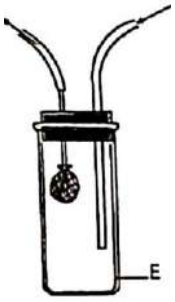
2024 KCSE
BIOLOGY PAPER 1
QUESTION PAPER

*Answer **all** the questions in the spaces provided.*

1 The following diagram shows an apparatus used in ecological studies.



(a) Name the apparatus. (1 mark)

……

……

……

(b) Why is glass preferred in the making of the part labelled E? (1 mark)

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……

2 (a) Name the Kingdom whose members are all microscopic. (1 mark)

……

(b) State **two** diseases caused by organisms belonging to the Kingdom named in 2(a).

(2 marks)

……

……

3 During a microscopy practical, the following materials were provided:

- a temporary mount of an onion epidermis
- a transparent ruler

(a) State the aim of the experiment. (1mark)

……

……

(b)Explain how the aim stated in 3(a) can be achieved. (3 marks)

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4 The following diagram represents a specialized animal cell.



(a) Identify the cell. (1 mark)

……

(b) (i) Name the cell organelle that is likely to be found in abundance in the part labelled F. (1 mark)

……..

(ii) Explain the answer in 4(b)(i). (2 marks)

……

……

5 Name **two** components of blood that are absent in the tissue fluid. (2 marks)

……..

……..

……..

6 Name the structures in plants through which the processes of transpiration and guttation occur.

Process	**Structures in plants where it occurs**	
a) Transpiration	……	(1 mark)
b) Guttation	……	(1 mark)

7 Name two Classes of the Phylum Arthropoda that have a **cephalothorax.** (2 marks)

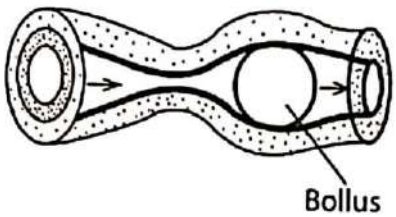
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8 (a) Name the source of hydrochloric acid in the human alimentary canal. (1 mark)

……

(b) The following diagram shows a process along the mammalian digestive system.



(i) Name the process. (1 mark)

……

(ii)State two roles of the process in digestion. **(2 marks)**

……

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9 Name one blood disorder caused by gene mutation.(1 mark)

……

10 Name the stage in meiosis where each of the following processes occur:

(a) formation of spindle fibres;

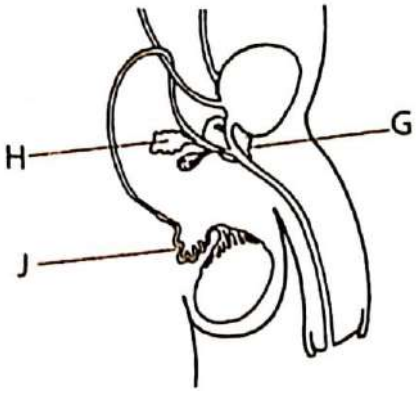
(1 mark)

……

(b) disappearance of nucleolus.(1 mark)

……

11 The following diagram represents part of the human male reproductive system.



(a) Name the part labelled **G.** (1 mark)

……

(b) State one function of the structure labelled **H**. (1 mark)

……

(c) How is the structure labelled **J** adapted to its function? (2 marks)

……

……

……

12 How do the following structural modifications in plants minimize the rate of water loss?

(a) Leaf folding. (1 mark)

……

(b) Sunken stomata. (1mark)

……

13 State two reasons for the absence of complex excretory organs in plants. (2 marks)

……

……

14 State the significance of each of the following characteristics in mammalian gaseous exchange structures and surfaces. (a)Presence of rings of cartilage in the trachea. (1 mark)

……

(b) Numerous blood capillaries lining the lungs. (1 mark)

……

15 (a) What is the most appropriate method of estimating the population of black ants in a school playing field (1 mark)

……..

(b) Why are shorter food chains advantageous in **an** ecosystem? (2 marks)

……

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……

16 (a) Using an example, define *convergent evolution.* (2 marks)

……

(b) Explain how *natural selection* is advantageous to living organisms (3 marks)

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17 (a) (i) Name the blood vessel that carries oxygenated blood from the heart to the rest of the body tissues (1 mark)

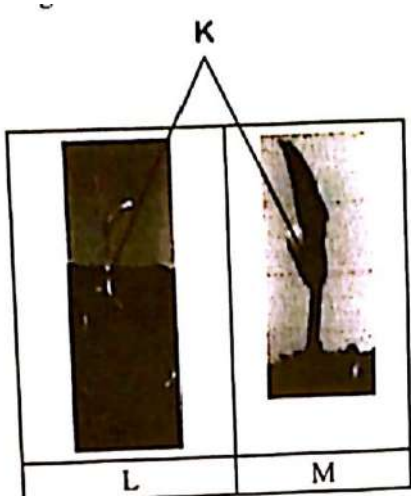
……

(ii) State the role of tricuspid valve in the mammalian heart. (1 mark)

……

(b) Why are people with blood group O referred to as universal donors? (2 marks)

18 The following diagram shows germination in two different seedlings labelled **L** and **M**.



(a) (i) Identify the type of germination shown in seedling L. (1 mark)

……

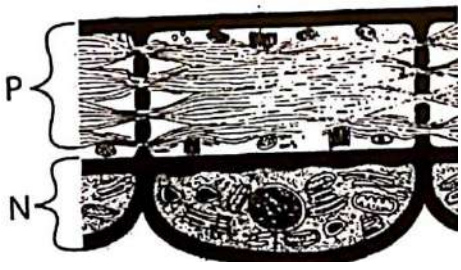
(ii) Give a reason for the answer in 18(a)(i). (1 mark)

……

(b) State **one** common function of the parts labelled **K** in seedlings **L** and **M**. (1 mark)

……

19 The following diagram represents a longitudinal section through a phloem tissue



Turn over

8

(a)Account for the high concentration of mitochondria in the part labelled **N**. (3 marks)

……

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……

(b)State **one** structural adaptation of the part labelled P to its function. (2 marks)

……

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……

20 The following word equation represents a metabolic reaction taking place in an animal tissue.

Glucose→Lactic acid+Energy

(a) State the condition under which the reaction occurs. (1 mark)

……

(b)How does the size of an animal affect the rate of respiration? (3 marks)

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21 (a) How can sexual reproduction in organisms lead to the evolution of new species?

(3 marks)

……

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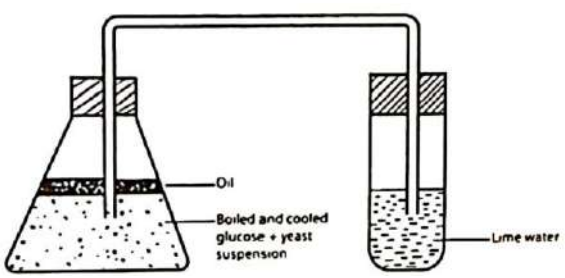
(b) State the role of continental drift in the evolution of organisms. (2 marks)

……

……

……

22 The following diagram represents an experimental set-up used to investigate a certain biological process.



(a) (i) Identify the biological process that can be investigated using the set-up. (1 mark)

……

(ii) Give a reason for the answer in 22(a)(i)

……

……

(b) Write a word equation illustrating the reaction taking place in the experiment. (1 mark)

……

(c)Suggest a modification on the set-up that would increase the rate of reaction in the conical flask.(1 mark)

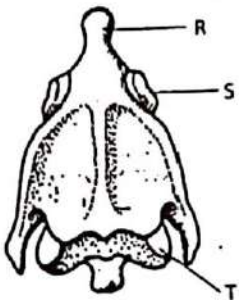
……

……

(d) Why is it necessary to cool glucose before adding yeast in the conical flask? (1 mark)

……

23 The following diagram represents a bone obtained from a mammalian axial skeleton.



(a)Identify the:

(1 mark)

(i) bone;

……

(ii)part labelled R. (1 mark)

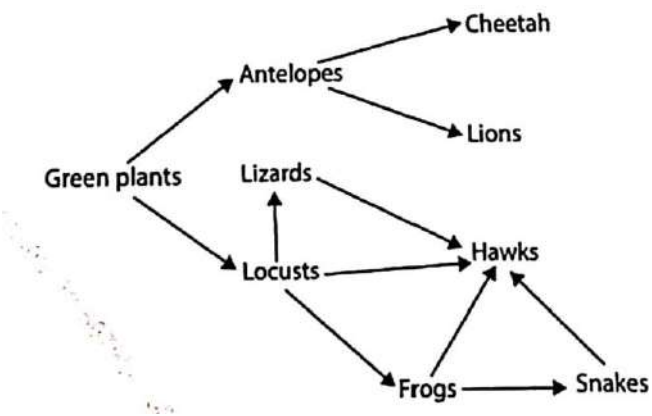
……

(b) Name the bones that articulate at the points labelled S and T.

