COURSE GUIDE

BIO 211
INVERTEBRATES (LABORATORY MANUAL)

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Printed 2023

ISBN: 978-978-058-947-9

NAME:_____

PROGRAMME _____

MATRIC. NO:_____

LEVEL: _____

GROUP _____

DATE_ _____

INTRODUCTION

Invertebrates (Laboratory Manual), is a 200 level, first semester, 2-credit unit course designed for students of Biology and related courses. The course is a hands-on laboratory course designed to provide students with practical experience in the study of invertebrate animals. This course will focus on the diversity, anatomy of invertebrates. Through a series of interactive practical sessions, students will gain a deep understanding of the fascinating world of invertebrates. There are 7 practical classes for this course. It is expected that you devote time and attention for each class. Students' participation in the practical class activity will play a crucial role in the overall assessment. You are expected to come with your laboratory coat, writing materials to ensure you are able to participate during the practical sessions.

COURSE COMPETENCIES

This course will accord you the opportunity of visualizing the various invertebrates you have studied in your previous lessons and texts. You will be able to see this animal under different magnification and be able to appreciate their morphological similarities and differences that exists between groups. It is also expected of you to make careful observations from your microscopic observations and draw the diagrams accordingly when asked to do so. Do not report what you did not see.

COURSE OBJECTIVES

The objectives of this course is to enable you to:

- Identify invertebrate's organisms using microscope and other laboratory equipment
- Report scientific observations

WORKING THROUGH THIS COURSE

To complete this course successfully, you will be required to attend all the practical classes. Read through, the basic requirement needed for your practical classes and meet up with them. Ensure that you ask questions or seek the attention of your laboratory technologist when necessary. Make sure you abide by the safety rules of the laboratory.

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SAFETY IN THE LABORATORIES

- Provision of first aid box
- Display of posters to indicate the possible dangers of chemicals and the correct remedial action to be taken in case of an accident
- Provision of fire extinguishers and blankets
- All accidents should be reported to the laboratory technologists for necessary actions to be taken
- Smoking and eating are not allowed in the laboratory in the interest of safety
- Fire alarm: in case of fire, the alarm will be triggered, ring continuously and the building must be totally evacuated
- Horse play (rough, boisterous fun) is NOT allowed in the laboratory
- If you are in any doubt about the safety of a chemical, or a piece of apparatus, do not hesitate to ask a member of staff before using it.

BASIC REQUIREMENTS FOR PRACTICALS

- Sharp HB pencils
- Sharpener/ blade to re-sharpen when necessary
- Dissecting kit
- Hand lens/ Magnifying lens
- Ruler and eraser
- Lab coat

GUIDELINES FOR PRACTICAL CLASSES

- All drawings should be large to avoid obscuring important details
- No great artistic ability is needed, but the majority requirements are accuracy and clarity.
- All pencils should be properly sharpened before and during practical work
- The lines should be thin and clearly visible. They should not be rough or wooly.
- Always label drawings clearly and fully, especially when you are instructed to make labeled drawings.
- Drawings should be centrally located so as to allow labelling on the sides
- Whenever possible, the guidelines leading from parts of the drawing to the labels should be horizontal and parallel to the top edge of the paper. The lines must never cross each other and should be ruled using a ruler.
- The labels should be placed on either side of the drawing so that the lines are kept shot and precise.All drawings must bear a heading stating what the diagram is.
- All drawings must bear a suitable scale or magnification or reduction below e.g. x1, x5, x10, x1/2, x1/4.

BASIC RULES FOR FIELDWORK

- Understand the objective of the fieldwork, the potential hazardsand appropriate response to such hazards.
- Your work must be designed carefully.
- Do not overestimate what can be achieved because fieldwork ismore tasking than laboratory work.
- Conduct a feasibility or reconnaissance or pre-field trip visit. Thisis done by the lecturer/field trip coordinator.
- Any physically challenged student should report to the Coordinator/organisers for appropriate precaution.
- Never work alone without permission of the lecturer in charge
- Make sure you can read a map and compass
- Shoes, clothing and equipment must be suitable for weather and condition you are likely to encounter.
- Avoid the use of perfumes, deodorants and scents/ scented creams and grease. These chemicals may attract bees, wasp and other insects to “pollinate you”!
- Check weather forecast before field trip
- Details of working location, routes and time must be made known and never change arrangement

International distress signals in clude:

E.g. six long whistle blast

Torch flashes, arm waving or shouts for help, then repeat severaltimes

Fire red flares or smoke.

- Medically unstable individuals (Pregnant students, asthmatic, diabetic, claustrophobic, hydrophobic etc.) must be reported to the field trip coordinator

PRACTICAL 1 AN INTRODUCTORY PRACTICAL

1.1 AIMS

- Appreciate the Biology Laboratory
- Use and care for microscope
- Preparing biological drawings
- Learn some basic biological terminologies

1.2 INTRODUCTION

In today's practical class, you will learn some basic skills that you will use for the rest of this course and beyond. One of the major skills that you are going to learn is the use of the microscope. Please read and follow the instructions carefully and if you have any doubts, ask the lecturer or technologist in attendance.

