handwritten or keyed information.

One example of a simple checking process is to always have two people review data transcription to verify its accuracy. Some computerized systems have electronic checks built into the system that require duplicate entry of data. If these duplicate entries do not match, an error alert is generated to the person entering the data.

Information sheet-7	Check pre-use and cleanliness of all items.

5.7. Check pre-use and cleanliness of all items.

5.7.1. Cleaning and disinfecting work area and equipment after use

Laboratory work area and equipment should make free of contamination to minimize hazards of:

- handling
- collecting,
- Transporting
- Disposing of left over samples and unnecessary other biological materials
- Minimize hazard effect to the environment.

All left over samples and unnecessary other biological materials shall be discarded in a containers specifically designed, planned and marked for disposal of hazard wastes. Biological waste containers should not fill beyond their designed capacity. Sharps including needle, lancets, scalpels, glass and metals discarded directly to the puncture resistance containers. Rubbish and other laboratory wastes shall not allow accumulate. Filled containers shall be removed on a regular base from work area. They shall be held in a designated secure place, normally with in the laboratory area, prior to decontamination or disposal.

- Cleaning - It is a process which removes visible contamination but does not necessarily destroy microorganisms. It is necessary prerequisite for effective disinfection or sterilization. . It is accomplished manually or mechanically using water with detergents or enzymatic products. Thorough cleaning is essential before high-level disinfection and sterilization because - Inorganic and organic materials that remain on the surfaces of instruments interfere with the effectiveness of these processes.

- If soiled materials dry or roast onto the instruments, the removal process becomes more difficult and the disinfection or sterilization process less effective or ineffective. Instruments should be presoaked or rinsed to prevent drying of blood and to soften or remove blood from the instruments.

Cleaning is performed manually and mechanically to remove visible or non-visible contamination. The two essential components of manual cleaning are friction and fluidics:

- Friction(e.g., rubbing/scrubbing the dirty area with a brush)
- Fluidics (i.e., fluids under pressure) is used to remove debris from internal channels after brushing and when the design does not allow passage of a brush through a channel

The most common types of mechanical or automatic cleaners are ultrasonic cleaners, washer decontaminators, washer-disinfectors, and washer-sterilizers.

- Ultrasonic cleaning removes contamination by cavitations and implosion in which waves of acoustic energy are propagated in aqueous solutions to disrupt the bonds that hold particulate matter to surfaces
- Washer-decontaminators/disinfectors act like a dishwasher that uses a combination of water circulation and detergents to remove debris
- Washer-disinfectors are generally computer-controlled units for cleaning, disinfecting, and drying solid and hollow surgical and medical equipment
- Washer-sterilizers are modified steam sterilizers that clean by filling the chamber with water and detergent through which steam passes to provide agitation

DISINFECTION: it is a process of decontamination or removal of pathogenic microorganisms from objects, so they are safe to handle, use, or discard. To prevent cross- contamination, maintaining aseptic transportation, storage and discarding of specimen and materials is very critical and important.

Self-Check 1	Written Test

Answer the Following Questions (2 point each):

1. Sample register or Log includes the following except.
   A. Date and time of collection
   B. Date and time the sample was received in laboratory
   C. Patient name and demographics, as required
   D. All.
2. What is/are not important elements to considerwhen planning and developing an information management system?
   A. Protection against loss of data
   B. Protection of patient confidentiality and privacy
   C. Effective reporting systems
   D. none
3. What are the two essential components of manual cleaning?

   _____

   _____
4. _____is a process which removes visible contamination but does not necessarily destroy microorganisms.
5. _____is Laboratory tests and services that are needed immediately in order to manage medical emergencies.
   A. STAT
   B. Emergency
   C. A and B
   D. None

LG27:. Distribute samples

Learning out comes (objectives): At the end of this module the trainee will be able to:-

- Group Samples with similar testing requirement
- Distribute Samples to each department and maintaining sample integrity
- Distribute Request forms
- Check samples and request forms are received by laboratory personnel

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described in number 5 to 11.
3. Read the information written in all Information Sheets. Try to understand what are being discussed. Ask you teacher for assistance if you have hard time understanding them.
4. Accomplish all Self-check according to learning session separately
5. Ask from your teacher the key to correction (key answers) or you can request your teacher 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 next Information Sheet. However, if your rating is unsatisfactory, see your teacher for further instructions or go back to pervious Learning Activity.
7. Submit your accomplished Self-check. This will form part of your training portfolio.
8. Try to understand what are being discussed. Ask you teacher for assistance if you have hard time understanding them.
9. Accomplish the all Self-checks.
10. After you accomplish self check proceed to operation sheet if available.
11. If you perform operation procedure correctly proceeds to LAP. test if available

Information sheet -1	Group Samples with similar testing requirement

6.1. Group Samples with similar testing requirement

The diagnostic laboratory is divided into distinct sections that's separate the types of tests performed based on the sample type and the intended result.

The major sections of the laboratory and their functions are:

- Reception section:
  Receive all types of samples (urine, stool, blood, sputum,…etc)
- Clinical Chemistry section
  The clinical chemistry section performs hundreds of quantitative analysis on a variety of body fluids. Common chemistry procedures include testing for glucose, cholesterol, hormones, and electrolytes.
- Immunology/Serology section
  Immunologic/serologic testing evaluates antibodies and/or antigens that may be indicative of many types of infectious diseases. This is important in not only confirming a diagnosis, but also in treating and managing various conditions.
- Coagulation section
  Coagulation procedures are performed to identify possible bleeding or clotting disorders. Coagulation testing is also used to monitor anticoagulant therapy.
- Hematology section
  The hematology section performs tests that are important in diagnosing many disorders such as anemia and leukemia,
  Whole blood and body fluids are analyzed electronically and examined microscopically for abnormal cells and diseases of the blood
- Microbiology section
  The microbiology section identifies microorganisms that may be causing disease (pathogens). The microbiology department also provides information regarding appropriate antibiotics to use as treatment for various pathogens.
- Urinalysis section
  The urinalysis section screens urine samples for evidence of kidney disease or bladder infections.

