

**NATIONAL BUSINESS AND TECHNICAL EXAMINATIONS BOARD  
NATIONAL TECHNICAL CERTIFICATE EXAMINATION**

**BIOLOGY (ESSAY)**

**PART I – INTRODUCTORY BIOLOGY**

1. (i) *Define the term 'Osmosis'.*

Osmosis is the movement of water molecules, from their area of higher concentration, to their area of lower concentration through a semi-permeable membrane, until equilibrium is reached.

- (ii) *Describe an experiment to demonstrate Osmosis using a named living material.*

A named living material – egg membrane, urinary bladder, base of pawpaw petiole, yam cup, pawpaw fruit, yam strip, yam tuber.

Description of the experiment:

1. Cut two thick pieces of yam tuber.
2. Peel off the bark
3. Remove the central portion to make them look like cup.
4. label them A and B
5. stand them side by side in a trough or distilled water.
6. pour some quantity of strong salt solution into A
7. leave B without salt solution to serve as a control
8. allow set-ups to stand for 2 – 4 hours.

Result:

1. Water molecules move from the trough into yam cup A,
2. Water level in A rises.
3. Water molecules did not move into yam cup B.

Conclusion:

Living tissues of yam as semi permeable membrane allowing water molecules, to move from area of higher concentration in the trough, to area of lower concentration in the yam cup A.

Yam Cup B had no salt solution, water molecule did not move into it, its water concentration was the same as the trough.

- (ii) Give *THREE* physiological processes in animals which are osmosis driven.
- i. Movement in and out of water molecules in animal cells
  - ii. Re-absorption of water in the kidney tubules
  - iii. Absorption of water from undigested food in large intestine/colon
  - iv. Haemolysis in red blood cells.

PART II – FLOWERING PLANTS AND SOIL SCIENCE

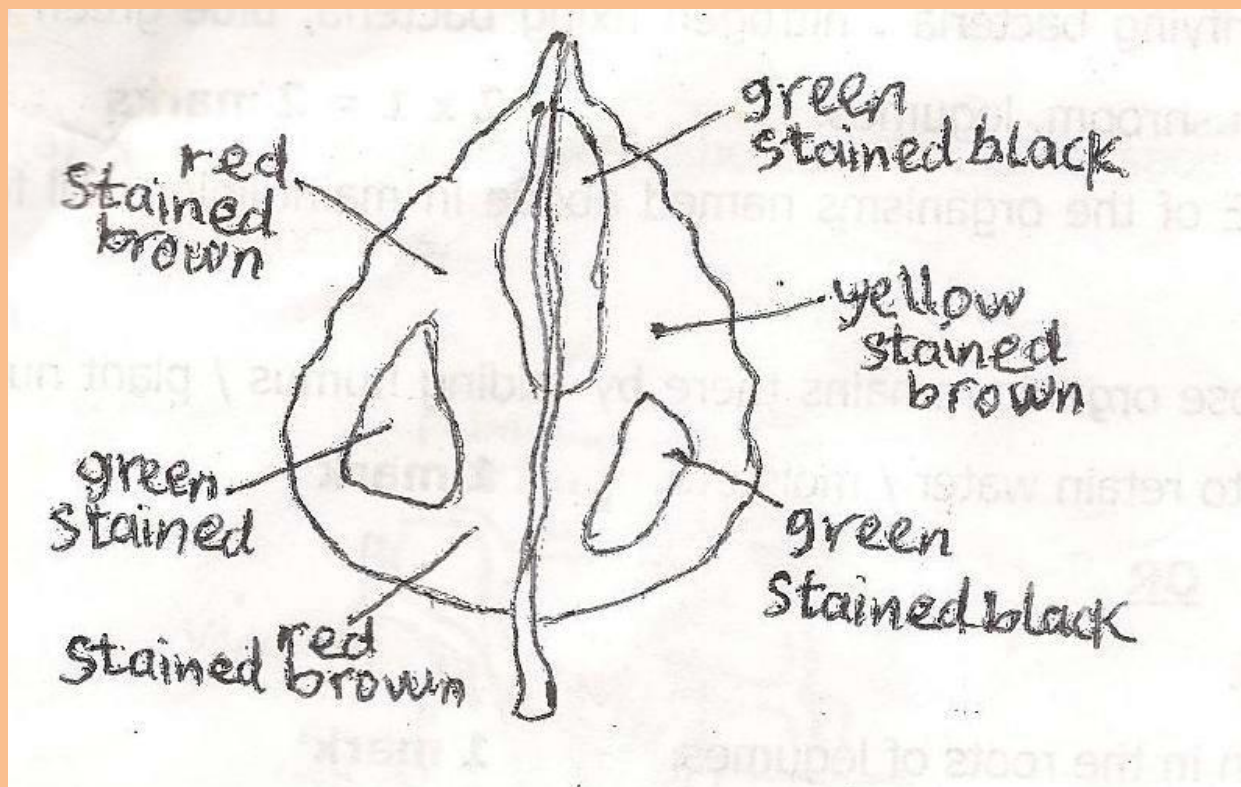
2. (i) *What is photosynthesis?*

It is the process of manufacturing organic substance, sugar, in green cells, in the presence of sunlight, using carbon (IV) oxide, water and dissolved salts, giving off oxygen; as a by-product.