S…….. (1 mark)

T…… (1 mark)

24 The following food web shows a feeding relationship found in a certain ecosystem.



(a)From the food web, identify the:

(i) organism with the lowest biomass; (1 mark)

……..

(ii)trophic level occupied by lizards.(1 mark)

…….

(b)Name the type of feeding relationship between the:

(i) lion and the cheetah; (1 mark)

…….

(ii) cheetah and the antelopes. (1 mark

…….

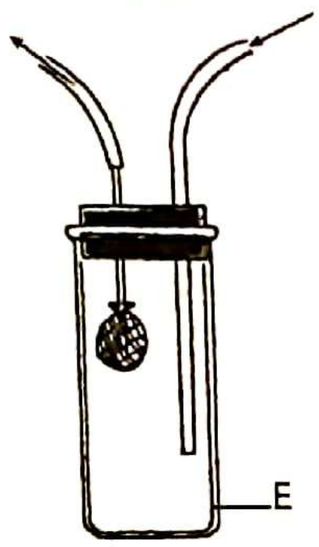
(c) Explain the role bacteria would play in this ecosystem. (2 marks)

……

……

*Answer **all** the questions in the spaces provided.*

1 The following diagram shows an apparatus used in ecological studies.



(a) Name the apparatus. (1 mark)

Pooter / Aspirator;

(b) Why is glass preferred in the making of the part labelled **E**? (1 mark)

Glass is transparent / to (clearly) see / observe / study the observable features / characteristics of the collected specimen); therefor allow light and the specimens / can be seen / viewed

2 (a) Name the Kingdom whose members are all microscopic. (1 mark)

Monera

(b) State **two** diseases caused by organisms belonging to the Kingdom named in 2(a). (2 marks)

Whooping cough/Pertusis; Cholera; Tuberculosis; Dental carries; Gonorrhoea; Anthrax; Typhoid; Syphilis; Tetanus; Meningitis; Pneumonia; Diph

3 During a microscopy practical, the following materials were provided:

- a temporary mount of an onion epidermis
- a transparent ruler

(a) State the aim of the experiment. (1 mark)

To estimate the size/diameter of a cell/cells (visible in the field of view);

(b) Explain how the aim stated in 3(a) can be achieved. (3 marks)

• Using the ruler determine the size of field of view (in mm);
• Count the (no. of) cells (that fits) across the field of view;
• Calculate / work out the diameter / size of one cell (in Mm) /
Diameter / size of one cell = Diameter of field of view (in Mm
No. of cells.

4 The following diagram represents a specialized animal cell.



(a) Identify the cell. (1 mark)

Sperm (cell); / spermatozoon;

(b) (i) Name the cell organelle that is likely to be found in abundance in the part labelled F. (1 mark)

Mitochondrion; Accept Mitochondria

(ii) Explain the answer in 4(b)(i). (2 marks)

Mitochondria enable the cell to respire hence provide energy; which aid in propulsion (of the cell);

5 Name **two** components of blood that are absent in the tissue fluid. (2 marks)

Red blood cell / Erythrocytes;
Some White blood cell / Leucocytes / non-phagocytic leucocytes;
Protein; Platelets / Thrombocytes;

6 Name the structures in plants through which the processes of transpiration and guttation occur.

Process	Structures in plants where it occurs
a) Transpiration	Stomata / stoma; cuticle(s); lenticel(s); (1 mark)
b) Guttation	Hydathodes; (1 mark)

7 Name **two** Classes of the Phylum Arthropoda that have a cephalothorax. (2 marks)

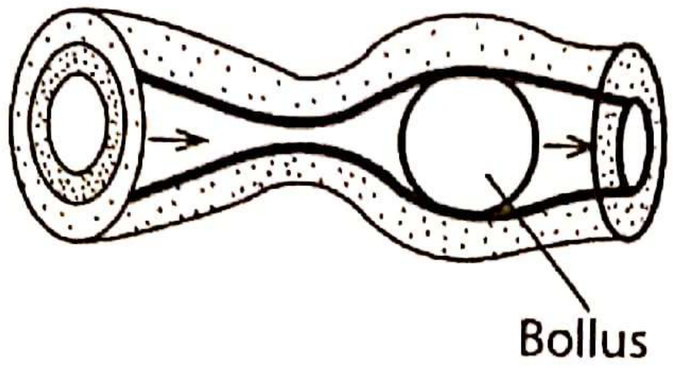
Crustacea ;

Arachnida ;

8 (a) Name the source of hydrochloric acid in the human alimentary canal. (1 mark)

Gastric glands / parietal cells / oxyntic cells ;

(b) The following diagram shows a process along the mammalian digestive system.



(i) Name the process. (1 mark)

Peristalsis ;

(ii) State **two** roles of the process in digestion. (2 marks)

• Facilitate Movt of food (along the digestive tract/system) ;

• Enables Mixing of food (down the alimentary canal) ;

• Enables large intestines/colon/rectum to absorb water from undigested food ;

Name **one** blood disorder caused by gene mutation. (1 mark)

// Sickle cell anaemia / sickle cell trait ; // Haemophilia ;

Name the stage in meiosis where each of the following processes occur:

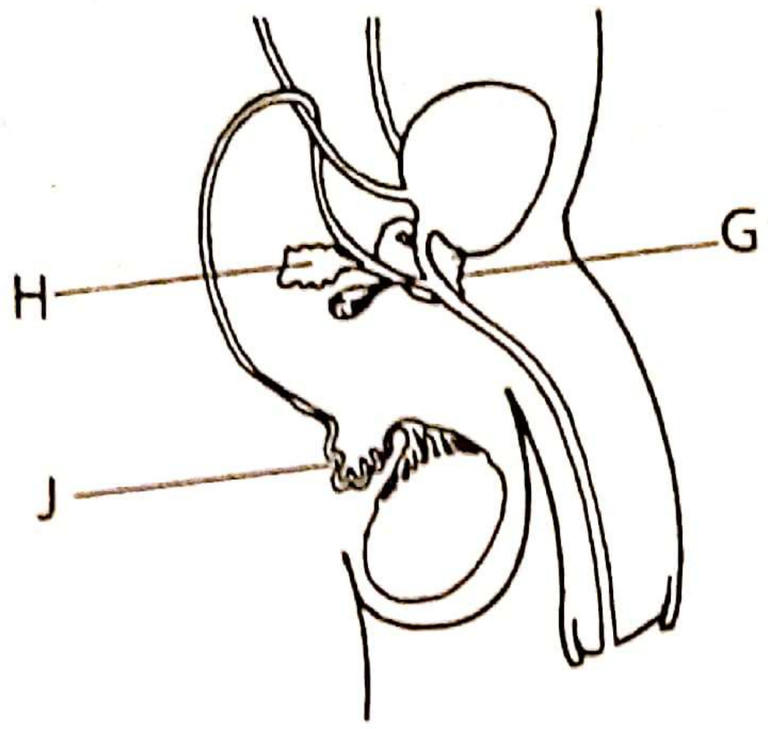
(a) formation of spindle fibres; (1 mark)

Metaphase I / Metaphase II ;

(b) disappearance of nucleolus. (1 mark)

Prophase I / Prophase II ;

11 The following diagram represents part of the human male reproductive system.



(a) Name the part labelled **G**. (1 mark)

Prostate gland;

(b) State **one** function of the structure labelled **H**. (1 mark)

• Provides an alkaline fluid to neutralize the acidity of vaginal fluide/ Provides nourishment to the spermatozoa / Aid in sperm movt;

(c) How is the structure labelled **J** adapted to its function? (2 marks)

• Highly coiled;

• To increase the S.A for the storage of the sperms;

12 How do the following structural modifications in plants minimize the rate of water loss?

(a) Leaf folding. (1 mark)

• Reduces the S.A exposed (to light / temperature);

(b) Sunken stomata. (1 mark)

• Water vapour / Moisture accumulates / is departed in the pits / sunken stomata reducing the diff. gradient / saturation deficit (btwn internal air spaces & the pits / inside and outside the leaf);

State **two** reasons for the absence of complex excretory organs in plants. (2 marks)

• Wastes form slowly / little wastes accumulate (due to the inactivity of the plants);

• Some waste materials are recycled / reutilized;

• The wastes are less toxic;

• Some are stored in plant parts that are later shed off / stored in dead tissues;

14 State the significance of each of the following characteristics in mammalian gaseous exchange structures and surfaces.

