

Candidate's Name: **DRAFT GUIDE**

Signatures **John Nkemba**

Random No.	Personal No.
<b>POLLYCARP</b>	

(Do not write your School/ Centre Name or Number anywhere on this booklet.)

**553/1**  
**BIOLOGY**  
**(Theory)**  
**Paper 1**  
**Oct. / Nov. 2020**  
**2 ½ hours**



**UGANDA NATIONAL EXAMINATIONS BOARD**

**Uganda Certificate of Education**

**BIOLOGY**  
**(THEORY)**

**Paper 1**

**2 hours 30 minutes**

**INSTRUCTIONS TO CANDIDATES:**

*This paper consists of sections A, B and C.*

*Answer all questions in sections A and B, plus two questions in section C.*

*Write the answers to section A in the boxes provided, answers to section B in the spaces provided and answers to section C in the answer booklets provided.*

**For Examiners' Use Only**

Section		Marks	Examiner's Signature and No.
A	No. 1-30		
B	No. 31		
B	No. 32		
B	No. 33		
C	No.		
C	No.		
<b>Total</b>			

## SECTION A (30 MARKS)

Answer all questions in this section. Write the letter representing the correct answer to each question in the boxes provided.

1. When using a microscope, magnification is partly determined by the

- A. mirror.
- B. adjustment knob.
- C. stage.
- D. eye piece.

 D

2. The following are modified functions of stems except

- A. food storage.
- B. water storage.
- C. vegetative propagation.
- D. conduction of water and mineral salts.

 D

3. Which one of the following is the correct sequence of stages in mitosis?

- A. Prophase, metaphase, telophase, anaphase.
- B. Prophase, metaphase, anaphase, telophase.
- C. Prophase, telophase, anaphase, metaphase.
- D. Prophase, anaphase, metaphase, telophase.

 B

4. Which one of the following is true about an animal cell? It

- A. stores glycogen and fats.
- B. stores starch and oils.
- C. possesses a permanent vacuole.
- D. has a cell wall and a cell membrane.

 A

5. When  $x$  grams of soil was heated, a constant mass of  $y$  grams was obtained at  $100^{\circ}\text{C}$ . After heating the soil sample to red hot, its weight reduced to  $z$  grams.

Which one of the following expressions represents the percentage of humus in the soil sample?

- A.  $\left(\frac{x-y}{z}\right) \times 100$ .
- B.  $\left(\frac{y-z}{x}\right) \times 100$ .
- C.  $\left(\frac{x-z}{y}\right) \times 100$ .
- D.  $\left(\frac{z-x}{y}\right) \times 100$ .

 B

6. Which one of the following animals would have the lowest rate of heat loss per unit mass under the same conditions?

- A. Cat.
- B. Rat.
- C. Cow.
- D. Goat.

 C

7. Which one of the following describes the structure of the white blood cell in relation to its function?

- A. Tiny, to easily fight germs.
- B. Lobed nucleus, to carry oxygen.
- C. Amoebic structure, for engulfing bacteria.
- D. Numerous, to carry more glucose.

 C

8. Which one of the following plants is propagated by leaves?

- A. Banana.
- B. Irish Potato.
- C. Ginger.
- D. Bryophyllum.

 D

9. The ear structures sensitive to sound and balance respectively are

- A. cochlea and semi-circular canals.
- B. cochlea and ossicles.
- C. eardrum and pinna.
- D. pinna and round window.