1.3.1. CONTENT

1.3.2. THE MICROSCOPE

THE IMPORTANCE AND USE OF THE MICROSCOPE

The information in the following pages is barely enough to acquaint us with the nature and possibilities of the microscope, some of its limitations, and brief instructions for the use and care of the instrument. The importance of the microscope need not be emphasized here as it is clearly evident how the microscope has contributed to the information, products and happiness of mankind.

The microscope is a precision instrument and an indispensable aid to the doctor for the prevention and cure of diseases. It has the greatest practical utility in many fields, it also differs unlimited possibilities as a

hobby for exploration in the world of the minute organisms, where beauty and artistic forms predominate.

NECESSARY SKILLS COMES WITH PRACTICE. DO NOT be disappointed if at first, less is seen than anticipated!

To be comfortable, sit properly to avoid stretching or cramping the body. Use both eyes with the binocular or alternate the eyes when usinga monocular body tube. The eyes not used should be kept open to avoid tiring the muscles by trying to hold it tightly shut. At first you will be bothered by seeing with the eye not looking through the microscope, buta very little practice will permit you to keep one eye closed and see with
the other. Holding the hand in front of the other eye and gradually takingit away will help you become accustomed to working correctly.

SPECTACLES AND EYEGLASSES

Spectacle and eyeglasses are used to correct near or far sightedness need not be worn when using the microscope. However, if the spectacles have a correction for astigmatism it is desirable that they be worn to avoid headaches.

N.B ALWAYS USE lens tissue/ paper provided to clean the lenses before using the microscope. Lens tissue is for cleaning the lenses ONLY.

USE OF THE MICROSCOPE

INTRODUCTION

Our senses are so limited and as such many things we would like to find out about living organism can be discovered only by making use of instruments. One of the most frequently used instruments is the microscope. The simple microscope (magnifying glass or hand lens) was used in ancient times. Compound microscopic were developed more "recently" (around 1600). You will use two type of compound microscope in the laboratory; (a) **stereomicroscope** for the study of opaque objects at low magnifications and (b) the **light microscope** for study of translucent or transparent specimen at low to high (40-400X) magnifications.

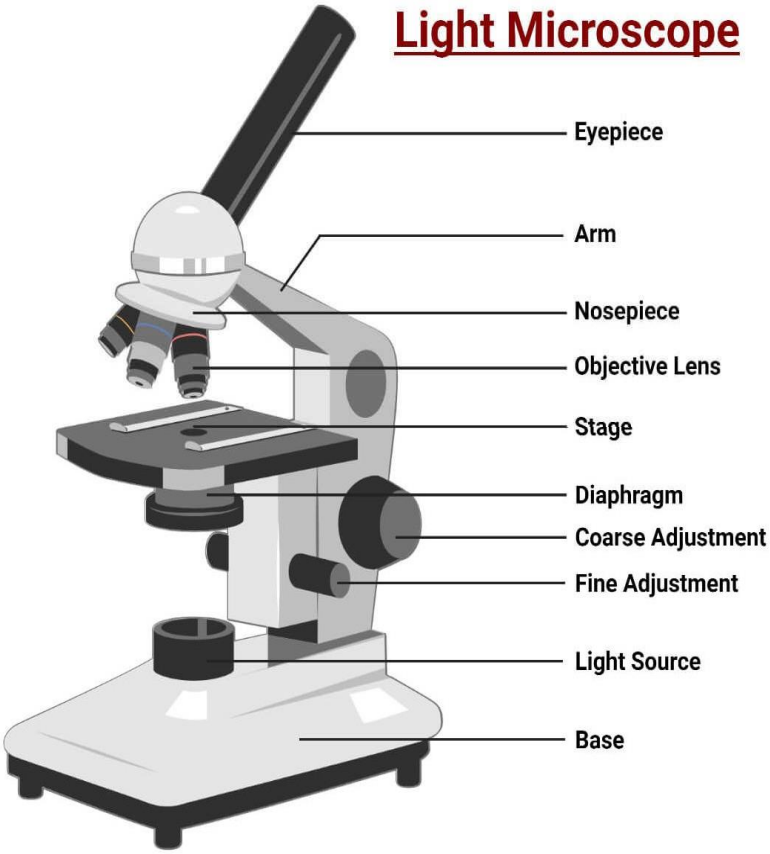
The purpose of this exercise is to acquaint you with the light microscope, its uses and care

SETTING UP THE MICROSCOPE

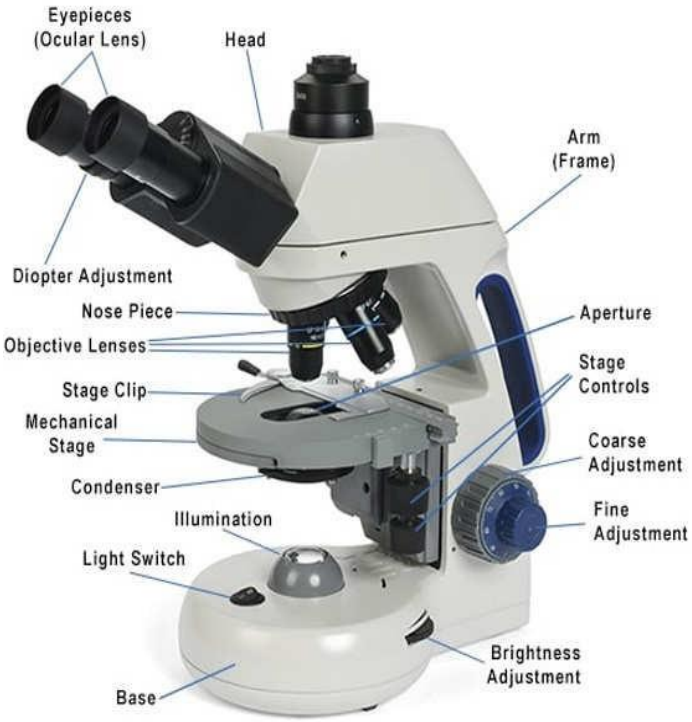
Remove the microscope from its case; grasp the curved arm of the instrument with one hand, and place the other hand under the base. **Always** carry the microscope in an upright position because the ocular lens is not fixed to the barrel (it will fall out if the microscope is inverted).

