



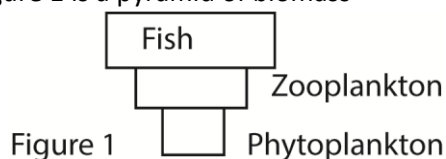
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UACE Biology 2022 paper 1

Answer all questions

- In bacterial and fungal cells, food is stored in form of
 - starch
 - lipids
 - proteins
 - glycogen
- Which one of the following is possible genotype of the parent in dihybrid test where an offspring shows up with all recessive trait?
 - RRGG
 - RrGG
 - RRGg
 - RrGg
- Which one of the following is controlled by the combined action of nervous and hormonal system?
 - Temperature
 - Blood pressure
 - Glucose levels
 - Solute potential
- Which one of these explains why the respiratory quotient normally falls when the seeds coat is shed during germination?
 - Shedding of the seed coat reduced the rate of respiration
 - Removing the seed coat increases surface area for enzyme action
 - Removal of seed coat leads to less carbon dioxide released
 - Removal of seed coat allows entry of oxygen
- Which one of the following is an adaptation of the loose connective tissues? Possession of
 - A matrix which contains flexible fibres for strength and resilience
 - An underlying tissue to protect against dehydration
 - A germ layer in the early growth and development of organism
 - A basement membrane composed of non-elastic collagen fibres
- Figure 1 is a pyramid of biomass



The pyramid shows that the

- A. Zooplankton have a higher reproductive rate than phytoplankton
 - B. Number of fish outnumber that of zooplankton and phytoplankton
 - C. Zooplankton have a short life span
 - D. Phytoplankton have a rapid turnover rate
7. Short day plant usually delay to flower when the nights are interrupted with red light because
- A. The light period is shorter than the critical length in the 24 hour cycle
 - B. Red light inhibits the release of chemical which initiated flowering
 - C. The light period is longer than the critical length
 - D. The dark period is longer than the critical length
8. Table 1 shows the results obtained in the capture-recapture method of estimating the population of grasshoppers in an ecosystem.

Table 1

Marked and released on day 1	Marked captured on day 3	Unmarked captured on day 3
180	30	120

What was the estimated population size?

- A. 900
 - B. 330
 - C. 720
 - D. 270
9. Figure 2 shows the inheritance of a recessive sex-linked trait in a family. The circles indicate female while the shading indicates the occurrence of the defect

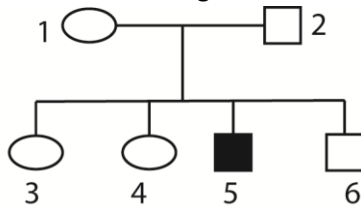


Fig. 2

It can be concluded the

- A. Individuals 1 and 2 were carriers
 - B. Each family member had at least one recessive allele
 - C. Individual 1, 3 and 4 were carriers
 - D. Individuals 2 and 6 had no recessive allele
10. The pitch of sound is determined by the
- A. Number of receptor cells stimulated
 - B. Position of receptor cells stimulated
 - C. Threshold value of receptor cells stimulated
 - D. Summation in the receptor cells
11. Figure 3 shows the population growth curve of rats in a cage

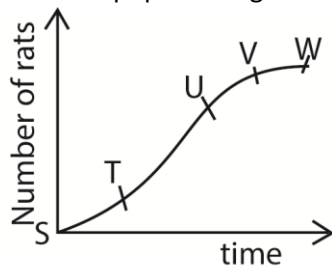


Fig. 3

In which region of the growth curve is the existence highest?

- A. ST
- B. TU

- C. UV
D. VW
12. The spore of a fern species has y number of chromosomes. What is the number of chromosomes in its leaf
A. $\frac{y}{2}$ B. y C. $2y$ D. $4y$
13. Which of the following features of sclerenchyma tissue enables it to contribute towards toughness and rigidity of the stem?
A. Very long fibres
B. Unevenly thickened walls
C. Uniformly thick lignified walls
D. Presence of plasmodesmata
14. Which of the following hormones stimulates seed germination?
A. Auxins and ethene
B. Cytokinins and Auxins
C. Gibberellins and cytokinins
D. Gibberellins and ethene
15. The tidal volume of an athlete whose number of breath per minute is 100 and ventilation rate of 250dm^3 per minute is
A. $25,000\text{ dm}^3$
B. 2.5 dm^3
C. 25 dm^3
D. 0.4dm^3
16. Which one of the following sub-stages of photosynthesis is unlikely to be slowed down by decrease in temperature?
A. Photolysis of water
B. Fixing of carbon dioxide by RuBP
C. Regeneration of RuBP
D. Conversion of PGAL to glucose
17. The following are advantages of excreting uric acid by flying organisms **except**
A. It is insoluble in water and non-toxic
B. It required very little water for its removal
C. It requires less energy for its formation
D. Its storage does not have to be osmoregulatory effect
18. The behaviour in which a snail ceases to withdraw its tentacles in response to repeated mechanical stimulation is
A. Associative learning
B. Exploratory learning
C. Imprinting
D. habituation
19. Which of the organism in table 2 required the most specialized respiratory system?