(a) Presence of rings of cartilage in the trachea. (1 mark)

Keep the trachea/wind pipe open/ Prevent from collapsing (for gaseous exchange);

(b) Numerous blood capillaries lining the lungs. (1 mark)

Increase the S.A for diffusion of (respiratory) gases/ increase diffusion gradien/ rapid transport of (respiratory) gases/ creates a steep concentration gradient;

15 (a) What is the **most** appropriate method of estimating the population of black ants in a school playing field? (1 mark)

Quadrat/ capture - recapture method;

(b) Why are shorter food chains advantageous in an ecosystem? (2 marks)

• They have fewer less trophic / feeding levels; therefore,
• (more) energy is conserved /minimize /reduce loss of energy;

16 (a) Using an example, define *convergent evolution.* (2 marks)

Is the modification of structures of organisms of different ancestral/embryonic origin to perform similar functions; eg wings of insects & birds / wings of bats/insects (modified for flying) / eyes of Mammals & limbs of mammals and Arthropods / Flippers of whales & fins of fish;

(b) Explain how *natural selection* is advantageous to living organisms. (3 marks)

It serves to identify organisms with desirable traits/ adaptations that help them survive and reproduce; eliminate organisms with harmful traits (that are less likely to survive and reproduce); pass on beneficial genetic traits/ mutations to subsequent generations through

17 (a) (i) Name the blood vessel that carries oxygenated blood from the heart to the rest of the body tissues. (1 mark)

Aorta;

(ii) State the role of tricuspid valve in the mammalian heart. (1 mark)

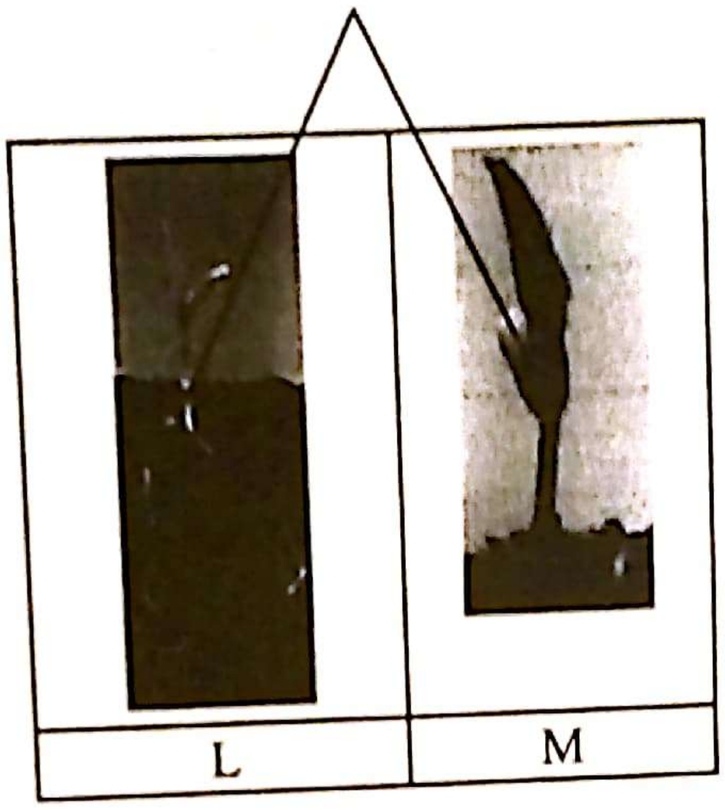
Prevent back-flow into the right atrium (when ventricle muscles contract) / allow flow of blood from right atrium into the right ventricle;

(b) Why are people with blood group **O** referred to as universal donors? (2 marks)

• Blood group O lack antigens / A B; therefore,

• No agglutination (with recipient antibodies);

18 The following diagram shows germination in two different seedlings labelled **L** and **M**.



(a) (i) Identify the type of germination shown in seedling **L**. (1 mark)

Hypogeal;

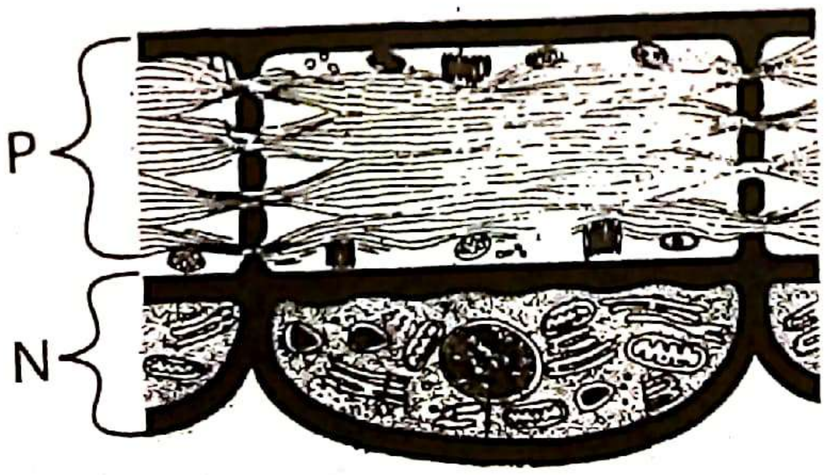
(ii) Give a reason for the answer in 18(a)(i). (1 mark)

• The cotyledon remains below the soil surface / underground.

(b) State **one** common function of the parts labelled **K** in seedlings **L** and **M**. (1 mark)

• Storage of food / contain digestive enzymes that breakdown / hydrolyse (stored) food (needed for germination);

19 The following diagram represents a longitudinal section through a phloem tissue.



(a) Account for the high concentration of mitochondria in the part labelled N. (3 marks)

• To synthesize the energy;
• Needed for the active transportation / translocation;
• Of food substances in / out of the sieve tubes;

(b) State **one** structural adaptation of the part labelled **P** to its function. (2 marks)

Ask the 1st one function no nature

• Close to companion cells; for easy access of energy / nutrients;
• Filled with fine cytoplasmic Filaments; for streaming of food from one sieve tube to another;
• Has organelles placed against the wall; increase SA for packaging of filaments;
• Has (sieve plates) sieve pores; to allow continuous flow of materials;

20 The following word equation represents a metabolic reaction taking place in an animal tissue.

Glucose ⟶ Lactic acid + Energy

(a) State the condition under which the reaction occurs. (1 mark)

In the absence of oxygen / insufficient supply of oxygen / Anaerobic conditions / Anaerobic respiration / Anaerobiosis;

(b) How does the size of an animal affect the rate of respiration? (3 marks)

Small bodied animals have larger SA:VR; exposed to higher / faster heat loss; hence higher rate of respiration to compensate for the lost heat; (and vice versa);

21 (a) How can sexual reproduction in organisms lead to the evolution of new species? (3 marks)

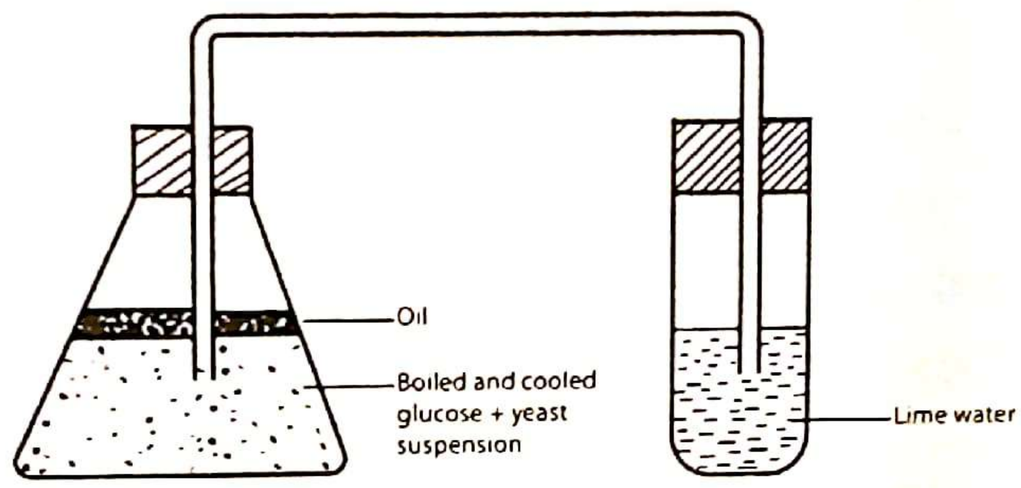
3 Points

• Gametes (with different genes/alles) from different parents;
• Fuse to form a new offspring;
• The varied offspring pass the desirable / advantageous traits to subsequent generations;
• Which may finally result in the establishment of new species over a long period of time; OWTTE

(b) State the role of continental drift in the evolution of organisms. (2 marks)

• Isolation/separation of organisms (with the same genetic composition) from the same origin to different environmental conditions; lead to the development of adaptive xtics/traits (for successful survival in the new habitat); OWTTE

22 The following diagram represents an experimental set-up used to investigate a certain biological process.



(a) (i) Identify the biological process that can be investigated using the set-up. (1 mark)

Anaerobic / Fermentation / Anaerobiosis;

(ii) Give a reason for the answer in 22(a)(i). (1 mark)

Boiling removes/drives out air/oxygen/the layer of oil prevents the entry/supply of oxygen/air;

(b) Write a word equation illustrating the reaction taking place in the experiment. (1 mark)

Glucose → Alcohol/Ethanol + Carbon(IV)oxide + energy (ATP);

(c) Suggest a modification on the set-up that would increase the rate of reaction in the conical flask. (1 mark)