THE LIGHT MICROSCOPE: This is a type of microscope that uses visible light and a special arrangement of lenses to generate magnified images of tiny objects. Ordinarily, the details of such objects cannot be seen with the naked eyes.

- Mechanical component of the Microscope:
- A heavy supporting base.
- An arm which can be bent thereby permitting the observer to better examine an object.
- A stage upon which the slide can be placed. The slide is held in place by two stage clamps. In some microscopes, the stage bears a mechanical apparatus which can displace the slide according to the Cartesian coordinates.
- A coarse adjustment knob which quickly raises or lower the optical tube. This knob permits the observer to quickly locate an object and bring it into a coarse focus plane.
- An optical tube which carries on its uppermost region the ocular lens and, at its lower most part, the objective lenses.
- A revolving nosepiece enabling one to readily change to objective lenses.
- A fine focusing knob which one uses to focus on fine detail within an object.
- A condenser adjustment knob which either approaches or removes the condenser from the stage.
- An illuminator to reflect light into the optical components.



A Monocular Light Microscope



Compound Light Microscope

A. Optical Component of Microscope

The light microscope has three lens systems:

- The lens through which observations are made is called the ocular. It receives and enlarges the real image from the objective lens thereby transforming it into a virtual image. The latter is therefore an inverted image of the object. Most of the oculars which you will find on your microscope magnify the image 10 times (10x).

- The objective lenses which produce a "real" image of the object. Their magnification is engraved on the metal of the lens (4x, 10x or 40x).

- The condenser lenses which collectively collect incoming light rays and focus them in a luminous cone on an area of the object. This is an effective system to ensure maximum light intensity. One uses the condenser adjustment knob to regulate the position of the condenser in respect to the object. Ideally the condenser should remain as close to the object as feasible. To regulate the quantity of light which can enter the condenser, one must adjust the relative position of the iris diaphragm. Finally, one should

note that the condenser lenses neither magnify nor produce animage of the object being viewed.

OPERATION OF THE MICROSCOPE

A microscope is an instrument on which some rather precise adjustments have to be made. Most beginners confine themselves to an adjustment of the focus which does no more than produce an image of sorts. Remember that the quality of the image is produced not only by the objective and ocular but by other parts of the microscope and its illuminating system.

Before going on to the practical use of the microscope, be sure that you know all its various components and their function. Proceed as outlined below:

- Turn the revolving nosepiece in order to place the 4x objective in

the optical axis of the microscope.

- Bring the condenser to its uppermost position i.e., just below the stage. Completely open the iris diaphragm.
- Orient the microscope toward the light rays into the optical axis. By looking through the ocular you will be able to correct the light intensity by adjusting the iris diaphragm.
- Begin all your microscopic observations by using the 4x objective lens. Place a glass slide on the stage and steady it with the two clamps.

Orient the slide so that the object comes to lie over the hole of the stage. By using the coarse adjustment knob, lower the optical tube while watching from the outside until the end of the objective lens rests at about "1/2" from the stage.

By looking through the ocular, go about getting the object into coarse focus. Once you have done this, use the **fine focusing knob** to bring about the finer detail of the object which you are viewing.

- If you wish to magnify one area of the object you should change to a higher power objective. While still with the low-power objective, center the area which you want to magnify, and by turning the nosepiece change to the desired lens (10x or 40x). Re- adjust the focus by using the FINE focusing knob **only**.

You should be aware of the fact that one can easily change the lens by focusing too quickly. If you are inexperienced with the microscope, proceed with caution and do not hesitate to consult your lab instructor.

CARE OF THE MICROSCOPE

A dusty or mascara-caked microscope will only give you mediocre results. Therefore, it is up to you to **clean each lens** (ocular, objective and condenser) **before** beginning your microscopic observations. Cleaning of all lenses should be done **only with lens paper**.

The objective lenses are screwed to the nosepiece and may occasionally loosen. At the end of each lab session, you should verify that each lensis tightly screwed onto the nosepiece.

You are asked to notify your lab instructor should you notice any damage or malfunction of your microscope. This will absolve you of any responsibility which you may have toward the maintenance and care of your microscope.

As was mentioned earlier, the microscope is an expensive

instrument and should be handled with care; pay attention to the following:

- Keep the instrument in a box (or under a cover) when not in usein order to maintain it in a dust free state.
- Remove it from the box using two hands and place it on the bench gently to avoid unnecessary jarring.
- The lenses must be kept clean by wiping with a lens tissue.
- The microscope must always be focused upwards neverdownwards.