  The diagnostic laboratory is equipped with devices, instrument and chemicals (reagents),----etc for performing experimental tests research activities and investigative procedure.

6.2.Distribute Samples to each department and maintaining sample integrity

Phlebotomists will distribute specimens to the appropriate sections. Communication will be given to the Technologists of priority-STAT, Timed Specimen, or routine.

The laboratory will perform the testing in the most efficient manner. Most testing will be done as soon as possible when received. A few tests are performed in batches

- emergency room orders

All emergency room lab orders will be collected and processed STAT.

The order will be given a priority of STAT at the time the order was placed in the Order Entry system. The labels will print on the STAT Label printer in the lab. These results are set to broadcast upon resulting on the Emergency Room printer as soon as they are available. The laboratory can also manually print results from ER specimens to the Emergency Room printer. This helps ensure that all laboratory testing ordered on patients from the Emergency Room will be reported in the E.R. This is especially important when an Emergency Room patient has been admitted to the hospital.

The laboratory will maintain ordering information for all emergency room patients for at least 2 years through the computer system.

- Outpatient laboratory testing

Outpatient laboratory services will be rendered to any outpatient upon presentation of a physician's order. Orders can be faxed or written and obtained for laboratory records, including the name and address of the physician or authorized person ordering the laboratory tests, diagnosis or clinical symptoms, how the testing is to be billed, all pertinent patient information, tests required, and physician's signature. All outpatients will be drawn in the Outpatient Drawing areas.

All outpatient request forms that are received in the Outpatient area contain the following information that is retrieved from the Laboratory Outpatient Requisition or a patient demographic sheet from the physician office:

The patient's name and Date of Birth

- ✓ Patient demographic information such as phone number, address, and Social Security number and/or Medicare/Medicaid number.
- ✓ The physician's name and address.
- ✓ Clinical symptoms or diagnosis.
- ✓ How tests are to be billed.
- ✓ What tests are ordered?
- ✓ The physician's signature.

All applicable patient demographics are entered into the system. All outpatient laboratory tests are ordered in the computer. The date and time of collection is also entered. The computer generates the patient's identification number and the specimen number for the tests ordered.

A phlebotomist will collect the specimen and deliver it to the Main Laboratory and enter the time received.

Results of outpatient tests are auto-faxed or manually faxed to the physician's office. Some results are printed and placed in physicians' boxes.

The lab will maintain a copy of the requisition or the printed Nursing Home Order for at least two years

- no-patient laboratory testing

No-patient laboratory testing is the testing performed on properly labeled and collected specimen from all physician offices and clinics, all Home Health Agencies, and any other caregiver that can provide such specimens. These specimens must be ordered by providers authorized by law to order Laboratory testing.

The specimens must be drawn in properly labeled specimen containers and the proper container for each test that is ordered. Flow of specimen is the same as outpatient and inpatient.

The time and date the specimen is collected and received is entered into the computer.
These specimens are brought to this lab by way of several couriers or individual home health nurses. In-house couriers and home health nurses are trained in specimen transport. The specimens must be accompanied by a signed request by an authorized healthcare provider. In the case of nursing home patients and/or home health patients, the signature resides on the patient chart at the home health or nursing home. Laboratory staff can no longer accept telephone orders; however, they can clarify orders via telephone with read-back and verify. The order can be faxed, but must be written.
As soon as the specimen arrives in the lab, the Laboratory staff must note the date and time received. When the patient is registered into the system and the tests are ordered, the date and time of receipt will then be entered into the computer. Couriers of specimens document the delivery time of the specimen on our specimen log.
Anyone receiving specimens must verify that the specimen was transported correctly and that the time and date of collection in correlation with the time and date of receipt in the Laboratory still constitute an acceptable specimen. Any unacceptable specimens will not be used for testing and will be reported on the Disposition of Unacceptable Specimens log. The physician's office or clinic is notified in order that they can recollect and resend the specimen. If the office or clinic is already closed by the time we receive the specimen, we use internal communications to inform laboratory staff to make sure the office is informed the next business day that the specimen must be recollected.

All No-Patient orders must be accompanied by a proper requisition or patient demographic sheet with the following information:

- ✓ Name of the patient.
- ✓ Patient's date of Birth.
- ✓ All patient demographic information such as phone number, address, and Social Security number or Medicare/Medicaid number.
- ✓ Physician's or Care giver's name and address.
- ✓ Time and date specimen was drawn.
- ✓ Time brought to the lab should be noted by laboratory personnel taking specimen from the courier.
- ✓ Tests that are ordered.
- ✓ Clinical symptoms and symptoms or diagnosis.
- ✓ How tests are to be billed. (To: the patient, insurance, the physician or client, or Medicare /Medicaid.
- ✓ The physician's name and information
- ✓ Whether the patient is male or female.
- ✓ Whether the patient is fasting or not, if applicable.
- ✓ Must include any specific clinical information if applicable for certain testing, such as prenatal screening tests, semen analysis, etc.

_If specimen is unacceptable and cannot be used for testing; the disposition of that specimen is documented on the Disposition of Unacceptable Specimens log. The appropriate office/provider/ home health is contacted about the unacceptable specimen.

_If the specimen is billed as an Industrial billing, the requisition is maintained for 10 years, as these are not maintained in HIM.

- verbal orders:

Any time a physician or physician's office calls and adds tests to a previous requisition, or needs to give a new order, the office must be able to fax a written order, immediately. we can no longer accept verbal orders, except from nursing homes and then we must have a faxed order or write the order on our form.

Information sheet -3	Distributing Request forms

6.3. Distributing Request forms

Request forms are important means of communication between physicians and diagnostic service providers. Pre-analytical errors account for over two thirds of errors encountered in diagnostic service provision. The importance of adequate completion of request forms is usually underestimated by physicians which may result in medical errors or delay in instituting appropriate treatment.