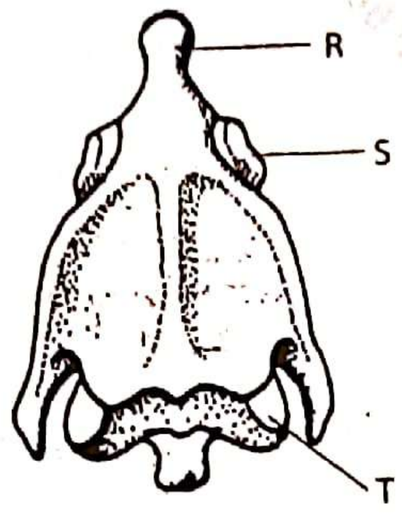
• Increasing temperature to optimum (to activate the respiratory enzyme);
• Increasing the concentration of yeast/Glucose;

Accept - Warming ei - introduce heat

(d) Why is it necessary to cool glucose before adding yeast in the conical flask? (1 mark)

• To avoid killing the yeast cells/denature the enzymes in the yeast/Zymase;

23 The following diagram represents a bone obtained from a mammalian axial skeleton.



(a) Identify the:

(i) bone; (1 mark)

Axis;

(ii) part labelled **R**. (1 mark)

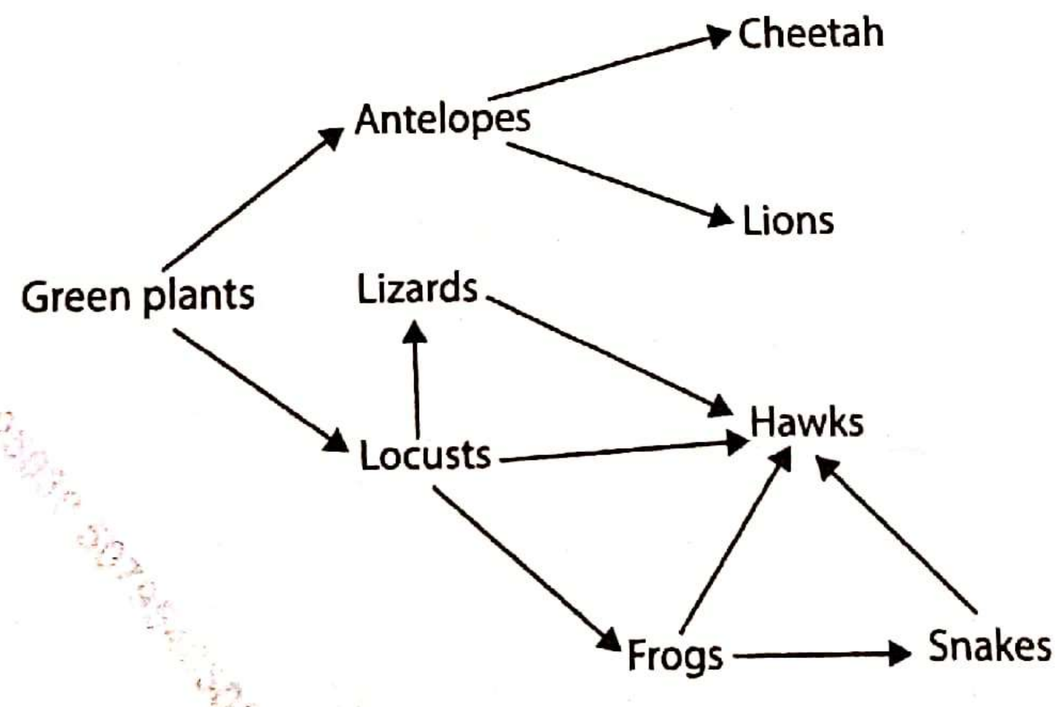
Odontoid process / Peg;

(b) Name the bones that articulate at the points labelled **S** and **T**.

S Atlas (1 mark)

T (Other) Cervical vertebra / 3rd cervical vertebra; (1 mark)

24 The following food web shows a feeding relationship found in a certain ecosystem.



(a) From the food web, identify the:

(i) organism with the lowest biomass; (1 mark)

Hawks;

(ii) trophic level occupied by lizards. (1 mark)

• Secondary consumer / 3rd trophic level;

(b) Name the type of feeding relationship between the:

(i) lion and the cheetah; (1 mark)

(Interspecific) Competition ; Rej intraspecific c

(ii) cheetah and the antelopes. (1 mark)

Predation / Predator-Prey relationship

(c) Explain the role bacteria would play in this ecosystem. (2 marks)

• Decomposition; for releasing / recycling of CMore nutrients in the ecosystem / cleaning the environment ;

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2024 KCSE
BIOLOGY
PAPER II
QUESTION PAPER

SECTION A (40 marks)

Answer all the questions in this section in the spaces provided.

1 The following word equation represents a biological process that occurs in green plants.

Carbon (IV) oxide + water_____Glucose + Product E

(a) Name the cell organelle where the illustrated process takes place in green plants. (1 mark)

……

(b) (i) Give the likely identity of product **E.** (1 mark)

……

(ii)Suggest ways in which the rate of production of **E** can be increased. (3 marks)

……
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……

(c) Suggest **one** possible source of carbon (IV) oxide if the above process was artificially conducted in a school laboratory. (1 mark)

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……

(d) Explain how the illustrated process is significant in nature. (2 marks)

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……

2 In an experiment, the number of red blood cells present in three samples of blood labelled **F**, **G** and **H** was estimated.Different concentrations of salt solution were then separately added to the samples. After an hour, the number of red blood cells present in each sample was counted and recorded as shown in the table below.

Blood sample	Salt solution % concentration added	Number of red blood cells
F	1.0	Number remained the same
G	0.6	Fewer cells observed
H	0.4	No cells observed

(a)Name the physiological process being investigated in the experiment. (1 mark)

……

……

……

(b) Account for the results made in blood sample F. (2 marks)

……

……

……

(c)Account for the difference in appearance of red blood cells in samples **F** and **G** at the end of the experiment. (2 marks)

……

……

……

(d) With a reason, predict the possible observation that would be made if blood sample F was treated with a salt concentration of 2.6% (2 marks)

(e) State the importance of the process being investigated above during urine formation (1 mark)

……

……

3 A genetic investigation on a certain population established that, in human beings, premature baldness is controlled by a dorminant gene, **N** located on the **Y** chromosome.

(a) Work out the phenotypic ratio of the offspring of a couple comprising of a normal mother and a father with premature baldness. (5 marks)

.....
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.....

(b) What is the probability that this couple would have a daughter with premature baldness? (1 mark)

.....

(c)Name **two** sex-linked traits in human beings associated with the X-chromosome (2 marks)

.....
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.....

4 During an ecological study in a lake ecosystem, a group of students made the following observations on the feeding relationships among some organisms.

- · Lobsters feed on algae
- Small fish feed on lobsters, worms and caterpillars
- Caterpillars feed on **algae**
- Worms feed on caterpillar
- Large fish feed on small fish
- · Penguins feed on small fish, lobsters and worms.

(a) From the students' observations, construct a food web for the ecosystem. (5 marks)

.....
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.....

(b) From the food web constructed in 4(a), extract a food chain with the penguin as a secondary consumer. (1 mark)

……

……

(c) Explain how spillage of oil from water vessels is likely to affect this lake ecosystem.

……

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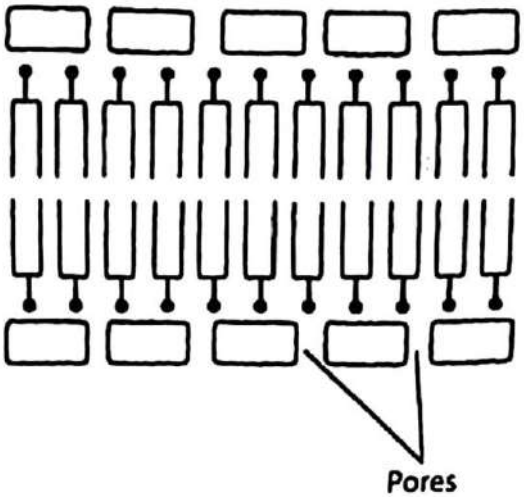
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5 The following diagram represents part of a cell structure as seen under an electron microscope.



