THE REPUBLIC OF UGANDA

Ministry of Education and Sports

O' Level

SELF STUDY

Biology

NCDC

NATIONAL CURRICULUM DEVELOPMENT CENTRE

Biology

Class: S.1

Revision activity 1:

Cells are the tiny building blocks of life that make up living organisms. Most cells are too tiny to be seen by unaided eye. You can only observe cells using a microscope. A microscope is an instrument used to observe things that are too small to be seen by an unaided eye. It makes them appear much larger and clearer. The egg of a bird is actually a cell and can be seen without the use of a microscope.

Things you will need:

i) Picture of an animal cell as seen under a microscope

ii) Raw chicken egg in a clear plate/saucer

iii) notebook

iv) pen /pencil

Activity set-up

Get a raw chicken egg and carefully crack it from the side of the airspace, hold the egg at the edge of a flat clear plate/saucer and gently pour out the contents onto the plate.

Procedure:

Step 1: Observe the raw egg on the plate/saucer. Look at the different layers.

i) How many layers are you able to see?

ii) Describe the size (big or small or thin) and position (outer, central, inner) of the layers

iii) Record the information from (i) and (ii) above in the table below. You will use it later in this activity.

Step 2: Study the picture of an animal cell as seen under a microscope

Step 3: Now compare the observation of the picture of an animal cell with that of the raw egg.

	Raw egg	**Animal cell**
Number of layers		
Size of layers		
Position of layers		

The central part of the animal cell is called the nucleus.
The fluid part surrounding the nucleus is called the cytoplasm.
The outer boundary surrounding the cytoplasm is the cell membrane.

Step 4: Draw and label the parts of the animal cell

Follow-up activity

1. Complete the following statements by filling in the blank spaces

   _____ is a thin, outer layer surrounding the contents of the cell. It allows some substances to go in and some to come out of the cell.

   _____ is a mucus-like liquid in the cell. This is where some of the life processes take place.

   _____ is the "brain" of the cell. It controls all the chemical activities that take place in a cell. For example, _____, _____ and _____

2. The coronavirus is a microscopic organism, how different or similar is it to the animal cell?

Revision activity 2

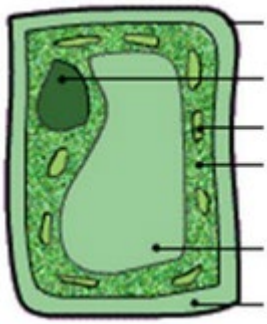
Introduction: The plant cell has parts that are the same as those found in an animal cell. It also has parts that are unique to it. The structure of the plant cell is also different from that of the animal cell.

Things you will need:

i) Picture of a plant cell as seen under a microscope
ii) notebook
iii) pen /pencil

Procedure:

Step 1: Study the picture of a plant cell as seen under a microscope



The thick outer polygon-shaped layer is called the cell wall. The small green oval-shaped structures scattered in the cytoplasm are called chloroplasts. The vacuole is the large centrally located area of the cell found within the cytoplasm.

Step 2: Draw the plant cell and label its parts.

Follow-up activity - Complete the following statements by filling in the bank spaces

The cell wall is made up of a tough material called cellulose hence it provides _____ to the plant cell. The chloroplasts are numerous round structures that are green in colour because they contain chlorophyll which is used to trap _____ energy needed in the process of _____. The vacuole stores waste materials and useful substances such as _____, _____ and _____.

Revision activity 3

Cells are grouped together or organised at various levels in order to carry out specific functions and key life processes in the body. This ensures efficient functioning of the body for the survival of the organism. In this lesson, you will find out the different levels of cell organisation and what they do.

Things you will need:

i) notebook
ii) pen /pencil

Procedure:

People in a group can perform more complex tasks than one person alone. Consider what happens when there is a social gathering at your home and three families are supposed to prepare a meal for the function.

Step 1: List the categories of foods that form the meal going to be prepared.

Step 2: For each of the categories you have identified, sort them out according to the number of people that would be required to prepare that category of food i.e.