- (ii) *Describe an experiment to show that photosynthesis can only take place in the presence of chlorophyll. (An illustrated diagram is required)*
1. Collect a variegated leaf
  2. illuminated for about 4 to 6 hours
  3. from a healthy growing acalypha/croton/ice plant/calladium plant
  4. map the leaf/draw the leaf and label the different coloured areas.
  5. treat/prepare the leaf for starch test
  6. spread iodine solution on the leaf
  7. compare/match the leaf with the map.

Result:

1. Green area stained black/blue black
2. Other coloured areas/white/red/yellow stained brown or yellow.



Conclusion:

1. Green areas contain chlorophyll, carried out photosynthesis, therefore stained black.
  2. yellow/white/red areas contained no chlorophyll, did not photosynthesize, stained yellow or brownish.
  3. photosynthesis take place only in the presence of chlorophyll.
- (iii) List THREE importance of photosynthesis to the living thing.
1. makes food available for all living things
  2. makes oxygen available for aerobic respiration
  3. removes excess carbon (iv) oxide
  4. fibre for making clothes, ropes, mats etc.
- (iv) Name TWO storage organs in flowering plants.
1. Root, 2. Stem 3. leaf 4. bulb 5. corm 6. rhizome/flower
3. (a) (i) Name TWO organisms that help in the improvement of soil fertility.
1. putrefying bacteria, nitrifying bacteria, nitrogen fixing bacteria, blue green algae.
  2. Earthworm, termites, mushroom, legumes.
- (ii) Discuss the role of ONE of the organisms named above in maintaining soil fertility.
1. The role of putrefying bacteria in maintaining soil fertility.

1. Causes decay: decompose organic remains thereby adding humus/plant nutrients to the soil, making soil to retain water/moisture. OR
2. Nitrogen fixing bacteria:
  - i. fix atmospheric nitrogen in the roots of legumes.
  - ii. change nitrogen to nitrites, in the soil.
  - iii. nitrogen fixing bacteria change nitrites, in the soil OR

