

A LEVEL BIOLOGY INTERNAL SEMINAR QUESTIONS TO BE DISCUSSED ON 10TH JULY 2022

CATEGORY ONE: (ECOLOGY)

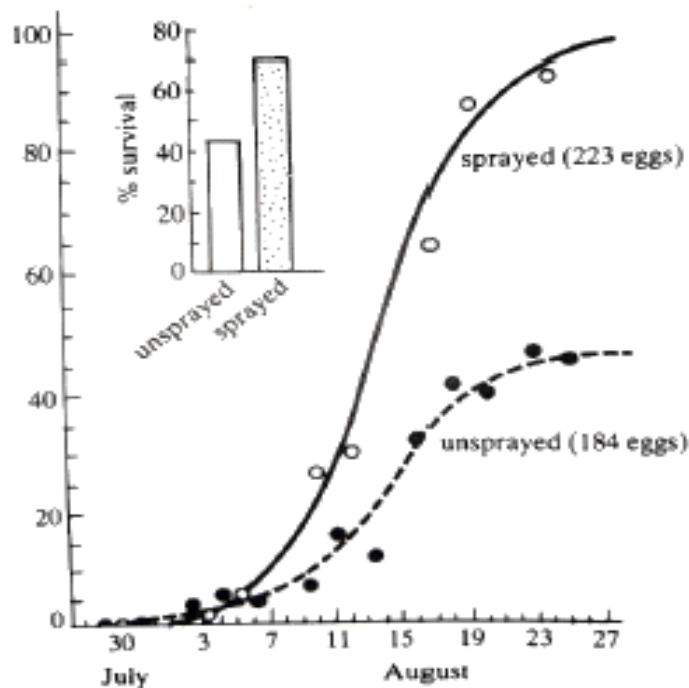
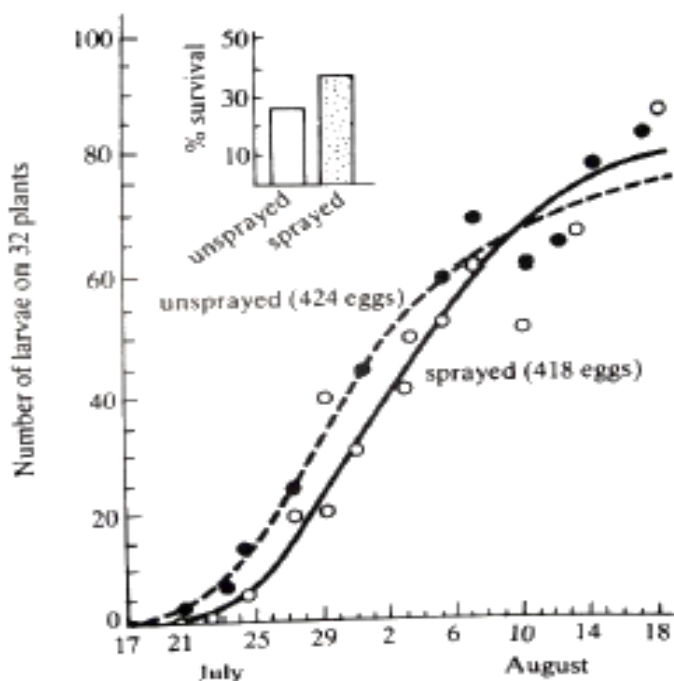
1. (a) What is meant by each of the following as applied in pest control.

(i) Lethal dose 50. (ii) Persistence

(b) The figure below illustrates the differential effects of DDT application on crop and soil fauna in the USA. **Pieris rapae** is a cabbage crop pest that feeds on its leaves. Spraying with DDT to control it is effective only for a short period in the first year. The larvae of the Cabbage crop pest are eaten by soil-dwelling ground beetle **Harpalus rufipes**.