- 1 person
- 2 to 3 people
- 4 to 8 people (one family)
- more than 9 people (2 or more families)

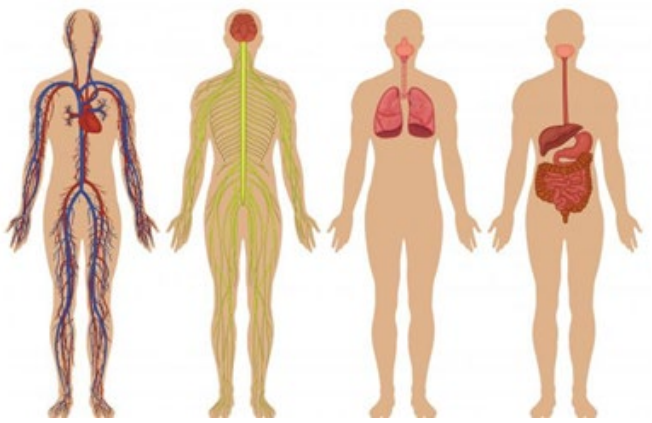
Write what you have done in a notebook

Step 3: Like people, similar cells in our bodies are organised into groups to make them work more effectively.

- *A group of* ***similar cells*** *performing a particular function is a* ***tissue*** *e.g. muscle tissue*
- *A group of* ***different tissues*** *form an* ***organ*** *to perform a particular function e.g. heart*
- *A group of* ***different organs*** *form an* ***organ system*** *to perform a particular function e.g. circulatory system*
- *A group of* ***different organ systems*** *form an* ***organism*** *e.g. a human*

Compare what you wrote down in step 2 with the information given in step 3. Write down what would be the equivalent of a cell, tissue, organ, organ system and organism.

Step 4: Study the figure below



Identify;

i) The four systems shown in the figure
ii) The organs that make up each of the systems shown

State the function of each of the systems you have identified.

Follow-up activity

The following is a list of some functions of systems in your body. Match the functions to the corresponding system.

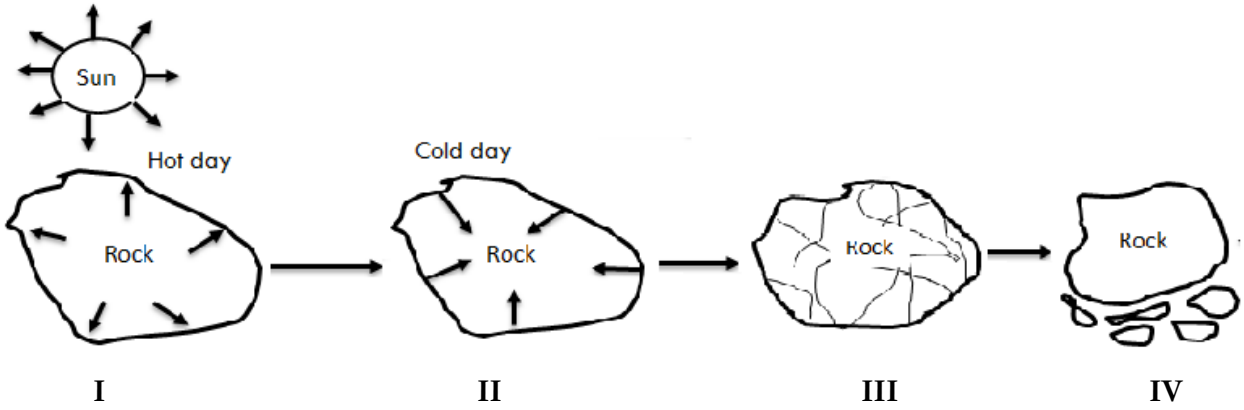
Transports materials around the body	Lymphatic system
Breaks down food substances for absorption	Circulatory system
Exchanges gases between the body and the surrounding	Urinary system
Produces gametes	Digestive system
Filters waste from the blood	Respiratory system
Defends the body against disease	Reproductive system

Biology

Class: S2

Revision Activity 1

Weathering is the process of soil formation by the breaking down of rocks into small particles. Weathering can be a biological process involving living organisms or a chemical process involving chemicals substances like acids or a physical process involving physical factors of the environment. Weathering is a slow and continuous process.



Study the figure above.

a) What is happening to the rock at Stage I
   Why is it happening?
b) What is happening to the rock at Stage II
   Why is it happening?
c) What is happening to the rock at Stage III
   Why is it happening?
d) What is happening to the rock at Stage IV
e) Do you think this is a physical or chemical or biological process?

Revision activity 2

Soil is grouped basing on the size and nature of the soil particles. Have you ever asked yourself why different types of soils are used for different purposes? In this lesson you will learn how to distinguish clay from loam and sand soil.