Table 2

Organism	A	B	C	D
Surface area (cm^2)	1	6	2	8
Volume (cm^3)	0.5	2	0.5	3

20. Sprinter usually take off at an angle rather than upright position in order to increase
A. Effective length of the limbs
B. The speed of movement

- C. The forward force
 - D. The upward force
21. Which one of the following pairs of plant tissues contains living cells at maturity?
 - A. Cork and xylem tissue
 - B. Parenchyma and phloem tissue
 - C. Sclerenchyma and collenchyma
 - D. Sclerenchyma and phloem tissue
 22. Why one of the following statements explains why DDT increases in birds during food shortages?

DDT

 - A. dissolves in water and then diffuses into blood
 - B. increases the insulation capacity of the birds
 - C. metabolises to release metabolic water
 - D. is released when fat is metabolised
 23. Which one of the following shows the correct coding sequence during the synthesis of polypeptides chain?
 - A. DNA → mRNA → tRNA → rRNA
 - B. DNA → mRNA → rRNA → tRNA
 - C. rRNA → DNA → tRNA → mRNA
 - D. RNA → rRNA → mRNA → rRNA
 24. Which one of the following is correct about the life cycle of mosses?
 - A. Diploid sporophyte produce spores by mitosis
 - B. Haploid sporophytes produces spores by meiosis
 - C. Haploid gametophyte produces gametes by mitosis
 - D. Diploid gametophyte produces gametes by meiosis
 25. Which of the following events takes place during metaphase II of meiosis?
 - A. Crossing over of genetic materials occurs
 - B. Homologous chromosomes align on the equator as tetrads
 - C. Homologous chromosomes align singly on the equator of spindle
 - D. Chromatids migrate to opposite poles
 26. Hydrogen carbonates are actively reabsorbed into the haemocoel because they
 - A. Combine with potassium ions
 - B. Lower the osmotic pressure of the Malpighian tubules
 - C. Increase the pH and lower the concentration of uric acid
 - D. Cause further reabsorption of water through the rectal epithelium
 27. Which of the following is not affected by the stimulation of the vagus nerve on the heart?
 - A. Force of ventricular contraction
 - B. Rate of heart beat
 - C. Atrio-ventricular node
 - D. Sino-atrial node
 28. The amount of phosphoglyceric acid increases after a photosynthesising plant has been in darkness for a short time because
 - A. Ribulose bisphosphate become more unstable
 - B. The concentration of RuBP carboxylase reduces
 - C. The available ATP and NADPPH not sufficient
 - D. All the formed triose phosphate converted back to phosphoglyceric acid
 29. Ovulation in human menstrual cycle occurs following an increase in
 - A. Progesterone hormone only
 - B. Luteinising hormone only