(a) 1964 (after one application of DDT, 6 July 1964)

(b) 1965 (after three applications of DDT, 6 July, 20 August 1964 and 28 June 1965)

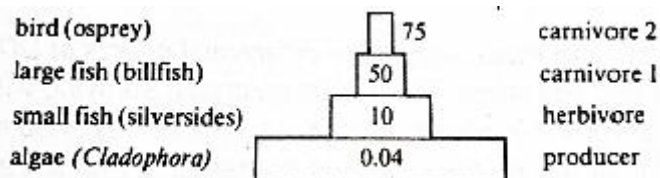


(i) Explain the effect of one application of DDT on **Pieris rapae** population.

(ii) Account for the differences in the number of eggs of **Pieris rapae** at the sprayed and unsprayed farm yards due to three successive applications of DDT.

(c) What advice would you give to the farmer before making the choice of the pesticide?

(d) The figure shows the biomass and amount of DDT in ppm at different trophic levels in a food chain collected during a certain study in the USA.



(i) Account for the trend of change in DDT concentration showed by the figure.

(ii) Suggest ways in which birds such as penguins and hawks in the Antarctic Ocean might have come to contain DDT.

(e) Disturbance of natural ecosystem of originally clear Lake California by eutrophication lead to increased population of midges (mosquitoes/fly) during the 1940s and these were treated by spraying with DDD, a close relative of DDT. The first and second application killed about 99% of the midges but they recovered so quickly that the third application had little effect on their population.

(i) Suggest the observation made following the different DDD applications.

(ii) Animal death due to DDT poisoning is rampant in times of starvation. Explain why this is so.

2. a) How does each of the following human activities harm the environment?

i. Use of plastic materials.

(10 marks)

ii. Use of chlorofluorocarbons.

(05 marks)

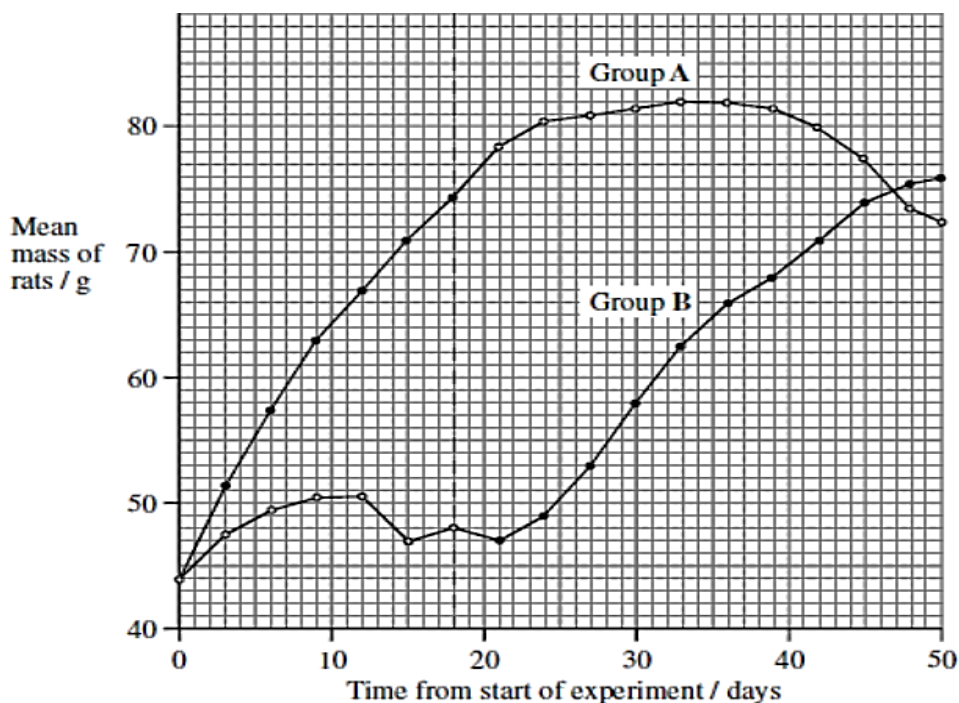
b) Why is it important to conserve?

(05 marks)

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CATEGORY TWO: (GENETICS/INHERITANCE, EVOLUTION, REPRODUCTION, GROWTH & DEVELOPMENT)

3. Hopkins carried out an experiment to investigate the effect of milk in diet on growth of rats. Two groups, A and B, each consisting of eight young rats fed on mice pellets having purified casein, sucrose, inorganic salts and water. Group A received a supplement of 30cm³ of milk per day for the first 18 days then received no further milk. Group B was given no milk for the first 18 days, then received a supplement of 30cm³ of milk per day. Study it carefully and answer the questions that follow.