MICROSCOPIC MEASUREMENTS

A. Units Used in Microscopy

· Micron (μ): unit often utilised in light microscopy.

1μ = 1/1,000mm
= 1/10,000cm.

- Angstrom (A): unit often used in electron microscopy.

1A = 1/10,000μ
= 10^{-7}mm = 10^{-8}cm

B. Magnification in the Microscope

The total magnifying capacity of the microscope is calculated as follows:
(Ocular magnification) x (Objective magnification)

For example, if you are using a 10x ocular with a 40x objective, the totalmagnification of the object is 10X x 40X = 400X.

C. Estimation of the Specimen's Actual Size

The diameter of the illuminated circle which you view (field diameter) is 3.4mm with the 4x objective, 1.4mm with the 10x objective and 0.4mm with the 40x objective, assuming a 10x ocular in each case. You may verify these with a transparent graduated straight edge.

In order to estimate the dimensions of the object being viewed, you should approximate the proportion of the field which it occupies
For example, if it occupies half of the field when viewed with the 40x objective you may state that it measures approximately 0.2mm or 200 microns (μ).

Try to estimate the size of some of the cell types which you have observed during this lab session.

D. Magnification in Drawings

The magnification of the object by a microscope is the multiple of eyepiece and objective lens magnifications. The final magnification therefore will be the number of times the microscope's magnified imageis enlarged or reduced. For instance, if the objective lens of x 10 is used and an eyepiece lens of x 10 is used to magnify an object, then the magnification is 10 x 10 = 100. If drawing the whole of the image, and your diagram is twice as large as that seen under the microscope, thenthe final magnification becomes 10 x I Ox 2 = 200.

Always accompany drawings you make with an indication of the actual size of the specimen pictured. This can be done in any one of several ways:

- State the actual size as estimated using the method above (e.g. diam. = 0.1mm).
- Draw a line to show what corresponds to a length of 0.01mm (for e.g.) in your drawing.
- State the magnification of the drawing (this is not necessarily the same as the viewing magnification calculated in part B) e.g. if the diameter of the cell is 0.1mm and that of the drawing is 3cm, the magnification of the drawing is 300x i.e.

Size of drawing

Size of the cell

- Estimate the magnification of the drawing in relation to the size of the image. E.g. if your drawing is 3x bigger than the actual image, then the magnification is 3x the magnification in the microscope determined in part B.

Fill in this table	
Field Diameter	
10X	4X
10X	10X
10X	40X

THE STEREOMICROSCOPE

Study the main features of the stereomicroscope, using the demonstration as a guide. Note that the two oculars can be adjusted to fit your interpupillary distance. Locate the focusing knob on the arm of the microscope, and the adjustable illuminator.

Place a coin on the stage and examine it carefully (remember that the binocular oculars must be adjusted to your interpupillary distance for optimum viewing).

How does the stereomicroscope differ from the light microscope?

Consider such things as depth of focus, image inversion, distance of objective from specimen and size of field in your comparison. Use the specimens available in the laboratory to practice using the stereomicroscope.

1.3.3. GUIDELINES FOR MAKING BIOLOGICAL DRAWINGS

The following should be observed while making biological drawings.

- Use sharp, HB quality pencils. Coloured pencils and biros are notallowed.
- Drawings must be large enough.
- Drawings must be simple and include outline of the structure andother useful landmarks to show relationship of parts.
- Drawings should be accurate and if the specimen has several similar parts, draw a small portion accurately.
- Lines for drawings should be clear and sharp. Lines should not bewavy, wooly, broken, thick or too thin and faint.
- Shading, dotting, hatching, etc. should be minimised.
- All diagrams should be labelled; this should be done as completely as possible. The label lines (guide limes) should touch

the item labeled; the lines should be ruled, not drawn freehand and they must not cross. Labels should not be done inside the diagram, but should be spaced around the figure. All labels should be done horizontally on the paper and not slanted or done vertically

- There should be an appropriate title under every diagram and the magnification should also be indicated. The viewpoint of the specimen (e.g. TS, LS etc) as well as explanatory notes should be made.
- *Draw what you see and not what you think you see and certainly not a textbook copy.*

IN TEXT QUESTIONS

- What is the function of an objective lens?
- Answer: It provides you with the real image of the object.
- In what units are microscopic observations measured?
- Answer: Microns.

EXERCISE I

Write the labelled parts of the light microscope and state their functionsbelow (**20 marks,**

Labeled part 1 mark each, function 1mark each). 1.

(Total Mark for Exercise I = 20)

Coordinator's signature and date ----------

WEB SOURCES

- https://www.youtube.com/watch?v=vzZklzLvWks&pp=ygUWY2FyZSBvZiB0aGUgbWljcm9zY29wZQ%3D%3D
- https://www.youtube.com/watch?v=FnOvLEaC4gg&pp=ygUWY2FyZSBvZiB0aGUgbWljcm9zY29wZQ%3D%3D
- https://www.youtube.com/watch?v=52KsBFLbp24&pp=ygUWY2FyZSBvZiB0aGUgbWljcm9zY29wZQ%3D%3D

PRACTICAL 2 THE PROTOZOA

2.1.1 AIMS

- To illustrate protozoan diversity of body form.
- To present the basic morphological features of the protozoans with a view to familiarizing the student with the art of identifying and classifying organisms.
- To improve student's capability of using the microscope.
- To develop/improve student's drawing skills.