- C. Both oestrogen hormone and follicle stimulating hormone
 - D. Both Luteinising and gonadotropin release hormone
30. Which one of the following occurs during the recovery phase in an axon? Active pumping of
- A. Na^+ ions into the axon
 - B. K^+ ions out of the axon
 - C. Na^+ ions out of the axon
 - D. Organic ions into the axon
31. Which one of the following fins may perform the same function as a swim bladder of a teleost fish?
- A. Vertical dorsal fins
 - B. Pectoral fins
 - C. Caudal fins
 - D. Ventral fins.
32. In which of the following parts does spermatogenesis take place?
- A. Vas efferens
 - B. Seminiferous tubule
 - C. Vas deferens
 - D. epididymis
33. Which one of the following statements is correct about the metabolic rate?
- A. Small animals require the same energy to maintain each gram of the body mass as large animals.
 - B. Large animals require less energy to maintain each gram of body mass than small animals.
 - C. The overall metabolic rate is inversely proportional to the body mass of an animal.
 - D. The overall relationship between metabolic rate and the body mass of animal is constant
34. During flight in birds, the air pressure is greater on the lower surface of the wings in order to
- A. Keep the bird soaring
 - B. Make the bird less dense
 - C. Enable the bird overcome resistance
 - D. Generate lift and move forward.
35. The movement of photosynthetic products into phloem from the companion cells occurs by
- A. Active transport across cell membrane
 - B. Mass flows through plasmodesmata
 - C. Diffusion along apoplast and symplast
 - D. Diffusion through the plasmodesmata.
36. The sodium concentration is higher in the descending limb than in the ascending limb of the loop of Henle due to
- A. Active pumping of sodium ions out of the ascending limb.
 - B. Increased permeability of ascending limb to water
 - C. Descending limb being impermeable to sodium ions resisting outflow
 - D. Renal fluid in the descending limb lying in the medulla with high ion concentration
37. The catalytic action of enzymes is attributed to
- A. their specificity to respond to one substrate at a time
 - B. faster disintegration of substrate to products
 - C. ability to properly the substrate molecules
 - D. ability to reduce activation energy of substrate
38. Which one of the following would occur in guard cells when a potted plant is shifted from a well lit room to a totally dark place?
- A. Potassium ions are pumped into guard cells

- B. Inner wall of guard cells bulge inwards
 - C. Pressure potential of guard cells increases
 - D. Water potential of guard cells become less negative
39. Which one of the following factors can determine the existence of recessive alleles in successive generations of a small population?
- A. Natural selection
 - B. Mutation
 - C. Chance
 - D. Random mating
40. Which one of the following factors is responsible for the faster rate of secondary succession than primary succession
- A. Presences of soil
 - B. Availability of water
 - C. Optimum temperature
 - D. Suitable light intensity

SECTION B

Answer all questions in the space provides

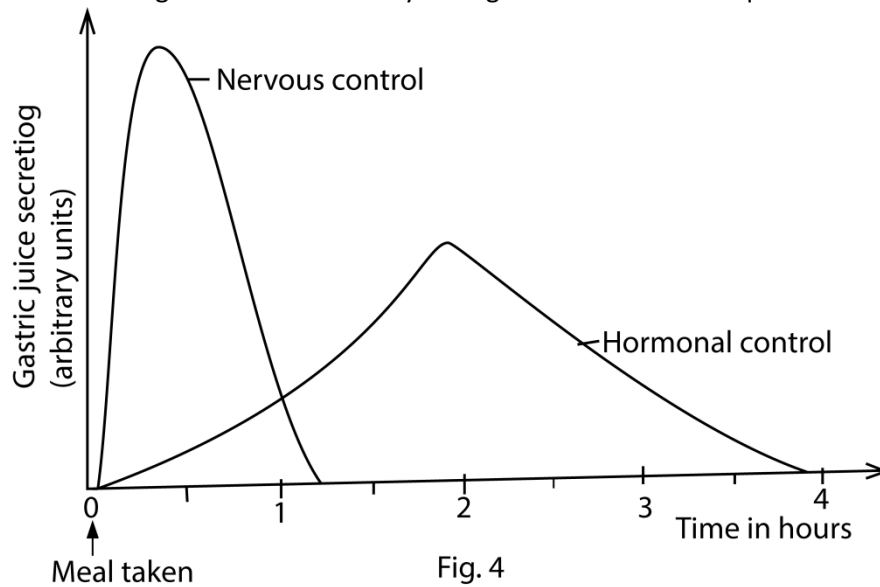
41. (a) What is gene linkage? (02marks)
 (b) How does codominance influence monohybrid phenotype in
 (i) F₁ generation? (01marks)
 (ii) F₂ generation (02marks)
 (c) Explain the effect of gene linkage on F₂ dihybrid phenotypes (05marks)
42. (a) State the difference between short day and long day plants. (02marks)
 (b) With reference to long day plants explain, explain
 (i) how flowering is controlled, (03marks)
 (ii) the effect of flashing red light in a long night. (02marks)
 (c) with reference to flowering, explain the significance of photoperiod in plants (03marks)
43. Table 3 shows the percentage composition of blood plasma and urine in g/100cm³ of fluid for a selection of substances. Study the table and answer the questions that follow.