- (a) From the graph, calculate the average growth rate of rats from the two groups, A and B at;
- 0th-10th day for group A. **(03 marks)**
 - 20th- 50th day for group B **(03 marks)**
- (b) Compare the changes in the mean mass of both groups of rats during the whole experiment. **(10 marks)**
- (c) Explain the changes in the mean mass of both groups of rats in (b) above. **(12 marks)**
- (d) Describe,
- the physiological significance of including mineral salt like calcium in the diet of rats? **(10 marks)**
 - How the rats were able to deal with excess proteins in their diet.

(02 marks)

4. In maize the genes for coloured seed and full seed are dominant to genes for colourless and shrunken seed respectively. Pure breeds of double dominant variety were crossed with double recessive variety; and a test cross of the resultant F1 offspring produced the following.

Phenotype	Number of offspring
Coloured full seed	382
Colourless shrunken seed	394
Coloured shrunken seed	15
Colourless full seed	13

- Suggest explanation for the phenotypic ratio obtained as shown by the results in the table.
- Using suitable genetic symbols; show how you have come to conclude as in (a) above.

(c) Calculate the distance in Morgan units between the genes for seed colour and seed shape on a chromosome.

(d) Outline the importance of Cross Over Values in genetics.

5. a) Explain the essential features of Darwin's theory of evolution. **(14 marks)**

b) Describe how the different forms of natural selection occur. **(06 marks)**

6. a) Describe the causes of genetic variation in a population. **(14 marks)**

b) How does variation influence the adaptation of a species to the environment? **(06 marks)**

7. a) Distinguish between a dominant gene from an epistatic gene. **(02 marks)**

b) i) Outline the Hardy- Weinberg equilibrium principle. **(02 marks)**

ii) State and describe the conditions required for Hardy-Weinberg principle to be maintained in a population. **(7½ marks)**

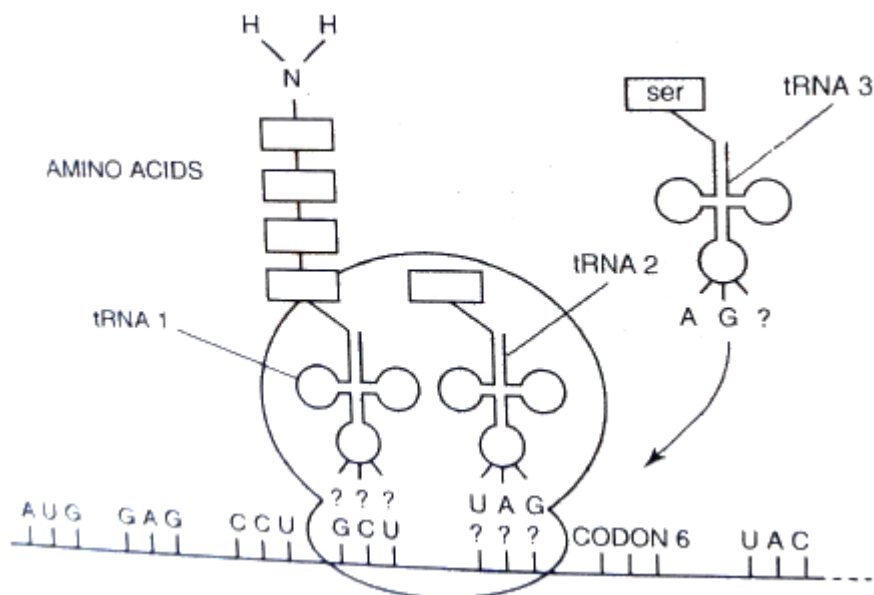
c) Normal skin pigmentation in a human population is controlled by a dominant allele. If in a population, 64% of the people have normal skin colour, using Hardy- Weinberg equation, determine the percentage of the population who are

i. Carriers for skin pigmentation. **(05 marks)**

ii. Homozygous dominant for skin colour. **(3½ marks)**

CATEGORY THREE: (CELL BIOLOGY-CYTOLOGY, CELL PHYSIOLOGY, CELL DIVISION & PROTEIN SYNTHESIS, CHEMICALS OF LIFE, HISTOLOGY)