2.1.2 INTRODUCTION

This practical is designed to help the student study microscopic organisms with the aid of the microscope, identify the organisms, and, based on their morphology, classify them to species level.
As you examine each organism, think of the functions of the different organelles and appreciate how each organism uses them to survive in its habitat.

2.1.3 ACTIVITIES

- You are provided with slides of the following protozoans:

- Euglena sp.
- Trypanosoma sp.
- Leishmania sp.
- Amoeba sp.
- Paramecium sp.
- Eimeria sp.

- Mount the slides one after the other on the stage of the microscope; examine under low power i.e., x 4, then x 10.
- Note the morphological features of the different organisms and remember that a single cell coordinates all the activities in these organisms.
- Note the differences in the body shapes of Euglena and Amoeba (2 marks).
- Note and outline the functions of the two types of nuclei in Paramecium (2 marks).
- Why are Euglena and Trypanosome placed in different classes?(2 marks).
- Make well-labelled diagrams of four (4) of the species provided(5 marks each, max. 20 marks).

- Classify the species listed (in Activity1 above) to species level (2 marks each, max. 12 marks).
- Name the locomotor organelle used by each of the species in Activity 1 above (1 mark for each correct organelle**, max. 6 marks).**

IN TEXT QUESTIONS

- List four protozoan organisms that you know
- Amoeba sp.
- Leishmania sp.
- Trypanosoma sp.
- Euglena sp.

EXERCISE II

- In a tabular form, state four (4) differences between Euglena and Amoeba (**2 marks, ½ each**)

Euglena	Amoeba
i.	
ii	
iii	
iv.	

- Outline the functions of the two types of nuclei in Paramecium **(2marks**).

i. _____
ii. _____
iii. _____

- Why are Euglena and Trypanosoma placed in different classes? (**2 marks**).

i. _____
ii. _____
iii. _____
iv. _____

- Make well-labelled diagrams of four (4) of the species providedin Activity 1 above (**5** marks each, max. 20 marks).

Species A (5 marks: shape of drawing ½, neatness of drawing ½, ruled horizontal guide lines ½, guideline touching organelle ½, six (6) correct labels ½ x 6 = **3).**

Species B (5 marks: shape of drawing ½, neatness of drawing ½, ruled horizontal guide lines ½, guideline touching organelle ½, six (6) correct labels ½ x 6 = 3).

Species C (5 marks: shape of drawing ½, neatness of drawing ½, ruled horizontal guide lines ½, guideline touching organelle ½, six (6) correct labels ½ x 6 = 3).

ecies D (5 marks: shape of drawing ½, neatness of drawing ½,ruled horizontal guide lines ½, guideline touching organelle ½, six (6) correct labels ½ x 6 = 3).

- Classify the species listed (in Activity1 above) to species level (**2 marks each, max. 12 marks**).

- Name the locomotor organelle used by each of the species in Activity 1 above (**1 mark for each correct organelle, max. 6 marks).**

(Total Mark for Exercise II = 44)

Coordinator's signature and date----------

Web Sources

- https://www.youtube.com/watch?v=PnN9B4Y_5ek&pp=ygUdcHJvdG96b2EgdW5kZXIgdGhlIG1pY3Jvc2NvcGU%3D

- https://www.youtube.com/watch?v=YH7CPkp3YK8&pp=ygUdcHJvdG96b2EgdW5kZXIgdGhlIG1pY3Jvc2NvcGU%3D

PRACTICAL 3 THE PHYLUM PLATYHELMINTHES

3.1.1 AIMS

- To illustrate the basic body form of the Platyhelminthes.
- To expose students to the variety of body forms found among the platyhelminths
- To note adaptations to parasitism among parasitic platyhelminths.
- To further improve students' skills of the use of the microscope
- To further improve students' drawing skills.

3.2.1. INTRODUCTION

This practical will show you some species and a variety of body forms found among platyhelminths. This will enable you relate what you learnt during the lecture to what you see in the laboratory, so that you can identify and classify platyhelminths. This practical will also help you distinguish between the different members of the phylum. The platyhelminths are flatworms that may be parasitic or free-living. Most of the important morphological features found in complex higher animal groups were first observed in the flatworms.

3.3.1. ACTIVITIES

- The slides of the following species are provided: *Taenia, Echinococcus, Gyrodactylus, Schistosoma* and *Fasciola* spp.
- Examine each of the slides, first, using the low power/wide angle(x4) objective of your microscope, then under (x10).
- Note:

- Their suckers
- Complete cuticle in some species
- The scolex
- The tape-like segmented body in the tapeworms
- The hooks on the head or scolex

1. Make large fully labeled drawings of two (2) of the following specimens: *Gyrodactylus, Taenia* sp. and *Fasciola* sp. (10 marks each x 2= 20 marks)
2. What are the functions of the complex cuticle, suckers and hooks? (1 mark each x 3= 3marks)
3. Classify all the specimens to species level (2 marks each x 5= 10 marks).
4. The tapeworms lack mouth and digestive system. Why?