Earthworms

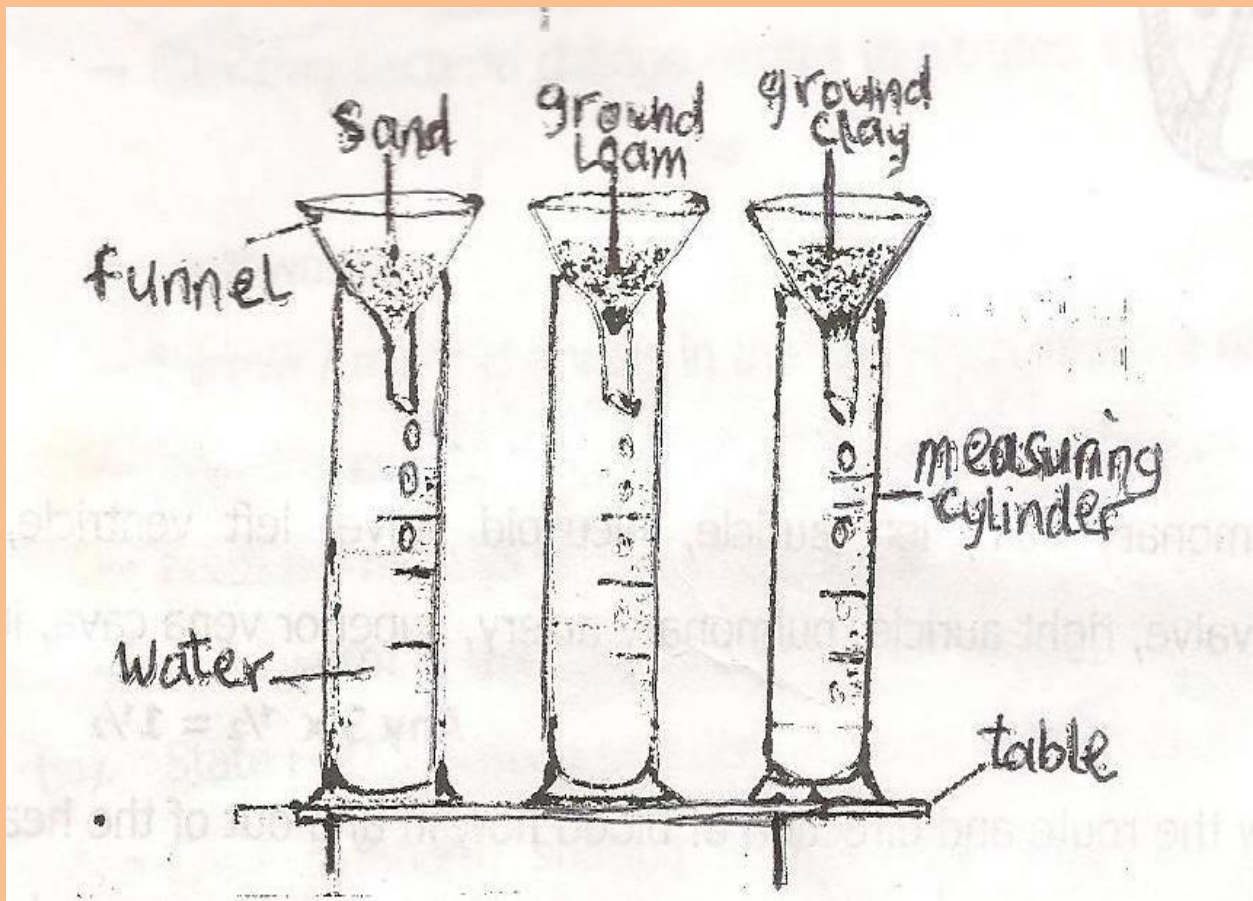
- i. burrow/make channels in the soil which improve drainage aeration and soil texture.
  - ii. drag leaves into the soil when leaves decay humus is added to the soil.
  - iii. Form worm caste which improve soil texture
  - iv. dead worm in the burrow add humus to soil
- 3(a) iii. State FOUR farming practices used by man to maintain soil fertility.
1. crop rotation
  2. shifting/fallowing method
  3. monocropping
  4. mixed farming
  5. application of organic manure
  6. application of inorganic fertilizer
  7. growing of cover crops/legumes.
  8. Ridging of farm land
  9. mulching
  10. ridging across the slope.

- 3(b) *Three measuring cylinders with a funnel on each were placed on a table. The necks of the funnels were plugged with cotton wool. Equal weight of soil samples were placed in the funnels as follows: Sand in the first, ground loam in the second, and ground clay in the third. Equal volume of water was poured in the three set-ups.*
- i. *write the aim of this experiment*
  - ii. *state the major observation of this experiment*
  - iii. *draw and label the experimental set-ups.*

Answer:

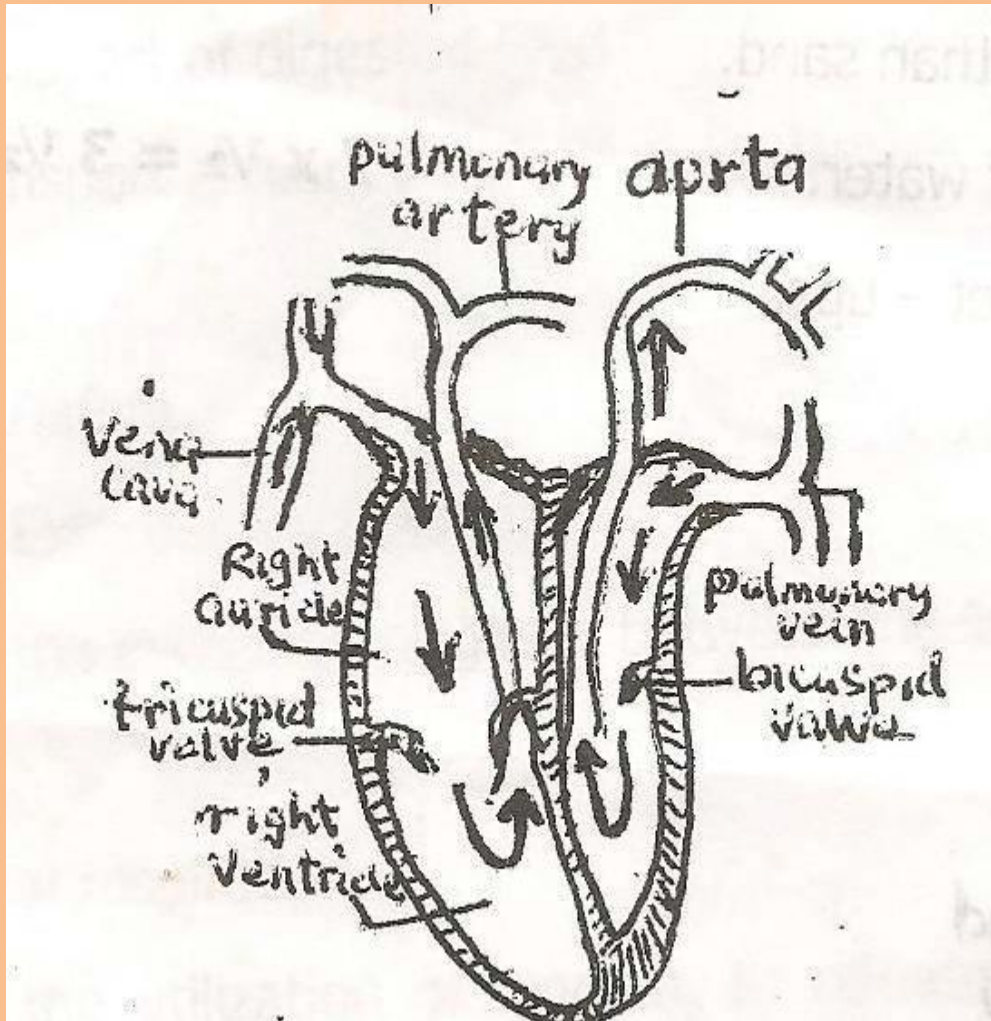
- i. to compare water retaining capacity/porosity of different soil types
- ii. (a) the major observation of this experiment is that water passes fast through the ground clay, faster in ground loam and fastest in sand.
  - (b) Highest volume of water is collected in the cylinder carrying sand.
  - (c) Less volume of water in the cylinder carrying ground loam
  - (d) Least volume of water in the cylinder carrying ground clay
  - (e) Ground clay retains almost all the water
  - (f) Sand retains very little amount of water.