 A

10. Name the enzyme whose activity is shown in figure 1.

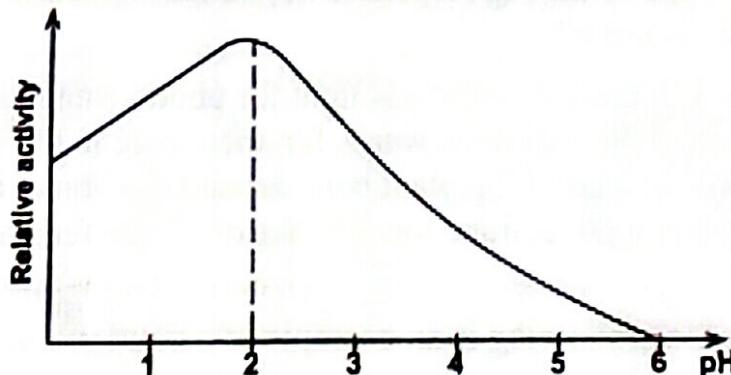


Fig. 1

- A. Pepsin.
- B. Amylase.
- C. Trypsin.
- D. Lipase.

 A

11. What is the diet of an animal whose dental formula is  $i:\frac{0}{3} c:\frac{0}{0} pm:\frac{3}{3} m:\frac{3}{3}$ ?

- A. Flesh.
- B. Plant material.
- C. Dead remains.
- D. Plant and animal material.

 B

12. Which one of the following events occurs when the eye is focusing on a distant object?

- A. Ciliary muscles contract.
- B. Suspensory ligaments are stretched.
- C. Curvature of the lens increases.
- D. More refraction of light rays occurs.

 B

13. Which of the following joints allow the highest degree of movement? Joints between the

- A. skull bones.
- B. femur and tibia.
- C. pelvis and femur.
- D. vertebrae of the spine.

 C

14. In which part of the nephron does ultrafiltration take place?

- A. Renal tubule.
- B. Collecting tubule.
- C. Glomerulus.
- D. Renal vein.

 C

15. Which one of the following responses shows the significance of a positive chemotropic response?

- A. Growth of the shoot towards light for photosynthesis.
- B. Growth of the root downwards for anchorage in the soil.
- C. Tendrils of a climbing plant bend around the object for support.
- D. Growth of a pollen tube towards the ovule for fertilisation.

 D

16. Which one of the following is an example of a continuous variation in humans?

- A. Skin colour.
- B. Sex differences.
- C. A, B, O blood grouping.
- D. Tongue rolling.

 A

17. The following are respiratory surfaces in animals except
- tracheoles.
  - alveoli.
  - spiracles.
  - gill filaments.
- C
18. Which one of the following methods can best be used to estimate the number of fish in a pond?
- Trapping and elimination.
  - Quadrat estimation.
  - Capture - recapture.
  - Direct counting.
- C
19. Which one of the following forms of reproduction leads to variation among offsprings?
- Budding in yeast.
  - Binary fission in amoeba.
  - Sporulation in mucor.
  - Conjugation in spirogyra.
- D
20. What is the effect of under secretion of thyroxine hormone in humans?
- Nervousness, irritation and restlessness.
  - Loss of body weight.
  - Increased appetite.
  - Reduced metabolic rate.
- D
21. Which one of the following is the correct genotypic ratio of offspring if carriers of albino genes marry?
- |    | Homozygous dominant | Heterozygous | Homozygous recessive |
|----|---------------------|--------------|----------------------|
| A. | 1                   | 2            | 1                    |
| B. | 2                   | 1            | 1                    |
| C. | 3                   | 0            | 1                    |
| D. | 0                   | 3            | 1                    |
- A
22. Which one of the following sugars is a common product of digestion of lactose, sucrose and cellulose in mammals?
- Glucose.
  - Fructose.
  - Galactose.
  - Maltose.
- A

**23.** A food chain involving organisms P, Q, R, S and T is represented as

$$P \rightarrow Q \rightarrow R \rightarrow S \rightarrow T$$

Which one of the following would happen if organism S was removed from the food chain?

- A. R would decrease.
- B. Q would increase.
- C. P would increase.
- D. T would increase.

 C

**24.** The following processes release carbon to the atmosphere **except**

- A. combustion.
- B. respiration.
- C. decay.
- D. fossilization.

 D

**25.** A plant shoot meant for an experiment to determine the rate of water uptake is cut under water in order to

- A. prevent the cut shoot from drying out.
- B. make it soft and easy to cut.
- C. prevent air from entering the xylem vessel.
- D. make it easy for water to enter.