Table 3

Substance	Percentage composition	
	Blood plasma	Urine
Water	90	96
Plasma proteins	8	0
Glucose	0.1	0
Urea	0.03	2
Chloride ions	0.37	0.6
Hormones	Trace	Trace

- (a) Explain any four significant differences in the composition of urine and that of blood plasma (04marks)
- (b) Give an explanation for expected change in composition of urine
 (i) During strenuous exercise(02marks)
 (ii) After a high protein meal (02marks)
- (c) Explain how the epithelial cells of the proximal convoluted tubule are adapted to perform their function. (02marks)

44. Figure 4 shows the control of gastric juice secretion in a mammalian stomach with increasing time after ingestion of food. Study the figure and answer the questions that follow



- Fig. 4
- (a) Comment on the effects of nervous control on the secretion of gastric juice. (03marks)
- (b) (i) State the difference in the effects of nervous and hormonal control of gastric juice secretion. (03marks)
- (ii) Give reason(s) for your answer in (b)(i) (04marks)
45. (a) State the difference between photosynthetic bacteria and chemosynthetic bacteria (02marks)
- (b) How are photosynthetic bacteria adapted to carrying out photosynthesis? (04 marks)
- (c) Using an example, explain the significance of chemosynthetic bacteria in an ecosystem. (04marks)
46. (a) How is the body protected from pathogen reinvasion through active immunity? (02marks)
- (b) Describe how the following protect the human body from entry of pathogens.
- (i) ear (01marks)
- (ii) anus (01marks)
- (c) What is the role of lymph nodes in prevention of diseases in animals? (02marks)
- (d) State four roles played by the body's immune system. (04marks)

Suggested answers

1D 4D 7C 10B 13C 16A 19A 22D 25C 28C 31C 34D 37D 40A
 2D 5A 8C 11D 14C 17D 20C 23B 26D 29B 32B 35A 38D
 3B 6D 9A 12C 15B 18D 21A 24C 27A 30B 33C 36A 39D

Comments

3. Blood pressure is controlled by

- the autonomic nervous system (ANS), which provides a short-term regulation by detecting changes in blood pressure and adjusting cardiac output or blood vessel diameter
- the kidneys provide a long term regulation by managing blood volume with hormones. i.e. antidiuretic hormone (ADH) increases reabsorption of water in case of low blood volume.

6. A rapid turnover rate enables phytoplankton to support a big biomass of zooplankton

8. 30 marked grasshoppers are contained in 120

10 rked grasshoppers are contained $\frac{120 \times 180}{30} = 720$ (whole population)

10. High-pitched sounds activate hair cells with shorter hair bundles, located near the entrance of the cochlea (closer to where sound enters the ear). While lower-pitched sounds activate hair cells with taller hair bundles, located further inside the cochlea.

12. The spores contain haploid number of chromosomes while leaf of fern contain diploid number of chromosomes

15. Tidal volume = $\frac{\text{ventillation rate}}{\text{number of breath per minute}} = \frac{250}{100} = 2.5 \text{dm}^3$

16. Photolysis of water is powered by light

19. Table 2

Organism	A	B	C	D
Surface area (cm ²)	1	6	2	8
Volume (cm ³)	0.5	2	0.5	3
Surface area/volume	2	3	4	2.67

A. has the least surface area to volume ratio

20. During a drive phase sprinter are trying to get as much of their momentum built up so that at top speed, it is easier to maintain.

Keeping the head down allows the sprinter to more efficiently by applying their power in a forward motion as opposed to an upward motion (the type of motion one gets from running straight up). This means that when their feet hit the ground they are pushing back instead of pushing up.

21. Cork is a protective layer of dead cells that replaces the epidermis of woody plants while xylem is made up of dead lignified cells at maturity.

22. DDT is store in fat deposits.

23. DNA is transcribed to mRNA; Messenger **RNA** (mRNA) molecules carry the coding sequences for protein synthesis and are called transcripts; mRNA binds with ribosomal RNA (rRNA) molecules that forms the core of a cell's ribosomes (the structures in which protein synthesis takes place); and then transfer RNA (tRNA) molecules carry amino acids to the ribosomes during protein synthesis.

28. ATP and NADPH are used to reduce PGA but their synthesis requires light

29. A spike in LH and FSH ("LH surge") causes **ovulation**, following a suppression of GnRH. i.e. at ovulation gonadotropin is suppressed.