(a) (i)Identify the structure represented. (1 mark)

……

(ii) State **two** functions of the structure. (2 marks)

……

……

……

(iii) Suggest **two** ways in which the functioning of the structure can be impaired. (2 marks)

……

……

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……

(b) Name two structures found in plant cells but not in animal cells. (2 marks)

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(c) What is the purpose of staining cells before observing them under a light microscope?
(1 mark)

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……

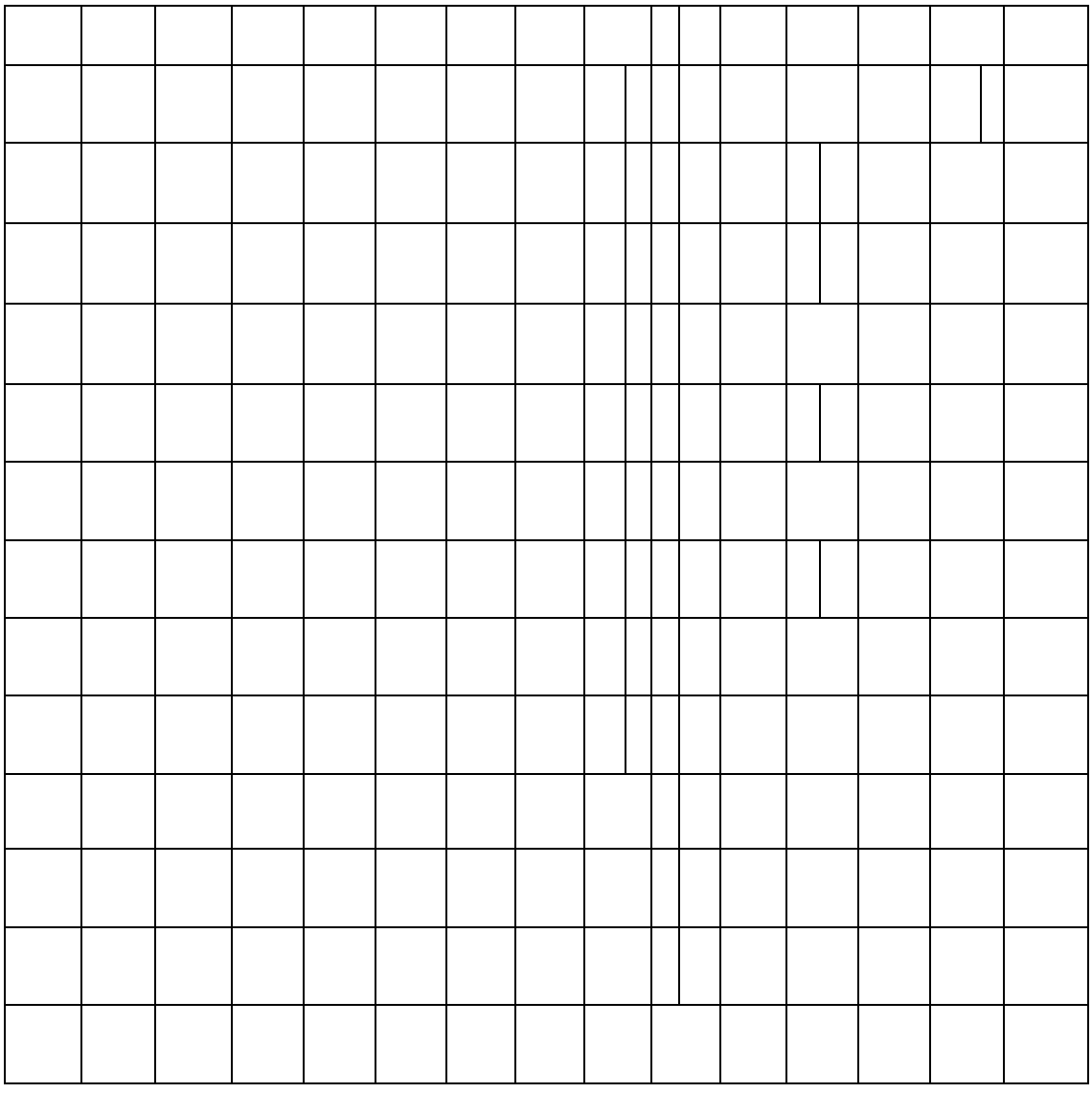
SECTION B (40 marks)

Answer question 6 ***(compulsory)*** *and either question* ***7*** *or* ***8*** *in the spaces provided after question 8.*

6 An investigation was carried out to monitor trends of growth in a group of boys and girls for a period of 20 years. Their average weights were recorded at two years' intervals as shown in the table.

Age(Years)	Average weights(kg)	
	Boys	Girls
0	2.4	2.4
2	11.0	11.4
4	14.5	15.5
6	18.2	19.6
8	21.7	26.8
10	25.2	27.4
12	27.7	31.5
14	37.2	35.4
16	44.5	44.5
18	46.8	52.6
20	48.6	55.6

(a) On the same axes, draw line graphs of average weights of girls and boys against their ages.(8 marks)



(b)From the graph,determine the:

(i) weight of boys at the age of 13 years; (1 mark)

……

(ii) growth rate of girls between the 13th and 15th year (3 marks)

……

……

……

c) Account for the trend in the growth of girls between the 14^{th} and 18^{th} year (2 marks)

……
……
……

(d) Apart from sex and age, state **three** other factors that affect the rate of growth in humans. (3 marks)

……
……
……

(e)Other than weight, state a parameter that can be used to establish growth in humans. (1 mark)

……
……

(f) Why do girls above 12 years require more iron in their diet than boys of the same age? (2 marks)

……
……

7 (a) Explain the effects of hypothyroidism in adults. (4 marks)

(b)Describe the hearing process in humans. (16 marks)

8 (a) Describe how urea is formed in humans. (5 marks)

(b) Describe the path followed by urea from the site of formation until it is eliminated from the body. (15 marks)

SECTION A (40 marks)

Answer all the questions in this section in the spaces provided.

The following word equation represents a biological process that occurs in green plants.

Carbon (IV) oxide + water ⟶ Glucose + Product E

(a) Name the cell organelle where the illustrated process takes place in green plants. (1 mark)

Chloroplast; Acc Chloroplasts

(b) (i) Give the likely identity of product **E**. (1 mark)

Oxygen; Acc. O_2

(ii) Suggest ways in which the rate of production of **E** can be increased. (3 marks)

Optimum temperature; Acc. increase in temperature.

Optimum light intensity / light; Acc Increase in light intensity / light

Increasing the concentration of Carbon(IV) oxide;

Increase availability / amount of water;

(c) Suggest **one** possible source of carbon (IV) oxide if the above process was artificially conducted in a school laboratory. (1 mark)

Sodium Hydrogen Carbonate; Acc: Sodium bicarbonate

Burning Candle / any hydrocarbon

(d) Explain how the illustrated process is significant in nature. (2 marks)

- Air purification / removes / reduces the concentration of Carbon(IV) oxide in the atmosphere / regulates the amount of Carbon(IV) oxide and O_2 in the atmosphere;
- Increases the concentration of Oxygen in the atmosphere used during respiration / Production / provision of Oxygen for other organisms;
- Provision of glucose / sugars / food; (Award any two)

2 In an experiment, the number of red blood cells present in three samples of blood labelled F, G and H was estimated. Different concentrations of salt solution were then separately added to the samples. After an hour, the number of red blood cells present in each sample was counted and recorded as shown in the table below.

Blood sample	Salt solution % concentration added	Number of red blood cells
F	1.0	Number remained the same
G	0.6	Fewer cells observed
H	0.4	No cells observed

(a) Name the physiological process being investigated in the experiment. (1 mark)

Osmosis;

(b) Account for the results made in blood sample F. (2 marks)

The concentration of cytoplasm was equal to that of 1·0% salt solution/ the salt soln was isotonic to the cytoplasm; therefore no net movement of water molecules in/out of the cell (number of cells remained the same since) no cell haemolysed.

(c) Account for the difference in appearance of red blood cells in samples F and G at the end of the experiment. Red blood cells in sample G appeared (2 marks)

swollen/bulging (outwards); since the soln was hypotonic to the cytoplasm and there was net mov't of water into the cell (by osmosis); while those placed in sample F assumed the normal shape/size; since the soln was isotonic to the cytoplasm hence no net movement of water molecules in and out of the cell (by osmosis); (before and after)

(d) With a reason, predict the possible observation that would be made if blood sample F was treated with a salt concentration of 2.6%. (2 marks)

Number of red blood cells would remain the same; the solution will be hypertonic to the cytoplasm; water molecules will be drawn from the cell, making the cells to shrink/appear crenated; Acc: Wrinkled for crenated

(e) State the importance of the process being investigated above during urine formation. (1 mark)

Reabsorption of water into the blood stream (from kidney tubules)

Conserves water/not much water is lost through urine;

(b) OR. The concentration of the solution was hypertonic to the cell cytoplasm; hence there was net movement of water out of the cell/cells were crenated/shrink;

A genetic investigation on a certain population established that, in human beings, premature baldness is controlled by a dorminant gene, N located on the Y chromosome.