 C

**26.** Which one of the following statements is correct when the heart muscles relax?

- A. Pressure in the ventricle decreases.
- B. Volume in each ventricle decreases.
- C. Pressure in each ventricle increases.
- D. Blood flows out of the ventricles.

 A

**27.** Which one of the following hormones maintains pregnancy?

- A. Follicle stimulating hormone.
- B. Progesterone hormone.
- C. Luteinising hormone.
- D. Oestrogen hormone.

 B

**28.** The type of bacteria that make nitrogen unavailable for plant use are

- A. nitrogen fixing bacteria.
- B. denitrifying bacteria.
- C. nitrifying bacteria.
- D. putrefying bacteria.

 B

**29.** Which one of the following is **not** a function of the liver?

- A. Homeostasis.
- B. Detoxification.
- C. Osmoregulation.
- D. Deamination.

C

**30.** The part of the brain that controls involuntary actions is the

- A. hypothalamus.
- B. cerebellum.
- C. cerebrum.
- D. medulla oblongata.

D

TOTAL - 30 MKS

### SECTION B (40 MARKS)

*Answer all questions in this section.*

*Answers must be written in the spaces provided.*

**31.** In an experiment, individuals of the same species of amoeba were taken from their natural environment and placed in solutions of different salt concentrations. After adjusting to their new environment, the rate at which the contractile vacuole emptied its contents was measured and recorded as shown in table 1.

**Table 1**

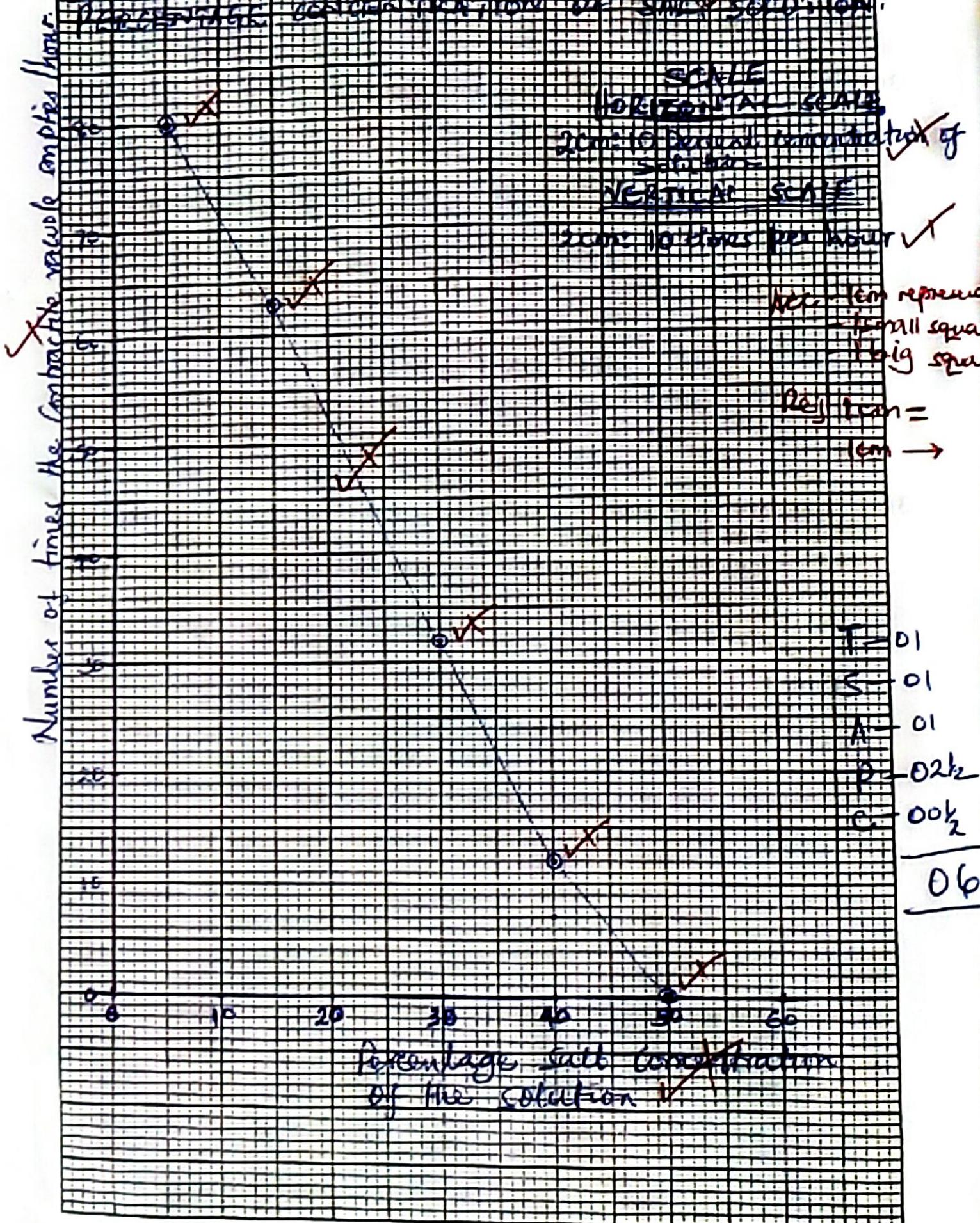
Percentage salt concentration of solution	Number of times the contractile vacuole empties per hour
5	80
15	63
30	32
40	12
50	0