8. The diagram below summarizes the processes of protein synthesis. Use it to answer the questions that follow.



- (a) (i) Which is the first tRNA anticodon used in protein synthesis from this mRNA?
 (ii) What is the anticodon sequence in tRNA 1?
 (iii) Give the DNA triplet code which is recognised by tRNA 2.
 (b) (i) Explain what changes will occur in the translation apparatus to allow codon 6 to be translated.
 (ii) What are the possible codon sequences for codon 6?
 (c) Explain why mutations involving the deletion of a base may have greater effects than those involving substitution of one base for another.
 (d) (i) Precisely describe how errors are minimized during

DNA replication.

(ii) Describe how errors that occur during DNA can lead to sympatric speciation.

(e) What is the significance of DNA duplication prior to mitosis?

(f) Describe how DNA controls the behavior and physical appearance of an organism.

9. a) Distinguish between translation and transcription. (05 marks)

b) Describe the process of translation in a cell. (12 marks)

c) What is the significance of translation in living organisms? (03 marks)

10. a) Explain why proteins are able to regulate the pH of blood. (05 marks)

b) How does the lock and key theory explain how enzymes function? (10 marks)

c) Explain how inhibitors regulate cell metabolism. (05 marks)

11. a) Compare the processes of active transport and osmosis. (08 marks)

b) Explain the changes that take place in a turgid plant cell placed in a hypertonic solution. (12 marks).

CATEGORY FOUR: (NUTRITION, TRANSPORT, HOMEOSTASIS, RESPIRATION, COORDINATION/ BEHAVIOUR, SUPPORT AND MOVEMENT, CLASSIFICATION, GASEOUS EXCHANGE)

12. (a) The following experiment was carried out to investigate the effect of light intensity on the rate of photosynthesis of a water plant, Elodea.

- Elodea was cut into three pieces, each 10 cm long.

- Each piece of Elodea was placed in a glass tube, containing 0.5% sodium hydrogen carbonate solution, which was then sealed with a stopper.

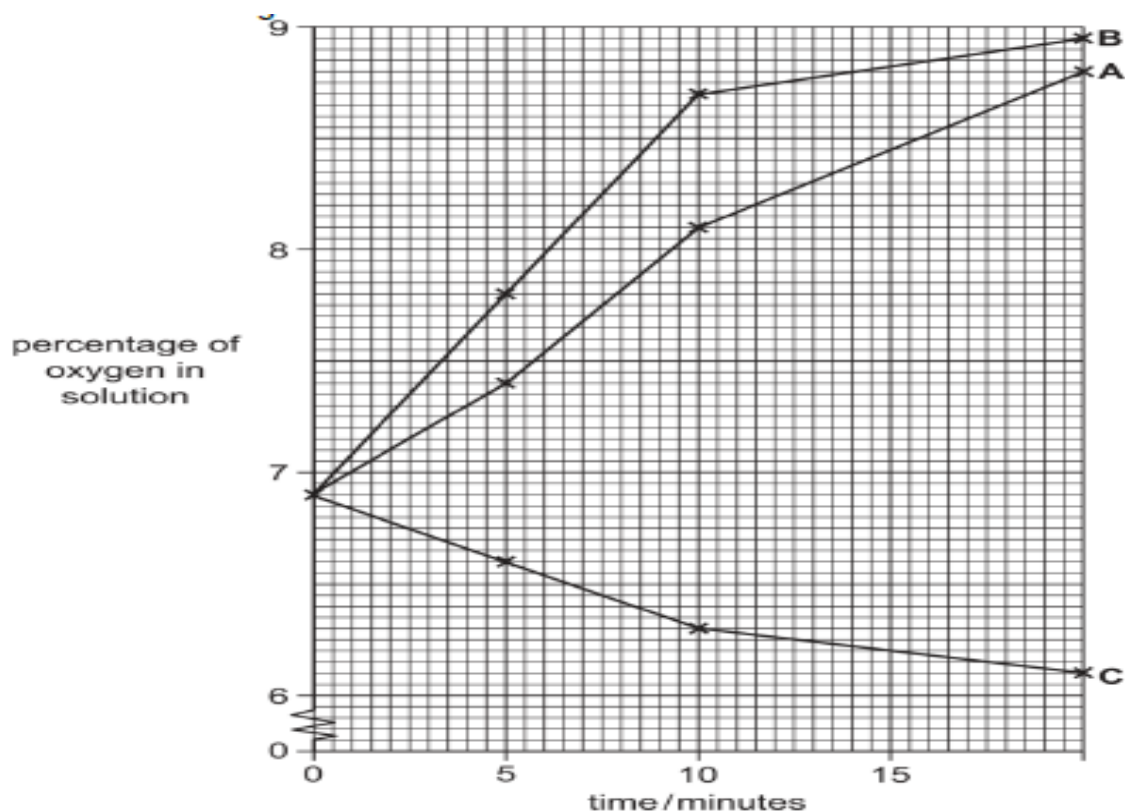
- Tube **A** was placed 10 cm away from a lamp.