(a) Work out the phenotypic ratio of the offspring of a couple comprising of a normal mother and a father with premature baldness. (5 marks)

♀ ♂

Parental Phenotype Normal Mother Bald headed father

Parental Genotype XX × XY^N

Gametes X X X Y^N

Fusion

F1 generation XX XY^N XX XY^N

Phenotypic ratio 2 Normal daughters : 2 Bald headed son

(b) What is the probability that this couple would have a daughter with premature baldness? (1 mark)

Zero/0/no chances/none/0%/Naught; Rej 0/2 or 0/4

(c) Name two sex-linked traits in human beings associated with the X-chromosomes. (2 marks)

* Haemophilia; Acc. Hemophilia
* Duchenne muscle/muscular dystophy;
* Colour blindness; Acc. Color blindness

Parental genotype XX × XY^N;

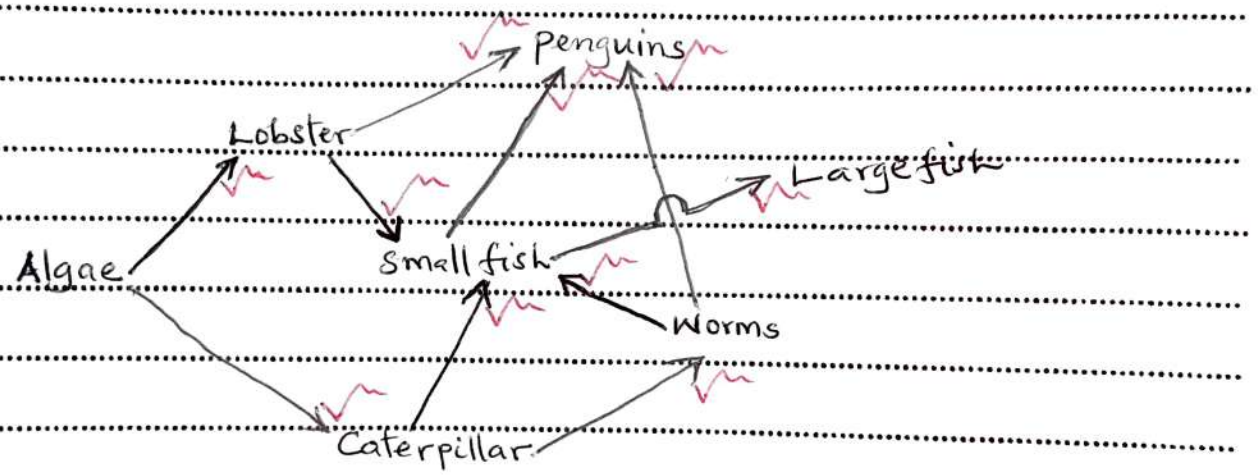
♀ \ ♂	X	Y^N
X	XX	XY^N
X	XX	XY^N

1 Normal daughter : 1 Bald headed son;

4 During an ecological study in a lake ecosystem, a group of students made the following observations on the feeding relationships among some organisms.

- Lobsters feed on algae
- Small fish feed on lobsters, worms and caterpillars
- Caterpillars feed on algae
- Worms feed on caterpillar
- Large fish feed on small fish
- Penguins feed on small fish, lobsters and worms.

(a) From the students' observations, construct a food web for the ecosystem. (5 marks)



(b) From the food web constructed in 4(a), extract a food chain with the penguin as a secondary consumer. (1 mark)

Algae → Lobsters → Penguins;

(c) Explain how spillage of oil from water vessels is likely to affect this lake ecosystem. (2 marks)

- prevents exit of air / Carbon(IV) oxide; cause suffocation / death of (living) organisms;

OR

- Prevents entry / diffusion of Carbon(IV) oxide / air; limiting / Preventing Photosynthesis;

OR

- Prevents entry / diffusion of oxygen / air; causing suffocation / death of (living) organisms;

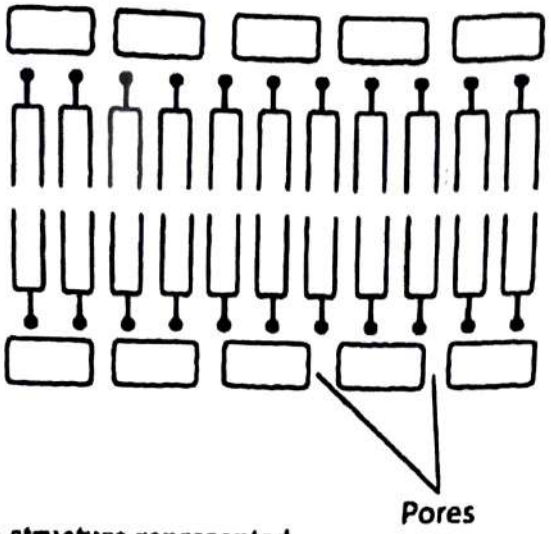
OR

- Reducing penetration of light; limiting / stopping / preventing Photosynthesis; acc. prevents / blocks for reducing penetration of light.

OR

- Clogs respiratory surfaces; causing suffocation / death / limiting gaseous exchange;

5 The following diagram represents part of a cell structure as seen under an electron microscope.



(a) (i) **Identify the structure represented.** (1 mark)

Cell membrane/ Plasmalemma/ plasma membrane.

(ii) **State two functions of the structure.** (2 marks)

Enclosing cell contents/ protection of the inner cell inclusions/ organelles.

Selective mov't of the materials in/out of the cell. Acc. Regulating/ controlling movement of substances in and out of the cell.

(iii) **Suggest two ways in which the functioning of the structure can be impaired.** (2 marks)

In the extremes of pH/ strong acid/ strong base.

Extremes in temperatures/ (too) low/ high temperature.

(b) **Name two structures found in plant cells but not in animal cells.** (2 marks)

Chloroplast/ plastids. Sap vacuole.

Cell wall. Tonoplast.

(c) **What is the purpose of staining cells before observing them under a light microscope?**

For clarity during observation/ makes structures more distinct/ clear. Acc. more visible/ more distinct. (1 mark)

SECTION B (40 marks)

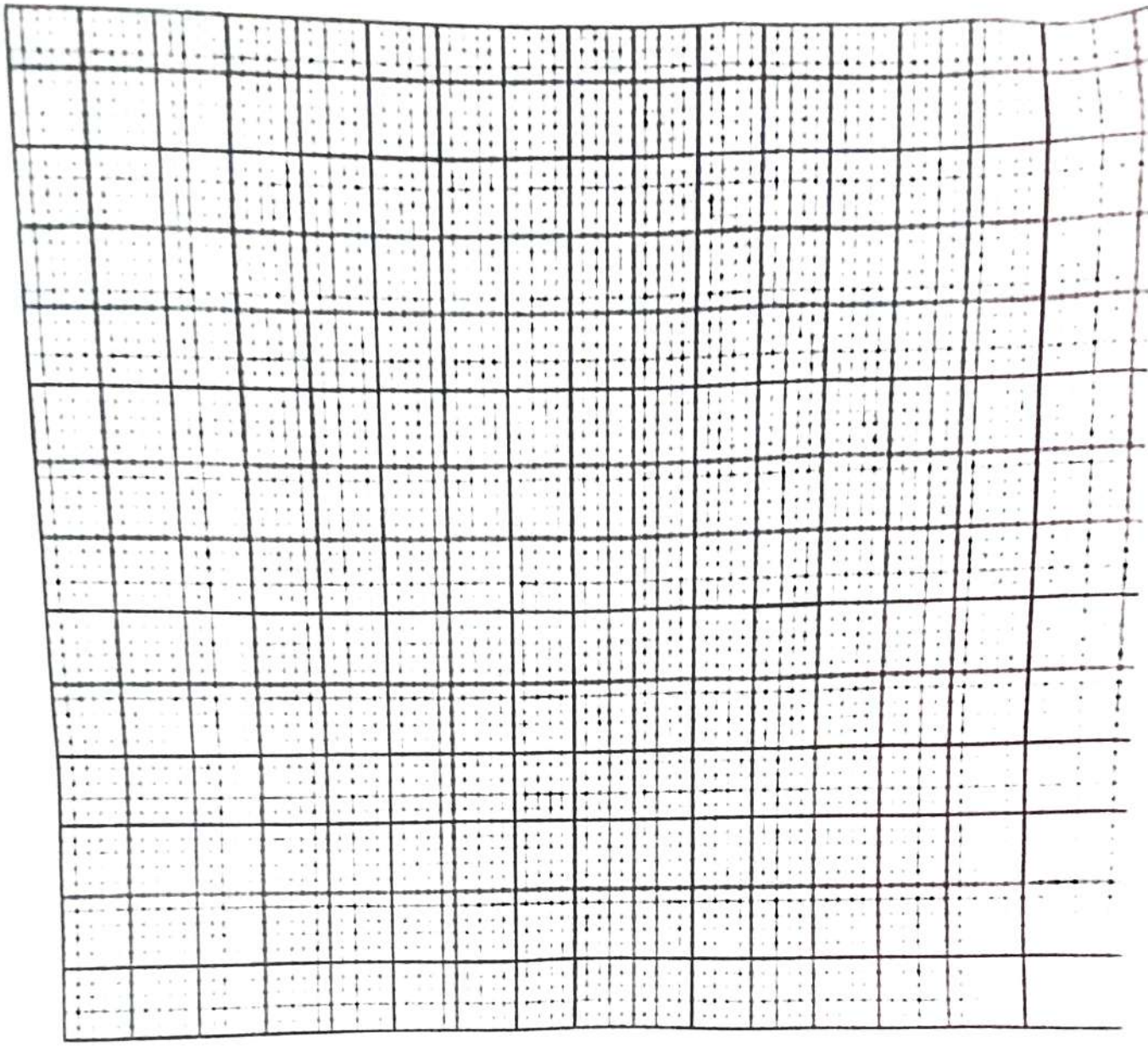
*Answer question 6 **(compulsory)** and either question 7 or 8 in the spaces provided after question 8.*

6 An investigation was carried out to monitor trends of growth in a group of boys and girls for a period of 20 years. Their average weights were recorded at two years' intervals as shown in the table.