(1mark x 2=2marks)

5. Name some of the diseases (if any) caused by each of the species

(1mark each x **5= 5 marks).**

TEXT QUESTIONS

- List two platyhelminths available for this practical class

  Answer: *Taenia* sp

  Answer: *Fasciola* sp

EXCERSICE III

1. Make large fully labeled drawings of two (2) of the following specimens: *Gyrodactylus, Taenia* sp. and *Fasciola* sp. **(5 marks each x 2= 10 marks)**

Web Sources

- https://www.youtube.com/watch?v=fDJ86cFbXbY&pp=ygUkcGxhdHloZWxtaW50aGVzIHVuZGVyIHRoZSBtaWNyb3Njb3Bl

2. What are the functions of the complex cuticle, suckers and hooksof Taenia spp.? **(1 mark each x 3= 3marks)**

Function of cuticle Function of sucker
Function of hooks

3. In a tabular form, Classify all the specimens (in Activity 1 above)to species level **(2 marks each**

4. The tapeworms lack mouth and digestive system. Why? **(1markx 2=2marks)**

a _____ ____
b._____ _____ ____

5. Name some of the diseases (if any) caused by each of the specieslisted in Activity 1 **(1mark each x 5= 5 marks).**

_____
_____
_____
_____

Total mark = 40

Coordinator's signature and date……

PRACTICAL 4 THE PHYLUM NEMATODA

4.1.1 AIMS

- To introduce students to morphology of the nematodes.
- To illustrate the variety of body form among the nematodes (the morphological differences between the different species may be very subtle).
- To improve student's observational skills,
- To illustrate some morphological adaptations to parasitism.

4.2.1 INTRODUCTION

Members of this group are commonly called roundworms. They are found in the sea, freshwater and moist soil or as parasites in plants and animals. They are unsegmented and pointed at both ends. They are of great medical and economic importance.

This practical is aimed at illustrating and introducing you to some representatives of this phylum. In the process of examining their morphological features, we shall outline their and medical importance as they relate to plants, animals and humans. This exercise will also illustrate the features that have adapted the nematodes to a parasitic mode of life.

4.3.1. ACTIVITIES

You are provided with slides of the following species: *Trichuris* sp., *Ancylostoma duodenale, Ascaris lumbricoides, Strongyloides* sp., *Onchocerca volvulus*.

- Mount the slides of each species one after the other on the microscope.
- Examine them and prepare well-labelled drawings of each worm.
- Classify them as far as possible
- Advance reasons for their classification.
- List their, adaptive features and their functions.
- Note:
- The thick cuticle that covers the body
- The cylindrical body-form, pointed at both ends
- Bilateral symmetry
- Briefly discuss the medical importance of each species.

IN TEXT QUESTIONS

What are the possible habitats for the round worms provided?

Answer: It is possible they were sourced from the sea, rivers, or soil

WEB SOURCES

- https://www.youtube.com/watch?v=7ytgmpQ6eug&pp=ygUmaG93IHRvIHNlZSBuZW1hdG9kZXMgdW5kZXIgbWljcm9zY29wZSA%3D
- https://www.youtube.com/watch?v=vP4Bc3FYftU&pp=ygUmaG93IHRvIHNlZSBuZW1hdG9kZXMgdW5kZXIgbWljcm9zY29wZSA%3D

EXCERSICE IV

- Prepare well-labelled drawings of two (2) of the worms listed in Activities 4.1.3. (5 marks each x 2 = 10 marks). (5 marks: shape of drawing ½, neatness of drawing ½, ruled horizontal guide lines ½, guideline touching organelle ½, six (6) correct labels ½ x 6 = 3).

- Under each drawing, classify the specimen as far as possible **(2 marks each 2 x 2 = 4marks)**

1. Give three reasons for each of the classification **(3 marks each x2 = 6 marks).**

_____
_____
_____
_____

2. List the adaptive features and their functions in each of the organism drawn (2 adaptive features for each = 2 marks x 2 = 4; 2 functions for each = 2 marks x 2 = 4 marks; Total = 8 marks.

_____
_____
_____
_____

3. Briefly discuss the medical importance of each species (**5 pointseach = 5 x 2 = 10marks)**

_____
_____
_____
_____
_____

Total mark = 38

Coordinator's signature and date……

PRACTICAL 5 THE PHYLUM ANNELIDA

5.1. AIMS

- To illustrate the basic body form and diagnostic features of annelids
- To illustrate the different body forms among annelids.
- To illustrate the diagnostic features of the three major groups ofannelids.
- To familiarize students with the representatives of each of the three main groups of annelids
- To improve students' observational and drawing skills

5.2 INTRODUCTION

The annelids are bilaterally symmetrical segmented worms. Some havea distinct head, which bears a number of tentacles. They possess chaetae, which are bristles that are arranged segmentally and composedof chitin.

This practical will enable the student identify the distinguishing features of *Lumbricus, Nereis* and *Hirudo* members of the classes Polychaeta, Oligochaeta and Hirudinea, respectively.

5.3 ACTIVITIES

You are provided with the following specimens and a slide:

1. *Lumbricus terrestris, Nereis* sp., *Hirudo* sp. (leech), and T.S. *Lumbricus*.
2. Name the habitats of each of the species **(1 mark each x 3 = 3marks).**
3. How are they adapted to these habitats? **(2 points each x 3= 6 marks)**
4. Examine the specimens carefully using a hand lens.
5. Make well-labelled drawings of all three specimens (**Drawings=2marks each= 6 marks; Labels= 5 labels each= 1 x5 x 3= 15 marks**).