(a) (i) Plot a suitable graph in the space below to represent the

information in Table 1.

(07 marks)

GRAPH showing the variation of number of times the  
concentration of a reaction requires per hour, with  
percentage with respect to the initial concentration.



(ii) Describe the graph you have plotted in (a) (i). (02 marks)

At lower concentration of salt solution, the number of times the vacuole empties is high, but as the concentration of salt solution increases, the number of times the vacuole empties its contents decrease; At 50%, no emptying occurs.

Total 03  
Max - 02 Mks

(iii) Explain the graph you have plotted in (a) (i). (03 marks)

At low concentration of the surrounding solution, more water enters the amoeba; contractile vacuole forms more often; as the concentration of the surrounding solution increases, less water enters the amoeba; vacuole forms less often. At 50% concentration, no net entry of water into amoeba occurs; no vacuole forms (No emptying occurs);

Total 04  
Max - 04 Mks

(b) From the graph, explain what would happen if an amoeba was placed in a solution whose salt concentration is;

(i) greater than 50 %. (02 marks)

Amoeba would lose more water to the surrounding / no more vacuoles would form / amoeba would shrink and eventually die; because the amoeba fluids would be less concentrated than the surrounding;

(ii) 0 %. (02 marks)

Amoeba would gain more water from the surrounding / more vacuoles form which fill and empty frequently / swells; because the amoeba fluids will be more concentrated than the surrounding;

Reject:  
bursting/rapture

- (c) (i) Using the results of the experiment, explain how the contractile vacuole is important to amoeba. (03 marks)

~~As the amoeba surrounds become very dilute, the contractile vacuole fills with water; which it empties as required to ensure that the internal concentration of fluids of amoeba remains constant.~~

03 Mks

- (ii) Name the process involved when the contractile vacuole is performing its function in amoeba. (01 mark)

Osmoregulation

01 mark

Accept: Excretion || Homeostasis.

TOTAL - 20 Mks

32. The experimental set-up in figure 2 was used in an investigation. During the investigation, tap A was closed after 10 minutes and the set-up left to stand for 1 day. Study the figure and answer the questions that follow.