All requests for routine laboratory procedures for Inpatients, Emergency Room patients, Observation patients, and Day surgery, and skilled bed patients must be requested through the Order Entry System. All Order Entry request labels contain the patient name, Date of Birth, hospital identification number, medical record number, physician, patient's room number, the date and time the test is to be done, and the tests ordered.

Order Entry requests automatically flow to the laboratory module. When the orders are placed, Labels/Orders automatically print in the laboratory. A specimen number is assigned per specimen at the time the labels print. These specimen numbers are used to enter results and track that particular specimen. The time the specimen is collected and received is entered into the computer when brought to the lab.

Requisitions for STAT procedures are sent through the Order Entry System. Nursing units should order those tests with the STAT priority.

All specimens not collected by laboratory personnel will also be ordered through the Order Entry system. When the order is placed, properly answered queries will cause the specimen label to print at the ordering site instead of in the lab. The specimen must always be labeled in the presence of the patient and is sent to the lab for testing. The date and time, if applicable, that the specimen is collected, should be noted. Time received is entered into the computer when personnel in the laboratory receive the specimen.

The laboratory will maintain requisition/Order Entry information for at least 2 years through the computer system.

Information sheet -4	Check samples and request forms are received by laboratory personnel

6.4. checking samples and request forms are received by laboratory personnel

Test requisition forms will be provided when ordering tests through the lab. Forms for urine specimens are different from the oral fluid test request forms. Please use the appropriate form for the specimen type being sent.
The sample cannot be processed without the information supplied on the test request form. if the test request form does not accompany the specimen, testing will be delayed.
For each specimen, the form should be completed with a water-resistant marker, such as a blue or black ball point pen (red color is not recommended since it tends to rub off).

- urine d screen type

Check the box indicating the reason the donor is being tested and note the temperature of the specimen.

- Security seal after completing the form, place the security seal over the top of the cap, down the sides of the bottle. Have the donor initial the security seal.
- specimen label

Indicate the following information on the label:

- ✓ Please indicate which test(s) or panel is to be ordered by placing a check mark in the appropriate box or by writing the test on the "other" line. Specific tests should be written on the request line.
- ✓ donor identification, collection date, and collector
- donor information & collector verification

The donor will enter his/her signature, printed name, date collected and donor id. The collector will verify the information provided by the donor and validate that the specimen was collected correctly.

- specimen label
- ✓ indicate the following information on the label:
- ✓ date that the specimen was collected
- ✓ donor identification § collector identification
- test requested
- ✓ Please indicate which test(s) or panel is to be ordered by placing a check mark in the appropriate box or by writing the test on the "other" line.
- ✓ Specific confirmation tests should be written on the request line.

- Chain of laboratory
  Indicate the following information on the chain of custody section of the label:
  - ✓ Date that the specimen was collected
  - ✓ Collector initials § collector comments
  - ✓ Do not put test requests in this section

Self-Check 1	Written Test

Answer the Following Questions (2 point each):

1. What is the type of order will be given a priority of STAT at the time the order was placed in the Order Entry system
   A. Emergency
   B. Verbal
   C. Outpatient
   D. No patient laboratory
2. Laboratory requests for laboratory procedures for Inpatients should include
   A. patient name
   B. Date of Birth
   C. Hospital identification number
   D. Medical record number
   E. Al
3. Laboratory Test requisition forms should be provided by Laboratory personnel when ordering tests through the lab(True/False).
4. Outpatient laboratory services will be rendered to only emergency upon presentation of a physician's order(True/False).
5. If the test request form does not accompany the specimen label what measure do you take?

LG28: Prepare sample for testing.

Learning out comes (objectives): At the end of this module the trainee will be able to:-

- Separation of the samples Physically
- Separation of the samples Chemically
- Preparing Sub-samples and back-up sub-samples that are representative
- Labeling of all sub-samples to ensure traceability and stored in accordance with SOPs.
- Distributing Sub-samples to defined work stations maintaining sample integrity and traceability requirements.
- Sample conditions are monitored and controlled before, during and after processing.
- Defining the preparation and safety procedures are followed to limit hazard or contamination to samples, self, work area and environment.

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described in number 5 to 11.
3. Read the information written in all Information Sheets. Try to understand what are being discussed. Ask you teacher for assistance if you have hard time understanding them.
4. Accomplish all Self-check according to learning session separately
5. Ask from your teacher the key to correction (key answers) or you can request your teacher 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 next Information Sheet. However, if your rating is unsatisfactory, see your teacher for further instructions or go back to pervious Learning Activity.
7. Submit your accomplished Self-check. This will form part of your training portfolio.
8. Try to understand what are being discussed. Ask you teacher for assistance if you have hard time understanding them.
9. Accomplish the all Self-checks.
10. After you accomplish self check proceed to operation sheet if available.
11. If you perform operation procedure correctly proceeds to LAP. test if available

Information sheet-1	Separation of the samples Physically

7.1. Separation of the samples physically

Types of Clinical Samples

Clinical samples are mainly distinguished into two types: solid or liquid. Solid samples include pieces of tissues harvested during biopsies or surgery and can beeitherfreshorfixedinafixative.Liquidsamplesincludebodilyfluidssuchas bloodorurine.Dependingonthetypeofdownstreamprocessingrequired,differentadditivesmaybeaddedtoliquidsamples.Th issectionbrieflydescribeseach category and provides information on the types of cells typically found in each category.

Information sheet-2	Separation of the samples chemically

7.2. Separation of the samples chemically

Wide variety of specimen type may be collected for store:-

- Blood and blood product/Fractions (Plasma, serum, Buffy coat and red cell)
- Tissue (from surgery Autopsy and transplant)
- Urine, saliva/buccal specimen

Information sheet-3	Preparing Sub-samples and back-up sub-samples that are representative

7.3. Preparing Sub-samples and back-up sub-samples that are representative

If repeat or confirmatory tests cannot be performed, the report will indicate that the specimen quantity submitted was “QNS” (Quantity Not Sufficient) for additional testing. When serum or plasma is to be submitted for analysis, it is good practice to collect a volume of blood that is 2 to2.5 times the volume of serum or plasma needed for the test. As an example, if 4 ml of serumor plasmais needed for a test, collect 8 to 10 ml of blood. If you have confirmed that the specimen collected has no feature of specimen rejection criteria and believed that integrity of the specimen is maintained correctly, it will be recorded on specimen accession list record format.