Materials you will need:

Soil Sample A, Soil Sample B, Soil Sample C, Water

Activity set up

1. Collect two cups full of soil from the following sites
   - **I.** Soil from the top layer of a well mulched garden/soil near a rubbish pit/soil under leaves in a forest/soil by the roadside where grass is growing **(**Labelled **Soil Sample A)**
   - **II.** Soil from a place where pots or charcoal stoves are made/ from a big anthill **(**Labelled **Soil Sample B)**
   - **III.** Soil from sand pits or mines/soil that remains by the roadside when slow moving water has drained. **(**Labelled **Soil Sample C)**
2. Place the soils on separate sheets of paper to dry
3. Remove any non-soil material from your samples
4. Keep the soils in separate containers for use in other activities

Caution: wash your hands with soap and water after this activity

Procedure:

Step 1: Take a pinch of soil sample A between your thumb and your forefinger. Press and rub gently. Describe the size of the soil particles. Are they small/ fine (powder-like)/big? Record your description in the table below.

Step 2: Repeat the procedure in step 1 using soil sample B and soil sample C.

Step 3: Take a pinch of soil sample A between your thumb and your forefinger. Pour ONE or TWO drops of water onto the soil between your fingers. Press and rub gently. Describe how the soil feels (texture). Is it smooth/rough/slippery/gritty? Record your description in the table below.

Step 4: Repeat the procedure in step 3 using soil sample B and soil sample C.

Step 5: Take a handful of soil sample A, add a little water at a time and mix it with the soil. Try and mould the soil into a ball. Throw the ball into the air about 50cm and then catch it. Describe what happens to the ball. Does it remain intact/it falls apart? Record your observation in the table below.

Step 6 Repeat the procedure in step 5 using soil sample B and soil sample C.

	Soil Sample A	**Soil Sample B**	**Soil Sample C**
Size of the soil particles			
Feel (texture) of soil			
Behavior of soil when thrown in air			

Read the characteristics below and use them to identify soil samples A, B and C.

Sand soil; feels gritty when wet, has relatively big particles that do not easily clamp together when wet.

Clay soil; feels smooth and slippery when wet, has very fine particles that strongly clamp together when wet.

Loam soil; feels like an intermediate between gritty and smooth, has small particles that readily clamp together when wet.

Soil Sample A is ……..

Soil Sample B is ……..

Soil Sample C is ……..

Follow-up activity:

Soil in Uganda is used for various economic activities or in making different products. Think about your community and identify the economic activities that use soil or products made from soil. For each activity/product identified, mention the type of soil used and give reasons why that soil type is preferred.

Revision activity 3

Soil drainage is the soil's natural ability to let water pass through it while water retention refers to the amount of water soil can hold. Why do you think it is important to understand these two properties of soil? In this lesson you will compare drainage in two types of soil.

Materials you will need:

4 empty clear plastic bottles (500/600mls) as receivers, cotton wool, dry sand and clay, clock/watch, water, 4 funnels *(If you cannot fine a ready-made funnel, then use a cutter (knife/razor blade) to cut ½ of upper portion of the empty clear plastic bottles and use them as funnels and the lower portions as receivers/containers. In this case, you will need a cutter (knife/razor blade)).*

Caution: Wash your hands with soap and water after this activity.

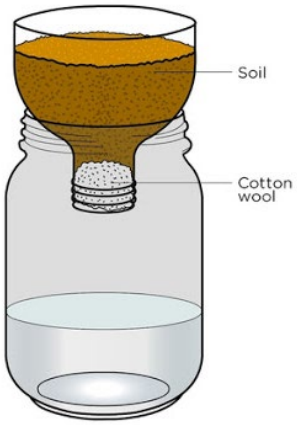
Procedure:

Step 1: Measure an equal volume of each soil sample, for example 30cm^3

Use a piece of cotton wool to plug each funnel

Step 2: Put clay in one funnel and the sand in the other funnel

Step 3: Place the funnels with their contents over the receivers.



Step 4: Pour (at the same time) an equal volume ($50cm^3$) of water on each of the soil samples. Look at your clock or watch and let the experiment run for 20 minutes

Step 5: Observe and take note of the following:

i. The soil from which water started dripping first.
ii. The volume of water collected after the experiment.

Step 6: Record your findings in a table of your choice.

What explained conclusions can you draw about:

i. Drainage in:

- Clay soil
- Sandy soil

ii. Water retention:

- Clay soil
- Sandy soil

Follow-up activity

Comment on how the knowledge of drainage and water retention of clay and sand is used in the following areas:

i. Agriculture
ii. Building construction
iii. Craft making

BIOLOGY SELF-STUDY MATERIALS
Senior Three

Topic: Gaseous Exchange
By the end of this topic, you should be able to demonstrate the mechanism of breathing.

Introduction
Breathing involves two actions; breathing in (inhalation) and breathing out (exhalation) of air.