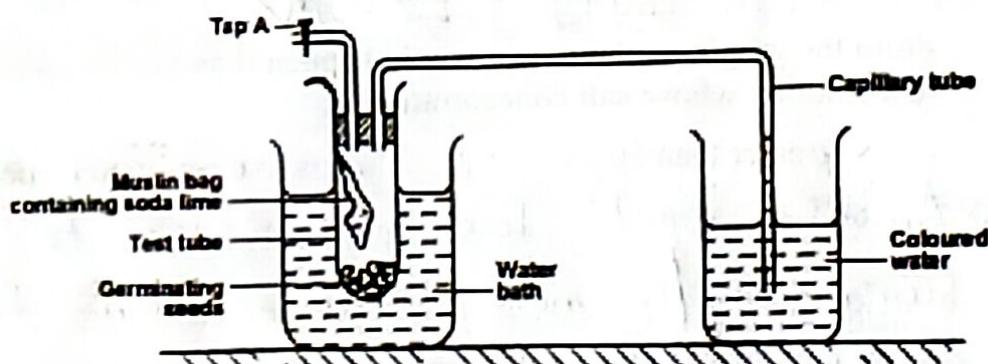


Fig. 2

- (a) State the aim of the experiment in figure 2. (01 mark)

To show that germinating seeds use oxygen / respire

Reject: living organism

- (b) Give the use of soda lime contained in the muslin bag. (01 mark)

For absorbing carbon dioxide gas

- (c) (i) What is observed in the capillary tube after one day? (01 mark)

Coloured water rises (in the capillary tube)

- (ii) Give reasons for the observation in (c)(i). (03 marks)

The germinating seeds take in oxygen / respire; if the carbon dioxide produced is immediately absorbed by soda lime; this reduces gas volume / pressure in the capillary tube; causing the coloured liquid to rise (in the capillary tube). 03 marks

*reject if answer is wrong*

- (d) (i) What would be observed in the capillary tube if there was no soda lime in the muslin bag? (01 mark)

The level of coloured liquid in the capillary tube remains unchanged / same / No change in the level of coloured water;

- (ii) Give a reason for the observation in (d) (i). (02 marks)

*reject if answer is wrong* Because the oxygen taken in by the germinating seeds would be replaced by carbon dioxide they produce; making no change in the volume / pressure of air inside the tube; 02

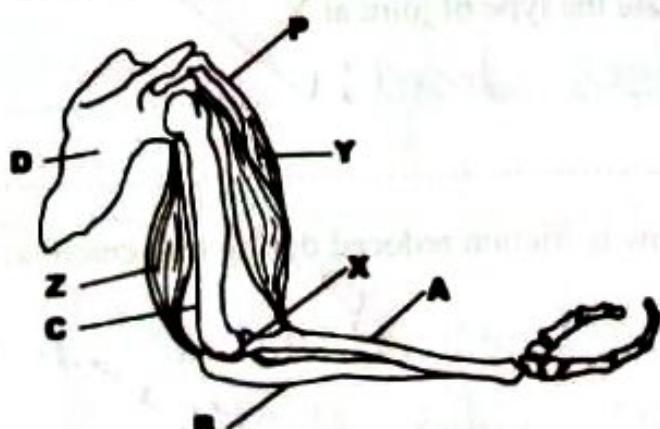
- (e) What changes can be made in the experimental set-up to come up with a suitable control experiment? (01 mark)

Use (disinfected) boiled seeds; 01

Rej: Non-germinating seeds. Reject, non-germinating seeds

**TOTAL = 10 MARKS**

33. Figure 3 shows a human limb. Study it and answer the questions that follow.



(a) Name the bones labelled A- D. (02 mark)

- A Radius ✓ .....  
B Ulna ✓ .....  
C Humerus ✓ .....  
D Scapula / shoulder blade ..... Rej - shoulder bone

02

(b) Name and give the function of the structure marked P. (02 marks)

Name of P Tendon: ✓ .....  
Function of P Joins the muscle to bone; ✓

02

Acc: Connects D to Y. Reject wrong commitment of name of P.