Information sheet-4	Labeling of all sub-samples to ensure traceability and stored in accordance with SOPs.

7.4. Labeling of all sub-samples to ensure traceability and stored in accordance with SOPs.

A backup sample is one that is taken and stored in case the sample is needed. The backup sample may be an aliquot of the primary sample or may be a second sample taken at the same time.

Step-1 Prepare subsample as a backup

- Preparing a subsample as a backup requires that:
  - ✓ The subsample is representative of the original sample
  - ✓ Neither the subsample nor the original sample are contaminated in any way
  - ✓ Contamination to self, the work area or the environment is avoided
  - ✓ The subsample is clearly labelled to indicate its origin and relationship to the original sample
  - ✓ The subsample is stored correctly to maintain its integrity
  - ✓ The subsample is of the appropriate weight or volume to allow it to be used for backup testing if required
  - ✓ The subsample is stored in such a way as to be readily identifiable and retrievable.

- Step 2.Label backup sample(s) and record information to maintain chain laboratory.

  - ✓ You will remember that when you collected the samples from collection site (Task 2, Step 4) you followed the Chain of laboratory protocol, and that Lab has a Chain of SOP and a Chain of log Sheet.
  - ✓ Review the Chain of laboratory Requirements in the SOP: Chain of laboratory Requirements (in the Methods Manual), to identify the special labels and recording of information a backup sample will require.

Information sheet-5	Distributing Sub-samples to defined work stations maintaining sample integrity and traceability requirements.

7.5. Distributing Sub-samples to defined work stations maintaining sample integrity and traceability requirements.

When organizing laboratory work space, divide the laboratory into areas with different access control in order to separate patients from biological samples. Where samples are actually processed, plan for spatial organization that ensures the best service.

- For optimal organization of the laboratory, consider.

✓ Delineation of laboratory activities—Care should be taken to either group related activities in a single room, or to clearly delineate bench space for specific activities. Measures must be taken to prevent cross-contamination of samples.

✓ Location of service rooms—Service rooms to accommodate autoclaves, sinks for cleaning glassware, preparation and sterilization of culture media, and others, should be located in a central area to minimize distances and facilitate circulation paths of materials, samples, and goods. A responsible staff member should be designated to oversee cleaning and maintenance of the service rooms.

✓ Location of activities with specific requirements, such as: o molecular biology—needs to be located in a separate space, with at least two rooms, so that preparation of DNA extracts is not performed in the same room as where the subsequent steps (preparation of reagent mixes and DNA amplification) are performed; o fluorescence microscopy—requires a dark room with proper ventilation; it must not be used for storage of stock materials and other chemicals; o UV illumination systems for DNA gel photography—requires a dark room and appropriate eye protection equipment.

Information sheet-6	Sample conditions are monitored and controlled before, during and after processing.

7.6. Sample conditions are monitored and controlled before, during and after processing.

- Sample management components

Written policies for sample management must be established and reflected in the Laboratory Handbook. Components to be addressed include:

- ✓ Information needed on requisitions or forms
- ✓ handling urgent requests
- ✓ Collection, Labeling, preservation and transport
- ✓ Safety practices (leaking or broken containers, contaminated forms, other biohazards)
- ✓ Evaluating, processing, and tracking samples
- ✓ storage, retention, and disposal.

Information sheet-7	Defining the preparation and safety procedures are followed to limit hazard or contamination to samples, self, work area and environment.

7.7. Defining the preparation and safety procedures are followed to limit hazard or contamination to samples, self, work area and environment.

- Safety management programme

Often, the responsibility for developing a safety programme and organizing appropriate safety measures for the laboratory is assigned to a laboratory safety officer. In smaller laboratories, the responsibility for laboratory safety may fall to the laboratory manager or even to the quality officer.
The steps for designing a safety management programme include:

- ✓ Developing a manual to provide written procedures for safety and biosafety in the laboratory;
- ✓ Organizing safety training and exercises that teach staff to be aware of potential hazards and how to apply safety practices and techniques—training should include information about universal precautions, infection control, chemical and radiation safety, how to use personal protective equipment (PPE), how to dispose of hazardous waste, and what to do in case of emergencies;
- ✓ Setting up a process to conduct risk assessments—this process should include initial risk assessments, as well as ongoing laboratory safety audits to look for potential safety problems.

- General safety equipment

The safety officer should be assigned responsibility for ensuring that there is an adequate supply of appropriate equipment for safety and biosafety, such as:

- ✓ PPE
- ✓ Fire extinguishers and fi re blankets
- ✓ Appropriate storage and cabinets for flammable and toxic chemicals
- ✓ Eye washers and emergency shower
- ✓ Waste disposal supplies and equipment
- ✓ First aid equipment.