- Tube **B** was placed 5 cm away from a lamp.

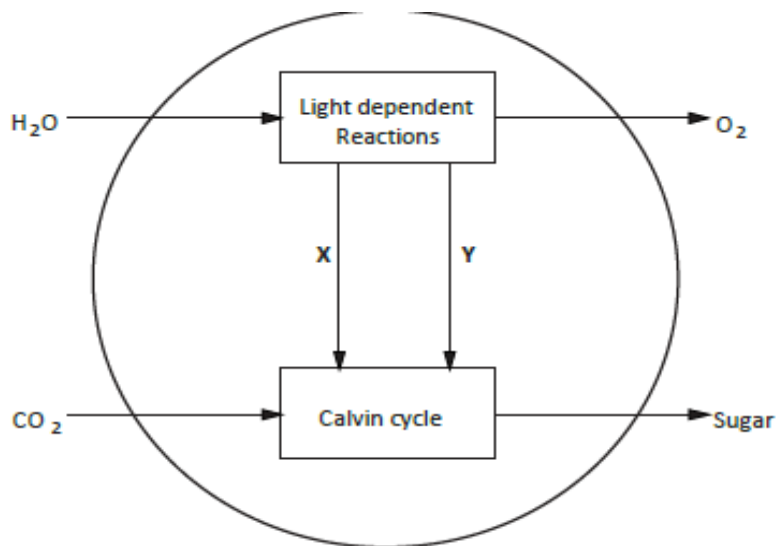
- Tube **C** was placed in a dark room.

- An oxygen sensor was used to measure the percentage of oxygen in the solutions at the start of the experiment and again at 5, 10 and 20 minutes.

The results are shown in Figure below.