(c) Explain how muscles Y and Z work when;

(i) bending the arm. (02 marks)

Y contracts; Z relaxes; pulling on the radius and ulna up; ✓  
Acc: Y Contracts; pulling on the radius & ulna up;  
Z relaxes;

02

(ii) straightening the arm. (02 marks)

Z contracts; Y relaxes; pulling on the radius and ulna down; ✓  
Acc: Z contracts; pulling on radius & ulna down;  
Y relaxes;

02

(d) (i) State the type of joint at X. (01 mark)

Hinge joint; ✓ .....  
.....

01

(ii) How is friction reduced during movement at joint X?

Synovial fluid; reduces friction by lubricating the joint; ✓  
.....

(02 marks)

02

Cartilage; reduces friction by being smooth & slippery allowing sliding of bones; ✓

12

TOTAL 11 MKS Max - 10 Marks

Tot - 03  
Max 02 mks

Accept Biceps and  
triceps for Y and Z  
respectively

Total - 03  
Max - 02 mks

## **SECTION C (30 MARKS)**

*Answer any two questions from this section. Answers to these questions must be written in the answer booklets provided. Additional question(s) answered will not be marked.*

34. (a) Describe the chemical digestion of proteins as food passes along the alimentary canal of a person. (05 marks)
- (b) How are products of digestion of starch and proteins utilised by the human body? (05 marks)
- (c) Explain the adaptations of the villi for their function. (05 marks)
35. (a) Explain the importance of phototropism in plants. (06 marks)
- (b) Describe the effects of auxins in plant growth. (06 marks)
- (c) How are auxins used in weed control? (03 marks)
36. (a) What is gaseous exchange? (02 marks)
- (b) Explain the characteristics of an efficient respiratory surface for gaseous exchange. (07 marks)
- (c) Describe how a frog carries out gaseous exchange using the buccal cavity. (06 marks)
37. (a) Explain how any four environmental factors affect the rate of transpiration. (07 marks)
- (b) What is the importance of transpiration to plants? (08 marks)

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**OCTOBER - NOVEMBER, 2019**

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Subject ..... Paper code ..... / ..... Personal Number 

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34

(a)	Site	pH	Enzyme	Substrate	Product
	Stomach; ✓	Acidic; ✓	Pepsin; ✓	-	Peptides / peptones; ✓
Total - 03 Mks	Duodenum; ✓	Alkaline; ✓	Trypsin; ✓	-	Peptides / peptones; ✓
Max - 05	Ileum; ✓	Alkaline; ✓	Peptidase / Pepsin; ✓	Peptides   Peptones   Poly peptides; ✓	Amino acids; ✓

(b) Glucose; ✓ 01 MK

Amino acids; ✓ 01 MK

- Oxidised to release energy; ✓ Growth | New cell formation; ✓ 02 MKs
- Converted to fats; ✓ Repair | replacement of worn out cells; ✓
- Converted into glycogen; ✓ Oxidised to release energy; ✓
- for formation of cell membrane; ✓ Synthesis of new materials such as enzymes, hormones, plasma proteins; ✓
- Maintenance of Osmotic balance; ✓ 03 MKs
- 03 MKs

(c) Villi are very many; ✓

- Increasing surface area for absorption; ✓
- Have thin epithelium to reduce diffusion distance; ✓
  - Dense network of capillaries; ✓ to transport food to blood stream; ✓ Res. blood alone

- Numerous microvilli; further increase the surface area; ✓
- Numerous mitochondria to provide energy for active transport; ✓

TOTAL - 15 MARKS

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Subject ..... Paper code .....