- Standard safety practices

Policies should be put in place that outline the safety practices to be followed in the laboratory.
Standard laboratory safety practices include:

- ✓ Limiting or restricting access to the laboratory
- ✓ Washing hands after handling infectious or hazardous materials and animals, after removing gloves, and before leaving the laboratory
- ✓ Prohibiting eating, drinking, smoking, handling contact lenses, and applying cosmetics in work areas;
- ✓ Prohibiting mouth pipetting
- ✓ Using techniques that minimize aerosol or splash production when performing procedures—biosafety cabinets should be used whenever there is a potential for aerosol or splash creation, or when high concentrations or large volumes of infectious agents are used

- ✓ Preventing inhalation exposure by using chemical fume hoods or other containment devices for vapours, gases, aerosols, fumes, dusts or powders
- ✓ Properly storing chemicals according to recognized compatibilities—chemicals posing special hazards or risks should be limited to the minimum quantities required to meet short-term needs and stored under appropriately safe conditions (i.e. flammables in flammable storage cabinets)—chemicals should not be stored on the floor or in chemical fume hoods
- ✓ Securing compressed gas cylinders at all times
- ✓ Decontaminating work surfaces daily
- ✓ Decontaminating all cultures, stocks and other regulated wastes before disposal via autoclave, chemical disinfection, incinerator or other approved method
- ✓ Implementing and maintaining an insect and rodent control programme
- ✓ Using PPE such as gloves, masks, goggles, face shields and laboratory coats when working in the laboratory
- ✓ Prohibiting sandals and open-toed shoes to be worn while working in the laboratory

- Waste management

- ✓ Laboratory waste management is a critical issue. All potentially harmful and dangerous materials (including liquids and radioactive materials) must be treated in a specific way before disposing. Separate waste containers should be used depending on the nature of the waste, and must be clearly identified by a colour code. Specific attention should be given to the management of potentially harmful contaminated waste such as sharps, needles or broken glassware. Sharps containers must be available on work benches so they are conveniently accessible to staff. Disposing of chemical, biological and other wastes according to laboratory policies.

Self-Check 1	Written Test

Answer the Following Questions (2 point each):

1. Which of the following is/are blood and blood product/Fractions
   A. Plasma
   B. Serum
   C. Buffy coat and red cell)
   D. All

2. What are the two main types of specimen?
3. List at least five Standard laboratory safety practices in laboratory.

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

You can ask you teacher for the copy of the correct answers

Answer Sheet

Score _____
Rating _____

Name: _____ Date: _____

Short Answer Question

1._____

2._____

3._____
_____
_____
_____
_____

4._____
_____
_____
_____
_____
____

LG29: Maintain safe work environment

Learning out comes (objectives): At the end of this module the trainee will be able to:-

- Established work practices and PPE are used to ensure personal safety and that of others.
- Understand Environmental impacts of sampling and generation of waste are minimized.
- Cleaning all equipment, containers, work area and vehicles according to enterprise procedures.
- Avoiding hazards due to laboratory equipment before storage.
- Ensured the safe collection of all hazardous for waste disposal
- Cleaning up Splashes and spillages immediately using appropriate techniques andprecautions.
- Segregate all laboratory wastes in accordance with safety policy and waste disposal
- Dispose all waste in accordance with enterprise procedures
- Use appropriate protective equipment to ensure personal safety when sampling, processing, transferring or disposing of samples.
- Report all accidents and spillages to supervisor.

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described in number 5 to 11.
3. Read the information written in all Information Sheets. Try to understand what are being discussed. Ask you teacher for assistance if you have hard time understanding them.
4. Accomplish all Self-check according to learning session separately
5. Ask from your teacher the key to correction (key answers) or you can request your teacher 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 next Information Sheet. However, if your rating is unsatisfactory, see your teacher for further instructions or go back to pervious Learning Activity.
7. Submit your accomplished Self-check. This will form part of your training portfolio.
8. Try to understand what are being discussed. Ask you teacher for assistance if you have hard time understanding them.
9. Accomplish the all Self-checks.
10. After you accomplish self check proceed to operation sheet if available.
11. If you perform operation procedure correctly proceeds to LAP. test if available

8.1. Establishing safe work practices and using PPE

8.1.1. safe working practices

- Personal hygiene measures and wearing of safe footwear.
- Regulations concerning the wearing, storing, decontamination and laundering of protective clothing.
- Preventing laboratory acquired infection including regulations to avoid the accidental:
  - ✓ Ingestion of pathogens,
  - ✓ Inhaling of pathogens,
  - ✓ Inoculation of pathogens.
- What to do when there is a spillage of a specimen or liquid culture.
- Safety rules concerning the handling and storage of chemicals and reagents that are flammable, oxidizing, toxic, harmful, irritant, and corrosive, and how to manage chemical spillages.
- What to do when there is a glass breakage.
- How to pipette and dispense safely.
- Safe operation of manual, electrical, and battery operated laboratory equipment.
- Working tidily, use of racks, and rules to prevent the floor and benches from becoming cluttered and exits obstructed.
- Use of protective gloves, goggles, face shield, dust mask, eyewash bottle.
- How to control noise levels and other causes of loss of concentration.

8.1.2. Personal Protective Equipment

Students, teachers and laboratory staff, when working in the laboratory, should wear suitable personal protective equipment (PPE) in all circumstances wherever there is any potential risk of bodily injury. All PPE should be kept clean and properly maintained in a serviceable condition. Defective PPE should be replaced immediately. The Guidance Notes on Personal Protective Equipment (PPE) for Use and Handling of Chemicals (http://www.labour.gov.hk/eng/public/os/C/equipment.pdf) issued by the Labour Department provides a practical guide for selection of suitable PPE for use and handling of chemicals in the science laboratory.

Each laboratory should be equipped with enough safety spectacles

1. Safety eye Goggles
2. Face Shield
3. Protective/Disposable gloves
4. Disposable Nitrile gloves
5. Gown
6. Apron
7. Boat

8.2. Minimizing Environmental impacts of sampling and waste generation

8.2.1. Ways to Minimize Waste from a Laboratory

Just as the world doesn't have an infinite capacity to deal with hazardous wastes, neither does the university have an infinite budget to pay for them. It is critical that a laboratory does everything it can to reduce the amount of hazardous waste it produces. The following steps will help reduce our generation of hazardous waste. Consider them all when planning or revising your work.