31. Non cartilaginous fish maintain buoyancy by continuous swimming.

38. Water potential become less negative because the guard cells lose solute and close in the dark.

39. Relates to genetic drift

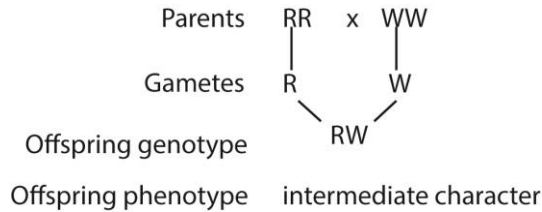
SECTION B

Answer all questions in the space provides

41. (a) What is gene linkage? (02marks)

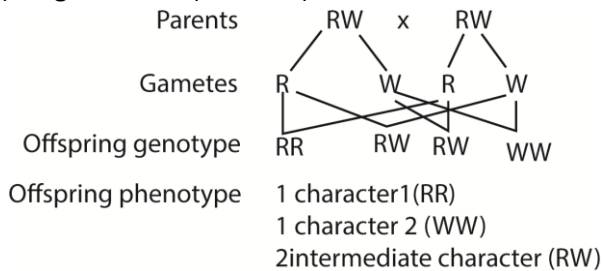
(b) How does codominance influence monohybrid phenotype in
(i) F₁ generation? (01marks)

Let R and W be the alleles for codominant genes



F₁ generation offspring have intermediate character

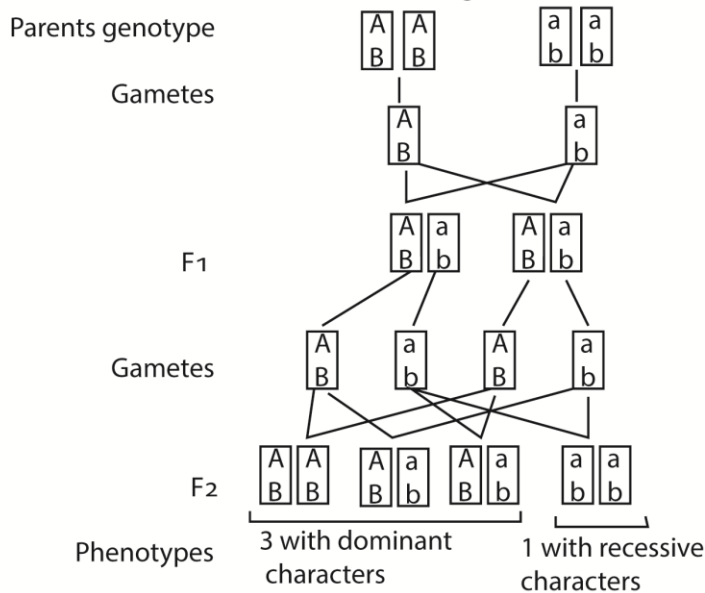
(ii) F₂ generation (02marks)



F₂ generation are in ratio 1:2:1 (1 of each character and 2 of intermediate characters)

(c) Explain the effect of gene linkage on F₂ dihybrid phenotypes (05marks)

Let Aand B be the alleles for the linked genes



3 out 4will show dominant characters

1 out 4 will show recessive characters

42. (a) State the difference between short day and long day plants. (02marks)

Short day plants are plants that flower/respond if the period of uninterrupted darkness is more than a certain length each day while long day plants are plants that flower/respond if the period of darkness is less than a certain length of the day. (Note it is the period of darkness that matter)

(b) With reference to long day plants explain, explain

(i) how flowering is controlled, (03marks)

On the basis of phytochrome system, Pfr promotes flowering in long day plants while Pr inhibits flowering. , Pfr is synthesised in daylight.

[Note: Unfiltered sunlight is rich in red light but deficient in far-red light. Therefore, at dawn, all the phytochrome molecules in a leaf quickly convert to the active Pfr form, and remain in that form until sunset. In the dark, the Pfr form takes hours to slowly revert back to the Pr form. If the night is long (as in winter), all of the Pfr form reverts. If the night is short (as in summer), a considerable amount of Pfr may remain at sunrise. Therefore, it is the length of darkness that is critical.]