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35(a) Shoots are positively phototropic | grow towards light; ✓ to (i) Expose leaves to trap sunlight; ✓ for photosynthesis | synthesis of chlorophyll; ✓ (ii) Expose leaves to air for gaseous exchange | obtain oxygen for respiration; <sup>TOTAL 04</sup> <sub>MKS 03</sub> carbon dioxide for photosynthesis; ✓

Roots are negatively phototropic | grow away from light; ✓ into the soil for anchorage; ✓ and to absorb water and mineral salts; ✓ <sup>03 MKS</sup>

(b) High concentration of auxins in shoots promote rapid cell elongation; ✓ (leading to growth) while low concentration retards growth; ✓

Low Concentration of auxins in roots <sup>TOTAL-07</sup> promote rapid cell elongation; ✓ (leading to growth), while high concentration of auxins in roots retards growth; ✓ <sup>06 MKS</sup>

Auxins also promote apical dominance; ✓ suppress growth of lateral roots; ✓ promote growth of fruits without fertilisation; ✓

(c) Auxins are sprayed on crop gardens; ✓ since they selectively affect the growth of weeds; by stopping their growth; crops then out compete weeds; ✓ <sup>03 MKS</sup>

**TOTAL - 15 MARKS**

Signature .....  
Subject ..... Paper code .....

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36 (a) A process of taking in and out gases;  
across a surface / membrane; ✓ 02 MK

(b) Thin / 1 cell thick; ✓ to provide a short distance  
over which gases diffuse; ✓  
well ventilated; ✓ to provide fresh supplies  
of air / maintain diffusion gradient; ✓ 07

*Total 09*  
*Part of MK*  
*Structure - air*  
*Function - respiration*  
Moist; ✓ to dissolve gases; ✓  
Numerous supply of blood capillaries; ✓ to conduct / carry gases; ✓  
Permeable; ✓ to allow gases to diffuse through; ✓  
Large surface area; ✓ to have large amount of gases exchanged; ✓  
Structure - 02 MK  
Function - 01 MK

(c) Air in the buccal cavity contains more oxygen than the surrounding blood capillaries;  
so oxygen dissolves in the moisture; ✓ then diffuses; ✓ through the thin epithelium lining of the buccal cavity; ✓ then through blood capillaries into blood; ✓

Carbon dioxide is more in the surrounding blood capillaries than in the buccal cavity;  
so then diffuses through the thin epithelium of the buccal cavity; ✓

**TOTAL - 15 MARKS**

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### 37(a) Light Intensity:

High light intensity increases the rate of transpiration; because the stomata are wide open;

Low light intensity reduces transpiration; because the stomata are not wide open;

*10/12 marks*  
*Mark 07*  
*Mark only first four responses*  
Humidity; High humidity lowers the rate of transpiration; because there is no more space for water vapour from the leaf to diffuse into;

low humidity increases transpiration; because there is more space around the leaf for water vapour to diffuse into;

Temperature; Increased temperature increases the rate of transpiration; because it increases the rate of evaporation;

Low temperature lowers the rate of transpiration; because it lowers the rate of evaporation;

Air movements; Still air lowers the rate of transpiration; because air around the leaf is saturated with water vapour;

Moving air (wind) increases the rate of transpiration; because evaporated water is carried away from the area around the leaf;

Atmospheric pressure: ✓ High atmospheric pressure reduces the rate of transpiration; ✓ because it reduces the rate of evaporation; ✓ Low atmospheric pressure increases the rate of transpiration; ✓ because it increases the rate of vapour formation; ✓

Availability of water in the Soil; ✓ The higher the water content of soil; - the higher the rate of transpiration; ✓ because the plant absorbs a lot of water; ✓ the lower the water content in the soil; the lower the rate of transpiration; ✓ because the plant absorbs less water; ✓

- (b) Maintaining the transpiration stream:
- ✓ Provide water needed by leaves for photosynthesis;
  - ✓ Maintain turgidity of plant cells;
  - ✓ Transport of water/salts from roots to leaves;
  - ✓ Cool's the plant/ temperature regulation;
  - ✓ Excess water loss from the plant is <sup>TOTAL = 9 MARKS</sup>.
  - More water/salts is/are absorbed;
  - Leads to wilting of the plant;
  - Leads to drooping in plants;
- <sup>Mark - 08</sup>

**TOTAL - 15 MARKS**