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16	44.5	44.5
18	46.8	52.6
20	48.6	55.6

(a) On the same axes, draw line graphs of average weights of girls and boys against their ages.

(8 marks)



(b) From the graph, determine the:

(i) weight of boys at the age of 13 years; (1 mk)

32±1; (Kg) (31–33)

(ii) growth rate in girls between the 13th and 15th year. (3 mks)

13th – 33·5±1 (32·5–34·5) | $\frac{41-32.5}{15-13} = \frac{8.5}{2} = 4.25$ Kg/year higher

15th – ~~40~~± (39–41) | $\frac{39-34.5}{15-13} = \frac{4.5}{2} = 2.25$ Kg/year lower | (2·25 – 4·25 Kg/year accepted)

(c) Account for the trend in the growth of girls between the 14th and 18th year. (2 mks)

Faster/rapid (trend in) growth/Exponential; it is the puberty stage/development of secondary characteristics/development of wide hips/broadening of hips/breasts; (Acc specific indicators of growth during the stage)

(d) **Apart from sex and age, state three other factors that affect the rate of growth in humans.** **(3 marks)**

(Effect of) hormones; Basal Metabolic Rate; Acc. BMR;
State of one's health/diseases;
Genetic/heritable factors/genes;
One's diet/feeding habits/environmental factors/food/emotions/stress;

(e) **Other than weight, state a parameter that can be used to establish growth in humans.** **(1 mark)**

Height;

(f) **Why do girls above 12 years require more iron in their diet than boys of the same age?** **(2 marks)**

Girls Menstruate (therefore lose blood); they require Iron to compensate for the blood lost;

7 (a) **Explain the effects of hypothyroidism in adults.** **(4 marks)**

(b) **Describe the hearing process in humans.** **(16 marks)**

8 (a) **Describe how urea is formed in humans.** **(5 marks)**

(b) **Describe the path followed by urea from the site of formation until it is eliminated from the body.** **(15 marks)**

7(a) Myxoedema/Myxedema/swollen thyroid gland/goiter; due to underproduction of the thyroid hormone/thyroxine; reduced production of thyroxine hormone leads to the overworking of the thyroid gland; in an attempt to produce more thyroxine hormone (causing the swelling); this further leads to low metabolic rate/reduced body temperature/reduced breathing rate/heart rate; Causes Mental/physical sluggishness; Obesity/increased body weight; and retention of body fluid/Oedema/swollen feet/puffy face;

(Total 8, Max: 4)

Process of Hearing in humans

7.(b) The (funnel-shaped) pinna; collects/ concentrates/ directs sound waves; into the (external) auditory meatus/ canal; Sound waves strike the eardrum/ tymphanum/ tympanic membrane; causing it to vibrate; and transforms sound waves into vibrations; the vibrations are transmitted to the ear ossicles/ Malleus, incus and stapes; (the ossicles are suspended by muscles tensor tympani and stapedius; the muscles prevent excessive vibrations which could damage the inner/ delicate membranous labyrinth) the ossicles (further form a system of levers that) amplifies; and transmits vibrations; to the oval window/ fenestra ovalis; the oval window vibrates; and transmits the vibrations to the fluids/ perilymph and endolymph; in the inner ear/ cochlea; the fluids conducts vibrations; (in the cochlea) The vibrations (in the cochlea) stimulate the sensory cell hairs/ hair cells; to generate nerve impulses; which are transmitted to the brain; through the auditory nerve; for interpretation; the intensity of the stimulus transmitted to the brain enables the brain enables the brain to interpret the impulses as sound of specific pitch/ loudness; Vibrations/ are dessipated/ exit/ released through the round window; to the Middle ear; (Total 22. Max. 16)

8.(a) How urea is formed

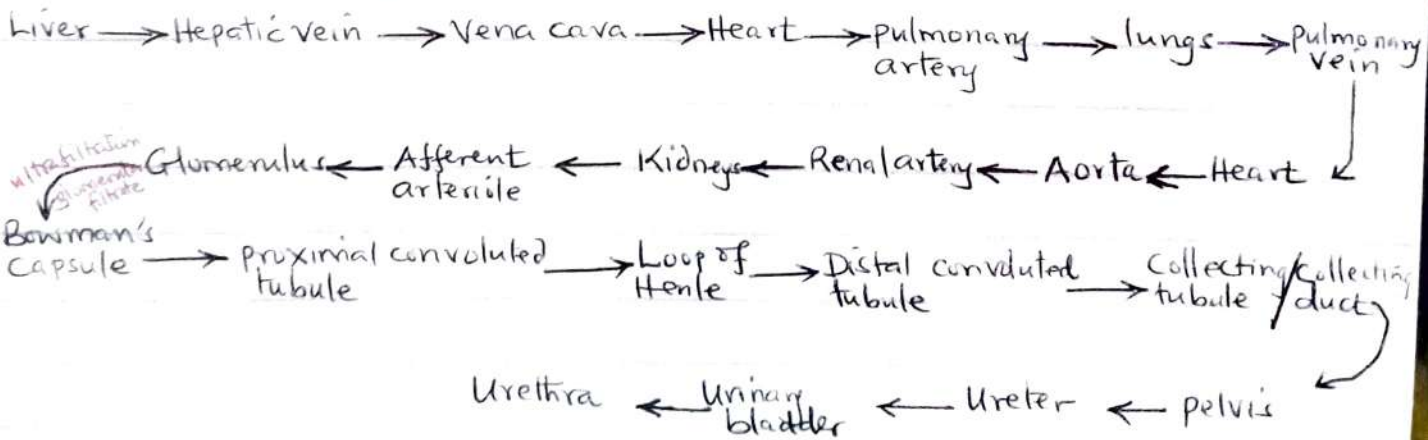
Urea is formed in the liver; where excess amino acids are deaminated// amino group is removed; the amino group reacts with hydrogen atom/ hydrogen ion; to form ammonia; which is toxic; ammonia combines with carbon (iv) oxide (in the Ornithine cycle); to form urea (which is less toxic);

8.(b) Path followed by urea till it is eliminated

(Urea that is formed in the liver) is carried in blood; through the hepatic vein; into the vena cava; blood containing the urea then enters the heart/right auricle/right auricle and right ventricle; leaves the heart through the pulmonary artery; into the lungs; (and out of the lungs through) the pulmonary vein; to the heart/left auricle/left auricle and left ventricle; (leaves through) the aorta; into the kidney; via the renal artery; to afferent arteriole; glomerulus; where ultrafiltration occurs; resulting in the formation of the (glomerular) filtrate; which enters the Bowman's capsule; into the proximal convoluted tubule; loop of Henle/descending and ascending loop of Henle; Distal convoluted tubule; urea enters the collecting tubule/collecting duct in urine; into pelvis; into the ureter; then into urinary bladder (for temporary storage); from where it ~~exits~~ exits the body through the urethra;

(Total 24. max. 15)

OR



1 Besides other laboratory fittings and apparatus, every candidate will require the following:

(a) A scalpel:
(b) A fresh Sukuma wiki, *Brassica oleracea* leaf, labelled **E**;
(c) A cockroach, labelled specimen **F**, placed on a petri-dish;
(d) A light micrscope, one for at least five candidates, with low, medium and high power objective lenses:
(e) Iodine solution, supplied in two test tubes, each containing about 2 ml, labelled as iodine solution:
(f) Two(2)cover slips:
(g) A white tile:
(h) A hand lens:
(i) Two (2) microscope slides;
(i) Two (2) test tubes in a test tube rack;
(k) An optical pin/needle:
(1) Specimen **H**: Moulds grown on a piece of bread/cassava/sweet potato (for about 5 days). The piece may be 2x2x2 cm, with visible moulds, placed on a petri-dish;
(m) A glass rod:
(n) A 30 cm ruler:
(0) 200 ml distilled water in a 250 ml beaker, labelled as distilled water;
(p) Two(2) droppers:
(q) Water in a wash bottle (may be shared);
(r) Piece of tissue paper/serviette.

2 Preparation of Iodine solution

lodine solution is prepared using the iodine crystals procured by the school and substance **G** supplied by the Kenya National Examinations Council. It is prepared as follows.