- Micro scale experiments whenever possible.
- Purchase the smallest quantity of chemicals needed (unused chemicals turn into hazardous waste, which is nearly always more expensive that any money saved by buying the "larger size".
- If you need a small amount of chemical or just need some to try out an experiment.
- Substitute less hazardous chemicals for hazardous items
- Minimize the use of heavy metals as they are particularly expensive to dispose of (a good start is to substitute "No-chromix" for chromic acid.)
- Use older items in your inventory before newer items.
- Check your inventory frequently to maintain your materials in good condition. Ethyl ether that has expired is MUCH more expensive to get rid of that ethyl ether that has NOT reached its expiration date.
- Eliminate mercury-containing devices, such as thermometers and manometers, replacing them with non-mercury alternatives.

Hazardous

We try to do our work in the most environmentally sound fashion possible. As a result, we have a number of programs in place to handle materials that are particularly damaging to the environment or that occupy lots of landfill space. Please look at the "recycling" page of the EH&S website and also the Green Practices Committee's website **www.cmu.edu/environment/get-involved/committee/**

When you look at the things your lab produces as waste, consider these four activities in this order:

Reduce Can you reduce the amount of waste produced?

Reuse Can you reuse any of the waste produced (perhaps as a cleaning rinse?)

Recycle Can any of the materials be recycled rather than being landfilled?

Recover Can any of the components of the materials be recovered and used again?

8.3. Cleaning all equipments, containers, work area and vehicles

Local environmental decontamination

Decontamination of the laboratory space, its furniture and its equipment requires a combination of liquid and gaseous disinfectants. Surfaces can be decontaminated using a solution of sodium hypochlorite (NaOCl); a solution containing 1 g/l available chlorine may be suitable for general environmental sanitation, but stronger solutions (5 g/l) are recommended when dealing with high-risk situations. For environmental decontamination, formulated solutions containing 3% hydrogen peroxide (H2O2) make suitable substitutes for bleach solutions.

Rooms and equipment can be decontaminated by fumigation with formaldehyde gas generated by heating paraformaldehyde or boiling formalin. This is a highly dangerous process that requires specially trained personnel. All openings in the room (i.e. windows, doors, etc.) should be sealed with masking tape or similar before the gas is generated. Fumigation should be conducted at an ambient temperature of at least 21C^{o} and a relative humidity of 70%. (See also section on Decontamination of biological safety cabinets in this chapter.) After fumigation the area must be ventilated thoroughly before personnel are allowed to enter. Appropriate respirators must be worn by anyone entering the room before it has been ventilated. Gaseous ammonium bicarbonate can be used to neutralize the formaldehyde.

Fumigation of smaller spaces with hydrogen peroxide vapor is also effective but requires specialized equipment to generate the vapor.

Information sheet-4	Avoiding Hazards due to laboratory equipment

8.4. Avoiding Hazards due to laboratory equipment

- Introduction

Definitions of terms Safety: is a prevention and protection of workers and working chemical, physical, ergonomically and psychological hazards known to cause accident and injuries at work. Containment:-control area of safety.

Safe work environment

Laboratory working area can be defined as accomplish laboratory tasks (specimen collection areas, testing areas & storage areas) without contamination.

In general, working areas in clinical laboratory requirements related to the working area.

Information sheet-5	Safe collection of all hazardous wastes

8.5. Safe collection of all hazardous wastes

8.5.1. Waste Management

Laboratory waste management is a critical issue. All potentially harmful and dangerous materials (including liquids and radioactive materials) must be treated in a specific way before disposing. Separate waste containers should be used depending on the nature of the waste, and must be clearly identified by a color code. Specific attention should be given to the management of potentially harmful contaminated waste such as sharps, needles, or broken glassware. Sharps containers must be available on the work benches so they are conveniently accessible to staff. Many labels that give warnings and instructions for safety precautions are internationally recognized and can be found at the following websites:
http://www.ehs.cornell.edu/lrs/lab_dot_labels/lab_dot_labels.cfm http://ehs.unc.edu/labels/bio.shtml
http://www.safetylabel.com/safetylabelstandards/iso-ansi-symbols.php
All materials exposed to blood and body fluids are to be discarded into the Biohazard containers on the bench tops, which will then be closed with a twist tie and disposed properly. The safety officer will inspect the day-to- day cleaning of the laboratory, countertops, glassware, and equipments.
Waste handling Waste is anything that is to be discarded. In laboratories, decontamination of wastes and their ultimate disposal are closely interrelated. In terms of daily use, few if any contaminated materials will require actual removal from the laboratory or destruction. Most glassware, instruments and laboratory clothing will be reused or recycled. The overriding principle is that all infectious materials should be decontaminated, autoclaved or incinerated within the laboratory. The principal questions to be asked before discharge of any objects or materials from laboratories that deal with potentially infectious microorganisms or animal tissues are:

- ✓ Have the objects or materials been effectively decontaminated or disinfected by an approved procedure?
- ✓ If not, have they been packaged in an approved manner for immediate on-site incineration or transfer to another facility with incineration capacity?
- ✓ Does the disposal of the decontaminated objects or materials involve any additional potential hazards, biological or otherwise, to those who carry out the immediate disposal procedures or who might come into contact with discarded items outside the facility?

Decontamination Steam autoclaving is the preferred method for all decontamination processes. Materials for decontamination and disposal should be placed in containers, e.g. autoclavable plastic bags, that are colour-coded according to whether the contents are to be autoclaved and/or incinerated. Alternative methods may be envisaged only if they remove and/or kill microorganisms.
Handling and disposal procedures for contaminated materials and wastes An identification and separation system for infectious materials and their containers should be adopted. National and international regulations must be followed. Categories should include:

- Non-contaminated (non-infectious) waste that can be reused or recycled or disposed of as general, “household” waste
- Contaminated (infectious) “sharps” – hypodermic needles, scalpels, knives and broken glass; these should always be collected in puncture-proof containers fitted with covers and treated as infectious
- Contaminated material for decontamination by autoclaving and thereafter washing and reuse or recycling
- Contaminated material for autoclaving and disposal
- Contaminated material for direct incineration.