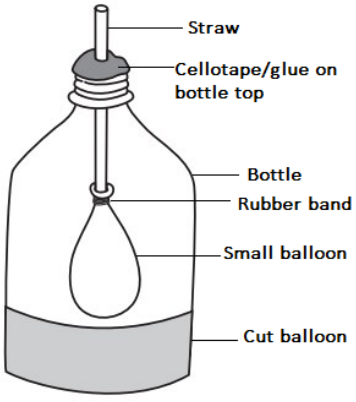
Activity: Demonstrating breathing

In the following activity, you are going to make a model and use it to demonstrate breathing in the human respiratory system.

Things you will need: 2 balloons (one small and one large), straw, empty plastic bottle, rubber band/ string.

Set up of the experiment

i) Measure 7 cm from the bottom of the water bottle and cut it off.
ii) Insert a straw of length 5 cm into the open end of the small balloon.
iii) Tie the balloon onto the straw using a rubber band. Make sure not to squeeze/ block the straw.
iv) Pierce a hole - the size of the straw - on the bottle top (cover of the bottle).
v) Insert the remaining open end of the straw through the hole at the bottle cap. Glue / cellotape the straw to make it firm on the cap.
vi) Cut the larger balloon in half. Keep the bottom half.
vii) Attach the bottom half of the larger balloon firmly around the cut end of the bottle.



Procedure

Part A

1. What do the following represent?
    i) Balloon in the bottle
    ii) Straw
    iii) Bottle
    iv) Piece of balloon at the bottom of the bottle

2. Pull the larger balloon at the bottom downwards.
    i) What does this action represent in the human respiratory system?
    ii) Why should the bottom of the balloon be pulled?
    iii) State what you have observed.
    iv) Explain your observation.
    v) What is the equivalent of this action in breathing process?
3. Now release the balloon to return to original position.
    i) What is this action equivalent to?
    ii) What do you notice?
    iii) Give reasons for your observation.
4. What is the scientific principle behind the breathing action?

Part B

1. Fill your mouth with water.
2. Push the water from your mouth into the small balloon through the straw.
3. Pull the larger balloon at the bottom downwards and then release it back to its position.
4. What do you observe?
5. Give reasons for your observation.

Follow-up activity

Corona virus causes accumulation of fluid in the human lungs. Patients suffering from Corona virus disease – 19 (COVID-19) have difficulty in breathing. How do you explain this?

BIOLOGY SELF-STUDY MATERIALS
Senior Four

Topic: Growth and Development

Introduction
By the end of this topic, you should be able to conduct an experiment on plant growth over time. You should also be able to plot a growth-time graph on the growth observed.

You can easily determine the growth in plants by using a germinating seedling. The rate at which a seedling grows shows the availability of nutrients in the soil and the overall health of the plant.

Activity: Determining the growth rate of a seedling
In the activity below, you will germinate seeds and take measurements on the shoot of the seedlings to determine the rate of growth.

Things you will need: Maize grains, empty plastic water bottle, water, knife or razor blade, ruler, pen / pencil, graph paper

Procedure
1. Half way the length of the water bottle, make a mark with pencil / pen.
2. Cut the bottle using a knife or razor blade from the marked part.
3. Remove the top part of the bottle.
4. Put soil in the remaining part of the bottle.
5. Put maize grains in the soil but on the side nearer the wall of the bottle where you can see.
6. Sprinkle water onto the soil. Why is this so? Keep checking on the seeds.
7. Note down when the shoot appears. Record this as day 0 in the table.

Time (days)	Length of shoot (cm)
Day shoot appears (day 0)	0
Day 2	
Day 4	
Day 6	
Day 8	
Day 10	

8. Then after two days, measure the height of the shoot in millimeters. Continue with measurement and record the result after every two days for the next 5 days.
9. From the records obtained, plot a graph of growth rate against time (number of days).

Follow-up activity

During germination and growth of maize, the dry weight of the endosperm, the weight of the embryo and the total dry weight were determined at two-day intervals. The results are shown in the table below.

Time after planting (days)	Dry weight of endosperm (mg)	Weight of embryo (mg)	Total dry weight (mg)
0	43	2	45
2	40	2	42
4	33	7	40
6	20	16	37
8	10	25	35
10	6	33	39

1. On the same axes, draw a graph of the dry weight of the endosperm, weight of the embryo and the total dry weight against time.
2. Determine the total dry weight on day 5
3. Explain:
   i) the decrease in dry weight of the endosperm from days 0 to 10.
   ii) the increase in dry weight of embryo from days 0 to 10.
   iii) the decrease in total dry weight from day 0 to 8.
   iv) the increase in total dry weight after 8 days.

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