(a) For centres having between 1 and 20 candidates

- Place 0.6 g of the iodine crystals procured by the school and all of solid G supplied in a beaker.
- Add 120 ml of distilled water and stir until it dissolves.
- Supply each candidate with two test tubes each containing about 2 ml of the solution labelled as **iodine solution.**

(b) **For centres having more than 20 candidates**

- Assume the number of candidates is **N**.
- Put 0.03N grammes of iodine crystals procured and all of substance G supplied in a beaker.
- Add 6N ml of distilled water and stir until it dissolves.
- Supply each candidate with two test tubes each containing 2 ml of the solution labelled as **iodine solution.**

NOTE D1 for right.
H1
Mark first diagram.

Magnification
Just see it =

1 **You are provided with the following materials.**

- Iodine solution in a test tube.
- Distilled water in a beaker.
- A hand lens.
- A scalpel.
- Microscope slide.
- Cover slip.
- Light microscope.
- Specimen **E**.
- A 30 cm ruler.
- White tile.

Procedure

(i) Dip the petiole of specimen **E** in the distilled water provided in the beaker.

(ii) Using the scalpel, cut off about 2 cm of the specimen **E** at the base while holding the cut area under water.

(iii) Immediately transfer the petiole with the freshly cut end into the iodine solution and leave it undisturbed for about ten minutes. Do not discard the iodine solution as you may need it in question 3.

(iv) Remove the petiole from the iodine solution and make a transverse section, about 1 cm from the end that had been dipped in the iodine solution.

(v) Place the cut section on the white tile and observe the freshly cut surface using the hand lens.

(a) (i) Make a labelled drawing of the structures observed from the cut section. (2 marks)

Label/Lie mark 1
- Any two correct.
- Others OVB
- See others consider wrong spelling - RJ.
- RJ Xylem and phloem for vascular bundles.
- Accept Xylem and phloem but singular and plural should be
- Labelling line should not cross
- Not bullets, arrows.
- No cross of label lines, not dotted.
- Touch intended structure.

2MKS
D✓ Diagram
- Depression not smart
- Outline CONTINUOUS and Double.
- Vascular bundles should be gaps, not overlapping Circle or semicircle arranged
- ND partition for vascular bundles.
- Minum of 3 vascular bundles.
- Orientation of VB.
- No shading
- Two dimension.
- Free hand
- Sector drawn, D mark dented
- Structures not flowing into each other.

If Epidermis is single dent D mark.
If LS dent D mark.

D✓
Epidermis
Vascular bundles
cortex
Pith.
Mg X30
Epidermis
Vascular bundle
Pith.
LS

(c) Suggest the likely difference in observation if a blunt object was used to make slices of specimen F for observation. (2 marks)

Blunt object produce thicker slices/sections which do not allow light to pass through and cells could be distorted/destroyed/damaged;

2 You are provided with specimen **F** on a petri-dish, which is an organism belonging to a certain Phylum. Carefully observe it using a hand lens.

(a) Identify the Phylum to which specimen **F** belongs. (1 mark)

Arthropoda

(b) Give **two** reasons for the answer in 2 (a) based on the observable features of the specimen. (2 marks)

- Jointed appendages/limbs/legs/mouthparts/antennae.
- segmented body (parts).
- (presence of) exoskeleton.

(c) Explain **three** observable features that make the specimen to colonise most habitats. (3 marks)

1. A pair of wings for flight in search of food/mates/escape predators/escape unfavourable environments
2. (A pair) antennae to sense danger/predators/food/mates
3. pair of eyes/mosaic vision/compound eyes to see danger/predators/food/mates
4. (Dorso-ventrally) flattened body to pass through/penetrate/hide/move through crevices/gevices/narrow parts/antenna exoskeleton that reduces loss of water/dessication/offers pro

(d) State **two** harmful effects of the specimen to humans. (2 marks)

- Contaminate food surfaces/disease vector
- Hit wacker/body parts/droppings may trigger allergic reactions eg coughing/skin rashes/dia
- Damages clothes/stored food
- Cause dermatitis/skin irritance
- Accept damaging of home equipment

(e) Account for the difference in the type of growth pattern found in specimen **F** and humans. (4 marks)

F	Human
Intermittent/staircase/discontinuous Pattern	Sigmoid pattern/S-shaped pattern
Reason It has a hard exoskeleton that limits growth/that is shed ecdysis/moulting occurs to allow growth	As continuous growth
Ignore Shade for shed	Reason: Has endoskeleton that allows continuous/growth (up to a given stage when growth rate stagnates
	Accept: Has endoskeleton that grows together with the body.

3 You are provided with the following materials:

- A light microscope.
- Microscope slides and cover slip.
- Specimen **H**, with some organisms grown on it, placed on a petri-dish.
- An optical pin/needle.
- A hand lens.
- A glass rod.
- Iodine solution in a test tube.
- A white tile.
- A test tube.
- A dropper.

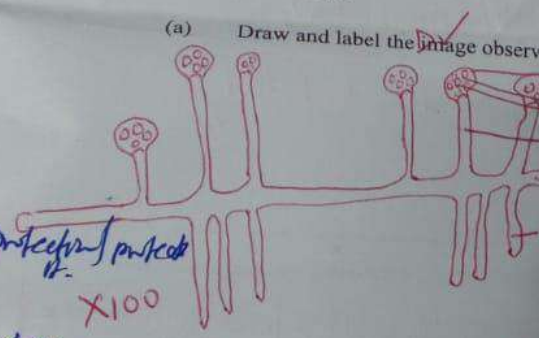
Procedure I

(i) Use the hand lens to observe the organisms on specimen **H**.

(ii) Using the pin, gently obtain a few strands of the organisms on specimen **H** and place them on the microscope slide. Stain them with a drop of iodine solution and cover with a cover slip.

(iii) Mount and observe the specimen under low power objective lens of the light microscope.

(a) Draw and label the image observed.

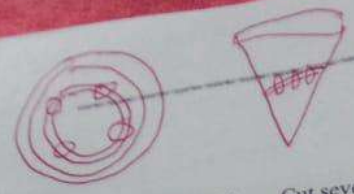


(b) (i) State the Kingdom to which the organisms drawn in (a) belong. (1 mark)

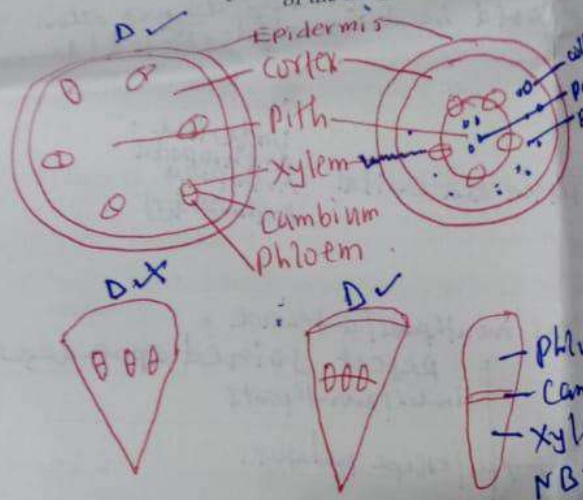
Fungi

(ii) Give **two** reasons for the answer in b(i) above. (2 marks)

- Hyphae/sporangiophore/stolon/Rhizoid/Mycellium;
- Sporangium/spore(s)
- Saprophytic/saprophyte/obtain nutrients from substrate
- Non green/lacks chlorophyll



(ii) Cut several other thinner slices from the freshly excised of the petiole and observe the thinnest slice using the light microscope. Make a labelled drawing of the image observed. (5 marks)



(b) (i) State the aim of the experiment

(ii) Explain the role of iodine solution in the experiment. (2 marks)

(iii) State why it was advisable to slice the specimen while holding the cut area under water.

(iv) Why was it necessary to make very thin slices of the specimen for observation under the light microscope? (1 mark)

Procedure II

(i) Using the scalpel, chop off a portion from specimen **H** without the organisms.

(ii) Carefully mercerrate or cut the portion into smaller pieces and gently crush the pieces using a glass rod on a white tile.

(iii) Place the crushed pieces in a test tube.

(iv) Add about 2 ml of distilled water into the test tube containing the crushed portion and shake to form a suspension.

(v) Test for the food substance present in specimen **H** and complete the table. (5 marks

Test	Procedure	Observation	Conclusion
(Test for) starch. Accept starch test. RJ Iodine test. RJ-Starch RJ-Scratch	To the suspension/ food substance/ specimen H/H, add (2) drops of Iodine solution (and shake)	Colour of Iodine solution retained/ brown colour	Starch absent.
		Light blue black/ Pale blue black/ Patches of blue black	(Traces of/ little amount of) starch present.
	NB solution has to be mentioned, drops imply solution. Add Iodine ^ and continue marking	Blue black/ black; RJ Blue.	Starch present.

Underline the following and don't mark: ~~Stach~~ ~~Stach~~ ~~Starc~~

(c) Account for the likely difference in observation if the food test was done on a fresh specimen **H**. (2 m

Fresh portion of specimen H would give a deeper blue-black/more blue-black/more black because starch has not been digested (by ma

NB If a student fails/ N get observation in the table he can't score this

(d) Explain why it was necessary to mercerrate the portion. (1

To increase surface area for reacting/mixing with distilled reagent/iodine solution

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