- Sharps

After use, hypodermic needles should not be recapped, clipped or removed from disposable syringes. The complete assembly should be placed in a sharps disposal container. Disposable syringes, used alone or with needles, should be placed in sharps disposal containers and incinerated, with prior autoclaving if required. Sharps disposal containers must be puncture-proof/-resistant and must not be filled to capacity. When they are three-quarters full they should be placed in "infectious waste" containers and incinerated, with prior autoclaving if laboratory practice requires it. Sharps disposal containers must not be discarded in landfills.

- Contaminated (potentially infectious)materials for autoclaving and reuse

No precleaning should be attempted of any contaminated (potentially infectious) materials to be autoclaved and reused. Any necessary cleaning or repair must be done only after autoclaving or disinfection.

- Contaminated (potentially infectious) materials for disposal

Apart from sharps, which are dealt with above, all contaminated (potentially infectious) materials should be autoclaved in leak proof containers, e.g. autoclavable, colour-coded plastic bags, before disposal. After autoclaving, the material may be placed in transfer containers for transport to the incinerator.

If possible, materials deriving from healthcare activities should not be discarded in landfills even after decontamination. If an incinerator is available on the laboratory site, autoclaving may be omitted: the contaminated waste should be placed in designated containers (e.g. colour-coded bags) and transported directly to the incinerator. Reusable transfer containers should be leakproof and have tight-fitting covers. They should be disinfected and cleaned before they are returned to the laboratory for further use.

Discard containers, pans or jars, preferably unbreakable (e.g. plastic), should be placed at every work station. When disinfectants are used, waste materials should remain in intimate contact with the disinfectant (i.e. not protected by air bubbles) for the appropriate time, according to the disinfectant used. The discard containers should be decontaminated and washed before reuse.

Incineration of contaminated waste must meet with the approval of the public health and air pollution authorities, as well as that of the laboratory biosafety officer.

8.6. Cleaning splashes and spillages immediately by using appropriate techniques

When surfaces are contaminated by biological spills, the appropriate actions to take are:

- Define/isolate the contaminated area.
- Alert coworkers.
- Put on appropriate PPE.
- Remove glass/lumps with forceps or scoop.
- Apply absorbent towel(s) to the spill; remove bulk and reapply if needed.
- Apply disinfectant to towel surface.
- Allow adequate contact time (20 minutes).
- Remove towel, mop up, and clean the surface with alcohol or soap and water.
- Properly dispose of materials.
- Notify the supervisor, safety officer, and other appropriate authorities.

Disinfectant:-

For most spills, use a 1:50 solution (1 g/l chlorine) of household bleach (sodium hypochlorite solution containing 50 g/l chlorine).

For spills containing large amounts of organic material, use a 1:10 solution (5 g/l chlorine) of household bleach, or an approved mycobactericidal.

- ✓ Suggested sources of mycobactericidals are registered with the United States of America Environmental Protection Agency (http://www.epa.gov/oppad001/chemregindex. htm). Alcohols are not recommended as surface decontaminating agents because they evaporate quickly, thus decreasing contact time.

If laboratory personnel become contaminated with biological hazards due to splashes or spills, immediate steps to take include:

- ✓ Clean exposed skin or body surface with soap and water, eyewash (for eye exposures) or saline (for mouth exposures).
- ✓ Apply first aid and treat as an emergency.
- ✓ Notify supervisor, safety officer, or security desk (after hours).
- ✓ Follow appropriate reporting procedures.
- ✓ Report to physician for treatment or counseling.

Information sheet-7	Segregating all laboratory wastes in accordance with safety policy

8.7. Segregating all laboratory wastes in accordance with safety policy

As a waste generator, you must assure that wastes are collected in a manner that segregates chemicals that could potentially react when mixed. In general, you should have separate containers for each compatible waste stream. Collect acids with acids, bases with bases, etc.

Once a hazardous waste is generated, federal and state regulations stipulate that the hazardous waste be managed according to statutory requirements. This includes putting the waste in appropriate containers, labeling the containers with a completed hazardous waste label, and properly storing the hazardous waste containers in designated areas. While you are accumulating waste from your process, the waste container must be maintained in a Satellite Accumulation Area (SAA) or Waste Accumulation Area (WAA**)**. Determining if you need to store your hazardous waste in a SAA or a WAA depends on the type, quantity and generation rate for your hazardous waste.

8.8. Dispose all waste in accordance with enterprise procedures

Waste Management

Laboratory waste management is a critical issue. All potentially harmful and dangerous materials (including liquids and radioactive materials) must be treated in a specific way before disposing. Separate waste containers should be used depending on the nature of the waste, and must be clearly identified by a color code. Specific attention should be given to the management of potentially harmful contaminated waste such as sharps, needles, or broken glassware. Sharps containers must be available on the work benches so they are conveniently accessible to staff.Many labels that give warnings and instructions for safety precautions are internationally recognized and can be found at the following websites:

- Needles and sharps

Needles, broken glass, and other sharps need to be handled and disposed of appropriately to prevent risks of infection to laboratory and housekeeping (custodial) staff. For proper disposal of sharps the following instructions should be followed.

- ✓ Needle recapping is not advisable or necessary. If recapping is crucial, the correct procedure is for the person doing the recapping to keep one hand behind the back, and using the other hand to scoop the cover onto the needle.
- ✓ Put sharps in a puncture-resistant, leak-proof, sharps container. Label the container with the word, "SHARPS". If the sharps are not biohazardous, deface any BIOHAZARD markings or symbols, and then seal the container tightly.

Laboratory glass and plastic ware are not considered to be sharps for disposal purposes. Laboratory glass (including plastic ware) is any item that could puncture regular waste bags and therefore endanger waste handlers. Laboratory glass must be placed in sturdy cardboard boxes for safety during transport through the building. Any cardboard box may be used, provided it is sturdy and of a size that will not weigh more than 40 pounds when full.

Contaminated laboratory glass must be appropriately decontaminated prior to disposal.

Never use boxes for the disposal of:

- ✓ Sharps;
- ✓ Biohazardous materials that have not been autoclaved;
- ✓ Liquid wastes;
- ✓ Chemically contaminated laboratory glassware / plastic ware;
- ✓ Chemical containers that cannot be disposed of as regular solid waste.