iii.



### PART III – ANIMAL BIOLOGY

4. (a) i. Make a large and well labelled longitudinal section of the heart of human being to show its structures.



4. (a) ii. Use arrows to show the route and direction of blood flow in and out of the heart. List FOUR components of blood. Discuss any TWO transport functions of blood.

Answer

Superior and inferior vane cavae → right auricle → right ventricle → pulmonary artery out to lungs. → in by pulmonary veins → left auricle → left ventricle → aorta out to all parts of the body.

Four components of blood

1. Red blood
2. white blood cells
3. plasma
4. blood platelets

Discussion of transport functions of blood.

1. Distribution of oxygen: Red blood cells pick oxygen in the areola of the lungs. Enters the heart and leaves by way of the aorta to all parts of the body.

2. Removal of carbon (IV) oxide: The blood pick carbon (IV) oxide from all living cells and carry it into the right auricle of the heart. The carbon (IV) oxide is taken to the lungs through the pulmonary vein for exhalation.
  - distribution of heat
  - Transport of digested food
  - Transport of hormones.

4. (b)
  - i. *Define external respiration.*  
This is the exchange of gases between the living things and the surrounding.
  - ii. *Define internal respiration.*

This is the utilization of oxygen to release energy in stored food giving off carbon (IV) oxide and water as waste products.

- iii. *List FOUR characteristics of respiratory surfaces.*

Thin, wet/moist, vascularized; ciliated, smooth.

- iv. *Write the respiratory structure of amoeba, five day old tadpole, tapeworm, land snail and grass hopper.*

Organism	Respiratory Structure
Amoeba	Cell membrane
Five day old tadpole	Internal gills
Tape worm	Body surface
Land Snail	Lung
Grass hopper	Trachea

#### PART IV – GENETICS AND ECOLOGY

5. (a) *Define:*
  - i. *Ecology*
  - ii. *Habitat*
  - iii. *Population*
  - iv. *Ecosystem*
  - v. *Community*

1. Ecology: is the study of the interactions of living things with their physical environment, and with one another.
2. Habitat: is a place where an organism is found/that can sustain/support life.
3. Population: is the total number of organisms, of the same species, living together in the same place, that can reproduce fertile offspring among themselves, at a given time.

4. Ecosystem: is the collection of different organisms, living together in a place, interacting among themselves and the physical environment.
  5. Community: is where different population, living together, in the same place mutually interdependent.
5. (b) Give ONE functions for each of the following tools in the study of ecology.
- i. Quadrant
  - ii. Sweep Net
  - iii. Pooter Depth
  - iv. Guage
- i. Quadrant: for sampling/determing population size frequency and density of a species.
  - ii. Sweep Net: for catching/collecting insects
  - iii. Pooter: for sucking in tiny/minute insects and other animals from tree barks, leaf and rock surfaces.
  - iv. Depth Guage: for measuring depth of water in an aquatic habitat.