6. Note the following:

i. Their bilateral symmetry
ii. The number and arrangement of chaetae per segment in the different species
iii. Absence of a distinct head in *Lumbricus*

iv. The number of segments in *Hirudo* sp. (leech)
v. The anterior and posterior suckers in *Hirudo*

7. Examine the slide of T.S *Lumbricus* under low power and notethe following:

a. The structure of the body walls.
b. The distribution and arrangement of muscles.
c. The coelom and its relationship with the viscera

8. Write down your observations on 7a-c**. (a and b = 1 mark each,c =2 marks. Total= 4 marks)**
9. Make a labeled sketch of the section **(2 marks for drawing, 3marks for labels. Total marks =5 marks).**
10. Briefly discuss the economic importance of *Lumbricus terrestris*
(1 x 5 points = 5marks).

IN TEXT QUESTIONS

What type of body symmetry do annelids have?

Answer. Bilateral symmetry.

WEB SOURCES

- https://www.youtube.com/watch?v=8u7P3G__pL4&pp=ygUcYW5uZWxpZCB1bmRlciB0aGUgbWljcm9zY29wZQ%3D%3D

EXERCISE V

1. Name the habitats of each of the species **(1 mark each x 3 = 3marks).**

a. _____

b. _____

c. _____

2. How are they adapted to these habitats? **(2 points each x 3= 6 marks)**

a.

b.

c.

3. Make well-labelled drawings of all three specimens (Drawings=2marks each= 6 marks; Labels= 5 labels each= 1 x5 x 3= 15 marks).

a. A Well- labelled diagram *Lumbricus terrestris* (marks: shape of drawing ½, neatness of drawing ½, ruled horizontal guide lines ½, guideline touching organelle ½, six (6) correct labels ½ x 6 = 3; Total = 5marks).

A well-labelled diagram of *Nereis* sp. (marks: shape of drawing ½, neatness of drawing ½, ruled horizontal guide lines ½, guideline touching organelle ½, six (6) correct labels ½ x 6 = 3; Total = 5marks).

b. A well-labelled diagram of *Hirudo* sp. (marks: shape ofdrawing ½, neatness of drawing ½, ruled horizontal guide lines ½, guideline touching organelle ½, six (6) correct labels ½ x 6 = 3; Total = 5marks).

4. Examine the slide of T.S *Lumbricus*. Write down your observations on activity 7a-c. (a and b = 1 mark each, c =2 marks. Total= 4 marks)

_____

_____

_____

_____

_____

_____

5. Make a labeled sketch of the section (T.S. *Lumbricus)* **(2 marks for drawing, 3 marks for labels. Total marks =5 marks).**

6. Briefly discuss the economic importance of *Lumbricus terrestris*

(1 x 5 points = 5marks).

_____
_____
_____
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_____
_____
_____

Total mark = 38

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PRACTICAL 6 ARTHROPODA AND MOLLUSCA

6.1.1 AIMS

- To introduce students to the basic structure of arthropods.
- To introduce students to the variety of arthropod body forms.
- To examine the features that have contributed to the success ofthe arthropods, as illustrated by the insects.
- To illustrate the distinguishing features of the Phylum Mollusca
- To introduce students to the variety of body form among molluscs.
- To illustrate the distinguishing features of the different molluscanclasses.

6.2.1 INTRODUCTION

The arthropods are cosmopolitan and they constitute the largest Phylum in the animal kingdom. They have jointed appendages and their body is covered by a chitinous exoskeleton.

Molluscs are triploblastic, unsegmented animals. Their body is divided into a head, ventral muscular foot and a dorsal visceral hump/mass.
Some species of molluscs are of great economic importance to humans e.g., the giant African snail.

In this practical class you are going to examine selected molluscs and arthropods.

6.3.1 ACTIVITIES

- You are provided with the following specimens:

- A housefly
- Crab
- Spider
- Butterfly
- Centipede
- Millipede
- Cockroach
- A chiton
- The giant African snail
- *Ostrea* sp.
- *Ensis* sp.
- *Haliotis* sp.
- A squid

- Octopus
- Examine the giant African snail and identify the following structures:
- The head
- The visceral mass
- The ventral muscular foot
- Part of the mantle
- The radula.

- Make a large, well labelled drawing of the giant African snail in lateral view **(5 marks).**
- Classify specimens i-vii (Activity 6.3.1) to order level. Eg: phylum, subphylum, order, species and genus.
- Give reasons for your classification.
- Enumerate and very briefly discuss the morphological differences between the centipede and the millipede
- Make a good-sized fully labelled drawing of the crab and the cockroach.
- Why is the cockroach placed in a different Class from the spider?
- Make annotated sketches of all the other mollusks and arthropodsnoting their diagnostic features.
- Briefly discuss the success of insects, based on the specimens provided.