- Chemical hazards

Exposure to toxic chemicals poses a real threat to the health and safety of laboratory staff. To prevent or reduce incidents caused by exposure to toxic chemicals, all chemicals, including solutions and chemicals transferred from their original containers, should be labeled with their common names, concentrations, and hazards. Additional information such as the date received, date opened, and date of expiration should also be recorded.

It is crucial that chemicals be stored properly. Store corrosive, toxic, and highly reactive chemicals in a well-ventilated area, and store chemicals that can ignite at room temperature in a flammables cabinet.

Radiochemical require special precautions, and need dedicated benches with specific bench covers for manipulation of radiolabeled elements. Specific storage areas for radioactive materials are needed. These must provide appropriate protection (plexiglass, lead) and specific waste containers, depending on the chemical nature of waste and radio elements.

Information sheet-9	Use appropriate protective equipment to ensure personal safety when sampling, processing, transferring or disposing of samples.

8.9. Use appropriate protective equipment to ensure personal safety when sampling, processing, transferring or disposing of samples.

Basic information

The major routes in which laboratory staffacquire work-related infections are:

- ✓ Inhalation of aerosols generated by accident or by work practices;
- ✓ Percutaneous inoculation;
- ✓ Contact between mucous membranes and contaminated material;
- ✓ Accidental ingestion.

To reduce the risk of these occurrences, it is imperative that staff have access to personal protective equipment (PPE), be trained in how to properly use it, and habitually use the PPE while working in the laboratory. Approved goggles, face shields, splatter guards, masks, or other eye and face protection should be worn when handling infectious or other hazardous materials outside the biosafety cabinet.

- Hand protection

Gloves should be worn in all instances, and be available to laboratory staff on a routine basis. Effective use of gloves, however, relies on two simple practices.

- ✓ Remove gloves when leaving the working area to prevent contamination of other areas such as the telephone, door handles, and pens.
- ✓ Never re-use gloves. Do not attempt to wash or decontaminate gloves — they will develop microcracks, become more porous, and lose their protective properties. After use, gloves must be disposed of in the contaminated waste.

- Face protection

Goggles—the projection of droplets is a frequent occurrence when opening patient sample containers. Protection of eyes and other mucous membranes is strongly recommended to prevent contact with these droplets; the use of goggles will protect eyes and should be systematic for this step.
Another way to protect eyes and other mucous membranes from projection is to manipulate the specimen tubes behind a screen, glass or plexiglass, or face shield. This equipment should be compulsory as well, when manipulating dangerous liquids, such as liquid nitrogen or some solvents.
Contact lenses do not offer protection from splashes. Additional eye protection must be worn with contact lenses.
Masks—Masks serve as a barrier when splashes or sprays occur.

- Body protection

Laboratory coats are compulsory in all instances in the regular level 2 laboratory. Be aware of the composition of fabrics, as some might be highly flammable.
A disposable laboratory coat is compulsory in level 3 laboratories or in specific instances such as sample collection when highly dangerous pathogens can be involved, such as suspected cases of H5N1 avian influenza or severe acute respiratory syndrome (SARS).

Information sheet-10	Report all accidents and spillages to supervisor

8.10. Report all accidents and spillages to supervisor.

If laboratory personnel become contaminated with biological hazards due to splashes or spills, immediate steps to take include:

- clean exposed skin or body surface with soap/water, eyewash (for eye exposures), or saline (for mouth exposures);
- apply first aid and treat as an emergency;
- notify supervisor, safety officer, or security desk (after hours);
- follow appropriate reporting procedures;
- report to physician for treatment/counseling

Reporting Injuries

The following guidelines should be used for employee injuries:

- Employee Actions
- ✓ Report the injury/illness to supervisor and the Employee Injury Management Office by calling.
- ✓ Obtain an Employee Injury Statement Form from your supervisor.
- ✓ Complete the form and have your supervisor sign and date it.
- ✓ If first aid medical care is needed, take completed form with you to the Employee Health Clinic or after hours to the Emergency Room. (Note: Employee has the right to be followedup by physician of their choice.)
- ✓ Ask medical care provider to complete bottom portion of form regarding work capabilities.
- ✓ Return completed form to supervisor.
- Supervisor and/ or Chief Tech
- ✓ Assist the employee in obtaining medical care if needed
- ✓ Have employee complete Employee Injury Statement Form
- ✓ Review form for completeness.
- ✓ Sign and date form, which indicates when the employee reported the injury and what occurred.
- ✓ Inform employee to call Employee Injury Management Office.
- ✓ Submit completed form to the Employee Injury Management Office.
- Lab Safety Committee
- ✓ The Laboratory Safety Committee will compile annual injury data to assess effectiveness of safety procedures and devices, and identification of opportunities for improvement

Self-Check 1	Written Test

Answer the Following Questions (2 point each)

1. Which of the following is cause of laboratory acquired accidental infection?
   A. Ingestion of pathogens,
   B. Inhaling of pathogens,
   C. Inoculation of pathogens.
   D. All

2. Which of the following steps will help reduce our generation of hazardous waste

A. If you need a small amount of chemical or just need some to try out an experiment.

   B. Substitute less hazardous chemicals for hazardous items
   C. Use older items in your inventory before newer items.
   D. All

3. Surfaces can be decontaminated using a solution of:-
   A. Sodium hypochlorite
   B. 70% Alcohol
   C. Giemsa solution
   D. All

4. Which of the following waste should be disposed in puncture-proof containers/safety box?
   A. Sharps hypodermic needles
   B. Scalpels
   C. Knives
   D. Broken glass

5. List at least 5 Laboratory personal protective equipment

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

You can ask you teacher for the copy of the correct answers

Answer Sheet

Score _____

Rating _____

Name: _____ Date: _____

Short Answer Question

1._____

2._____

3._____

4._____

5._____

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