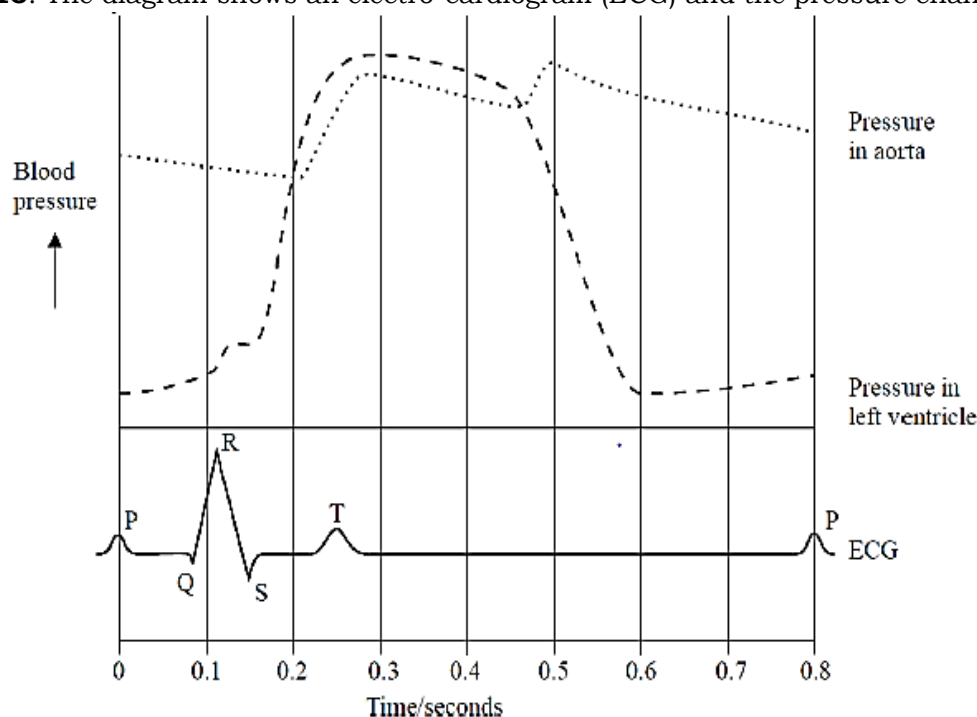
- Describe the changes in the percentage of oxygen in solution for tubes A and C.
 - State why sodium hydrogen carbonate solution was used.
 - Calculate the mean rate of oxygen production for tube **A** for the 20 minutes of the experiment.
 - Compare the results for tubes **B** and **C**.
 - Explain the results for tube **C**.
 - Suggest what factor, which may have an effect on the rate of photosynthesis, was **not** taken into account in this experiment.
- (b) Figure below shows the relationship between the light dependent and light independent reactions in a chloroplast.



- Name substances **X** and **Y** in Figure above.
- Describe the steps involved in the formation of the products in the above reactions.
- Explain what makes C4 plants more photosynthetically efficient than C3 plants.

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13. The diagram shows an electro-cardiogram (ECG) and the pressure changes during a human cardiac cycle.

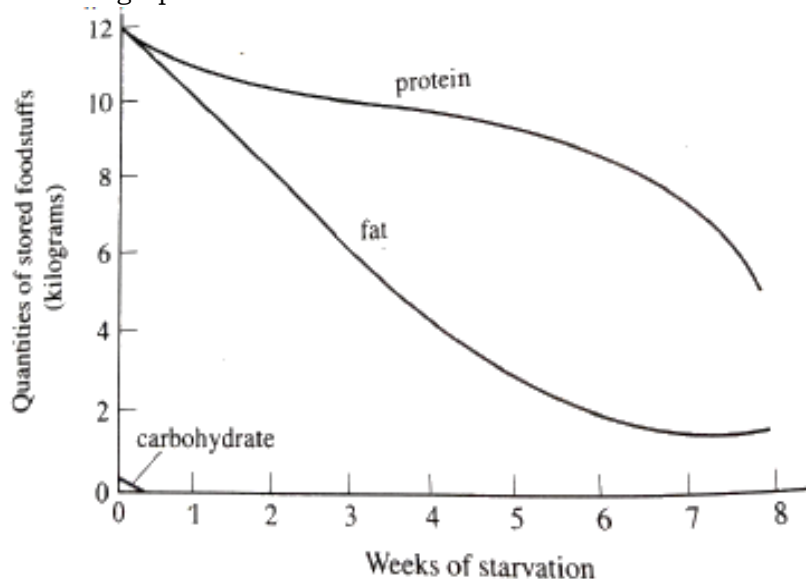


- (a) (i) Define the term electrocardiogram.
- (ii) What does each of the waves shown on the ECG represent and state their significance.
- (iii) Explain why there is no change in the electrical activity between 0.31s and 0.77s.
- (b) Use the graph to calculate the heart rate of humans.
- (c) (i) Compare the pressure changes in the left ventricle and aorta.
- (ii) State the significance of the differences stated in (c) (i) above.
- (d) The pressure changes shown in the diagram are on the left side of the