IN TEXT QUESTIONS

- Which species of molluscs is of great economic importance
- Answer: Giant African snail

WEB SOURCES

https://www.youtube.com/watch?v=6NZ3qbPuG18&pp=ygUKYXJ0aHJvcG9kYQ%3D%3D

https://www.youtube.com/watch?v=RxGxZtxXLbk&pp=ygUITW9sbHVzY2E%3D

Exercise VI

- Make a large, well labelled drawing of the giant African snail in lateral view.
- (marks: shape of drawing ½, neatness of drawing ½, ruled horizontal guide lines ½, guideline touching organelle ½, six
- (6) correct labels **½ x 6 = 3; Total = 5marks).**

1. Classify the representative arthropods to order level (mark 1 x 7 species = 7 mark: ½ for (Activity6.3.1:i-vii) **Sub-phylum, ½ for order, species and genus).**

Specimen	**Phylum**	**Sub-phylum**	**Order**	**Species**	**Genus**
i.					
ii.					
iii.					
iv.					
v.					
vi.					
vii.					

2. Give reasons for your classification in exercise 2 above. **(mark = 7, 2 reasons each = ½ x 14 = 7)**

3. Enumerate and very briefly discuss the morphological differences between the centipede and the millipede **(mark = 4 differences,1 x 4)**

4. Make a good-sized fully labelled drawing of the crab and the cockroach.

- Labelled diagram of the crab
- (marks: shape of drawing ½, neatness of drawing ½, ruled horizontal guide lines ½, guideline touching organelle ½, six
- (6) correct labels ½ x 6 = 3; Total = 5marks).
- Labelled diagram of the Cockroach
- (marks: shape of drawing ½, neatness of drawing ½, ruled horizontal guide lines ½, guideline touching organelle ½, six
- (6) correct labels ½ x 6 = 3; Total = 5marks).

5. Why is the cockroach placed in a different Class from the spider?

(Marking: 1 x 3 points = 3 marks)

6. Make annotated sketches of all the other mollusks and arthropods noting their diagnostic features **(mark = 30; 10 sketches, 3 mark per sketch. 5 molluscs and 5 arthropods)**

7. Briefly discuss the success of insects, based on the specimens provided **(10 points = 1 x 10 = 10 mark)**

_____

_____

_____

Total mark = 76

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PRACTICAL 7 PHYLUM: ECHINODERMATA

7.1.1 AIMS:

- To introduce students to the basic classification of theEchinoderms
- To introduce students to the variety of Echinoderm forms.
- To examine the features that have contributed to the success ofthe Echinoderms.

7.1.2 INTRODUCTION

The echinoderms have star-like appearance, and are spherical or elongated marine animals with spiny skin. They are triploblastic, have coelomic cavity and exhibit organ system level of organization. They are generally divided into three classes as given below:

- *Class: AsteroideaOrder:Forcipulata*
- *Genus: Asterias (Sea star)*

- *Class:OphiuroideaOrder: Ophiurae*
- *Genus: Ophiocoma (Brittle star)*

- *Class: Echinoidea Order: Camarodonata*
- *Genus: Echinus (Sea urchin)*

GENERAL CHARACTERISTICS OF ECHINODERMS

- Exclusively marine.
- Adults with radial symmetry.
- Larvae bilateral symmetry.
- No head, body unsegmented.
- Have oral and aboral surfaces, oral surface (have mouth located in the center of the body). aboral surface (have anus).
- Body wall contains an endoskeleton of ossicles, sharp protective spines made of calcium plates covered with thin epidermal layer.
- With unique water vascular system (network of canals throughout the body) is important for locomotion, feeding, respiration and excretion.
- Have a large coelom (fluid-filled cavity between body wall and gut lined by mesoderm) where all the main organs occur.
- No brains, central nerve ring surrounds mouth, connect radial nerves run under each arm have ganglia.
- Digestive system complete.
- Respiration by dermal gills, tube feet or respiratory tree.

- Sexes are separate, fertilization is external.

7.3.1 ACTIVITIES

- You are provided with the following specimens:

- *Asteria* sp. (Sea star)
- *Ophiocoma* sp. (Brittle star)
- *Echinus* sp. (Sea urchin)

1. Examine, draw and label the specimens provided in Activity 1above **(5 marks each x 3 = 15).**

2. Give the characteristics of the classes in phylum Echinodermata **(5 marks each, x 3 = 15 marks).**

IN TEXT QUESTIONS

Where can you find any of the specimens provided in this section

Answer: Marine environment.

EXERCISE VII

1. Examine, draw and label *Asteria* sp. (Sea star)

(5 mark: shape of drawing ½, neatness of drawing ½, ruled horizontal guide lines ½, guideline touching organelle ½, six (6) correct labels ½ x 6 = 3).

2. Examine, draw and label *Ophiocoma* sp. (Brittle star)

(5 marks, shape of drawing ½, neatness of drawing ½, ruled horizontal guide lines ½, guideline touching organelle ½, six (6) correct labels ½ x 6 = 3)

3. Examine, draw and label *Echinus* sp. (Sea Urchin)

(5 mark: shape of drawing ½, neatness of drawing ½, ruled horizontal guide lines ½, guideline touching organelle ½, six (6) correct labels ½ x 6 = 3)

4. Give the characteristics of the class Asteroidea. Ophiurodea and Echinodea in phylum Echinodermata **(5 marks each, x 3 = 15 marks).**

a. Asteroidea

_____
_____
_____
_____
_____

b. Ophiuroidea

_____
_____
_____
_____

c. Echinoidea

_____

_____

_____

_____

Total mark 30.

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