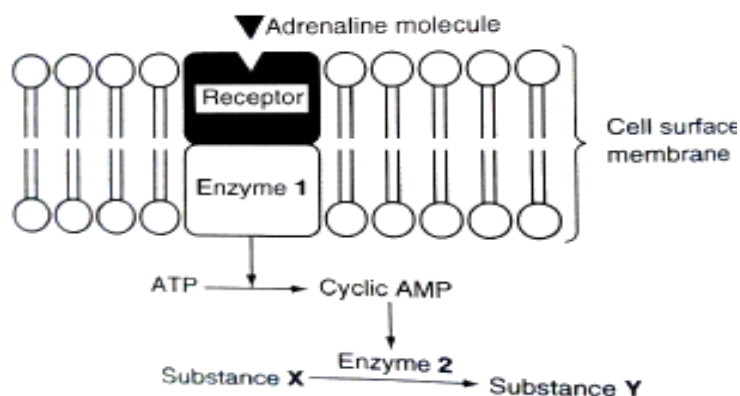
heart. Sketch a curve on the graph to show the pressure changes in the right ventricle.

(e) Outline the functional properties of heart muscles.

14. The graph below shows the effect of starvation on the food stores of the human body.



- (a) Compare the effect of starvation on the quantities of fat and protein stored in the body.
- (b) (i) Define the term starvation.
- (ii) Explain the trend of each of the foodstuffs with increasing weeks of starvation.
- (c) Account for each of the following.
- (i) Lipids have a higher energy value than carbohydrates of comparably the same mass.
- (ii) Cells of poikilothermic animals have a higher proportion of unsaturated fatty acids than homoeothermic animals.
- (d) What is meant by obesity and state its effects.

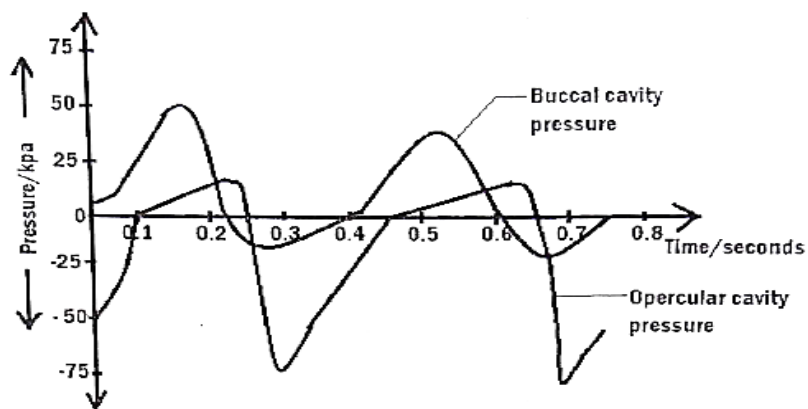


15. (a) What is meant by **cascade effect** of hormonal action?
- (b) The diagram summarises the way in which adrenaline can control a chemical reaction in a liver cell.
- (a) Describe the function of cyclic AMP in this process.
- (b) Give an example of a chemical reaction in a liver cell which is controlled by adrenaline by naming substance X, Substance Y, and enzyme 2.
- (c) Use the diagram to explain:
- (i) why adrenaline may affect some cells and not others.

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- (ii) how a single molecule of adrenaline may cause this cell to produce a large amount of substance Y.
- (d) Differentiate between peptide and steroid hormones.
- 16.** a) What is meant by photorespiration? (05 marks)
- b) How does the variation of carbon dioxide and oxygen affect photorespiration and photosynthesis? (08 marks)
- c) Explain why the rate of photosynthesis in C_4 is not promoted by high atmospheric carbon dioxide as in C_3 plants. (07 marks)
- 17.** a) Compare photosynthesis and photorespiration. (11 marks)
- b) Explain how photorespiration is avoided in C_4 plants. (09 marks)
- 18.** (a) i) State the Bohr effect. (02 marks)
- ii) What is the physiological significance of the Bohr effect? (06 marks)
- (b) Describe how carbon dioxide is expelled as gaseous carbon dioxide by the lungs. (08 marks)
- (c) Explain the physiological advantage of increasing the body temperature on the dissociation of haemoglobin in the mammalian blood. (04 marks)
- 19.** a) How does the structure and physiological conditions of the respiratory surface in mammals make efficient gaseous exchange? (09 marks)
- b) How is ventilation controlled in man? (11 marks)
- 20.** a) Explain how leaf modifications are related to the distribution of terrestrial plants. (10 marks)
- b) How do stomata open and close according to the osmotic pressure theory? (10 marks)
- 21.** a) What is meant by oxidative decarboxylation? (03 marks)
- b) Explain the chemiosmotic theory of energy formation. (10 marks)
- c) Describe the respiratory metabolism of glycerol in the cytoplasm of the cell. (07 marks)
- 22.** a) Give an account of the events that lead to perception of clear image of far objects by the human brain during a bright day. (13 marks)
- b) Explain how the phytochrome system induces flowering in short day plants. (07 marks)
- 23.** Describe how mammalian circulation is
- a. Maintained. (10 marks)
- b. Controlled. (10 marks)
- 24.**(a) The human kidneys process 1200 cm^3 of blood every minute. This 1200 cm^3 of blood contains 700 cm^3 of plasma. As this blood passes through the glomeruli of the kidneys, 125 cm^3 of fluid passes into the renal capsules (Bowman's capsules). This fluid is called the glomerular filtrate and is produced by a process is called ultrafiltration.
- (i) Calculate the percentage of plasma that passes into the renal capsules. Show your working.
- (ii) Explain how the structure of the glomerular capillaries is adapted for ultrafiltration.
- (iii) Explain why the epithelial cells of the proximal convoluted tubule have many mitochondria in them.
- (iii) Describe the role of the hypothalamus and kidney nephrons in the control of the osmotic pressure of blood.
- (b) Kidney failure may result in a buildup of urea in the blood, protein in the urine and retention of tissue fluid. Patients with kidney failure may need a transplant. Recipients of transplanted kidneys are treated with drugs that suppress their immune system.
- (i) Explain how ultrafiltration and reabsorption remove urea from the blood without losing essential nutrients such as protein and glucose.
- (ii) Explain the part played by the loop of Henle and the collecting duct in concentrating urine in a healthy individual.
- (iii) Explain the link between protein in the urine and retention of tissue fluid in patients with kidney failure.
- (iv) If not treated with drugs, explain how the recipient's immune system would reject a transplanted kidney.
- 25.** The figure below shows the pressure changes in the buccal and opercular cavities of a teleost fish that were obtained using a hypodermic tubing connected to a pressure recorder.

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Species of fish	Thickness of lamellae in (μm)	Distance between lamellae in (μm)	Distance between blood and surrounding water in (μm)
A	20	30	6
B	12	35	3
C	7	20	1

The table summarizes the features of gill lamellae of three species A, B and C of teleost fish.

Use the above information in the figure and table to answer the questions that follow,

- Compare the pressure changes in the buccal cavity and opercular cavity.
- Give explanations for the observed pressure changes in the first 0.4s in the,
 - Buccal cavity
 - Opercular cavity
- what is the physiology significances of the observed differences between the pressures in the buccal cavity and opercular cavity.
- from the table, explain how the thickness of lamellae is related to the extent of activity in these fishes.
- suggest reasons why the gill lamellae would not provide an efficient respiratory surface on land.
- give the adaptation of gills as gas exchanged surface in bony fishes.

RECALL HOW QUESTIONS ARE SELECTED TO MAKE UP P530/2

Criteria used to select and form 6 questions in paper two (P530/2):

- One question is selected from any topic in each **group/category** as arranged above. (A must do affair). Then two groups contribute more than 1 question to arrive at 6 questions.
- Senior 6 and 5 topics** are equally represented in the paper. S.5, 3 questions and S.6, 3 questions. But one level/class can have more than 3 questions preferably senior five topics.
- The final paper set must have questions on both plant and animal biology. A paper on only animal biology is a biased one.

S.5 topics	S.6 topics
Cell biology	Nutrition
Chemicals of life	Respiration
Classification	Coordination
Ecology	Homeostasis
Evolution	Gaseous exchange
Inheritance	Support and movement
Transport	Reproduction
Cell physiology	Growth and development

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