(ii) the effect of flashing red light in a long night. (02marks)

It promotes flowering of long day plants because Pfr is synthesized and suppresses flowering in short day plants

(c) With reference to flowering, explain the significance of photoperiod in plants (03marks)

- Enables plants to flower insect pollinators are active in summer (long-day plants) and autumn (short-day) but not in winter.
- Long day plants require more **exposure to light** in order to initiate flowering and can be induced to flower by flashes of light at night
- Short day plants can be induced to flower covering and eliminating nature light or move the plants into the dark chamber for **specific periods of time.**
- Short day and day neutral plants on the other hand, tend to live nearer the equator where days and nights are about the same length all the year, but in the temperature zone long day tend to flower in summer and short day plants flower in the autumn.

43. Table 3 shows the percentage composition of blood plasma and urine in g/100cm³ of fluid for a selection of substances. Study the table and answer the questions that follow.

Table 3

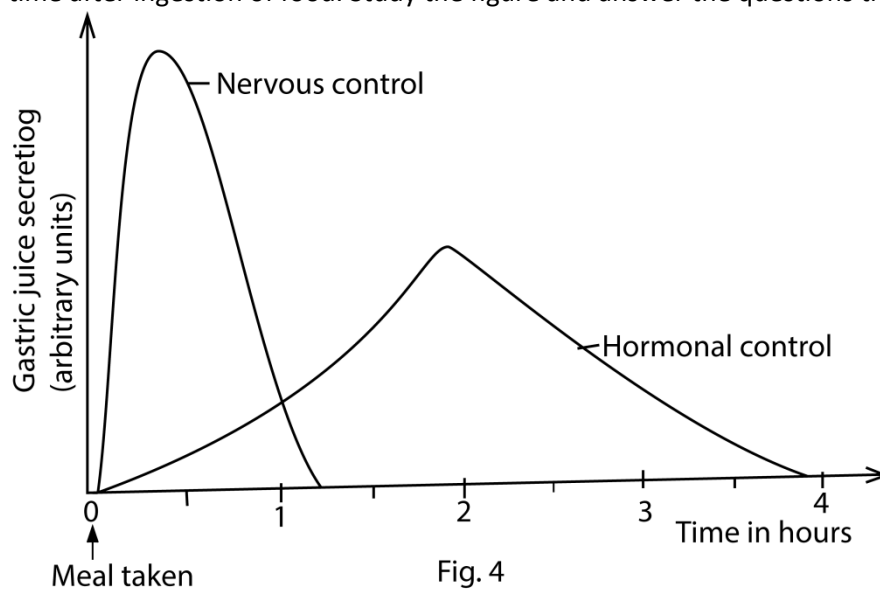
Substance	Percentage composition	
	Blood plasma	Urine
Water	90	96
Plasma proteins	8	0
Glucose	0.1	0
Urea	0.03	2
Chloride ions	0.37	0.6
Hormones	Trace	Trace

(d) Explain any four significant differences in the composition of urine and that of blood plasma (04marks)

- There are no proteins in urine because they are too big molecules to be filtered
- There no glucose in urine due to complete reabsorption

- High concentration of urea in urine compared to that in blood because it is the excretory product removed from blood by secretion and filtration with minimal reabsorption.
 - Percentage of water in urine is high due to absence of proteins that would have occupied some percentage of urine
 - Trace hormones in urine because there are trace hormones in blood
- (e) Give an explanation for expected change in composition of urine
- (i) During strenuous exercise(02marks)
- Percentage of water in urine decrease due high reabsorption
 - Urine may contain short chain proteins
- (ii) After a high protein meal (02marks)
- Percentage of urea increases due to high deamination and urea formation
 - May lead to proteins in urine
- (f) Explain how the epithelial cells of the proximal convoluted tubule are adapted to perform their function. (02marks)
- Epithelial cells have brush border of microvilli that increase the surface area on the apical side of the epithelial cells for reabsorption.

44. Figure 4 shows the control of gastric juice secretion in a mammalian stomach with increasing time after ingestion of food. Study the figure and answer the questions that follow



- (a) Comment on the effects of nervous control on the secretion of gastric juice. (03marks)
- rapid response
 - high peak response
 - responded for one and quarter hours.
- (b) (i) State the difference in the effects of nervous and hormonal control of gastric juice secretion. (03marks)
- Responded earlier than hormonal control
 - Showed higher response than hormonal response
 - Showed a brief response (1¼ hour) than hormonal response (4hrs)
- (ii) Give reason(s) for your answer in (b)(i) (04marks)
- Nervous response is fast because transmission is electrical and neurons are interconnected while hormonal response is slow because hormones have to be distributed in blood.

- Nervous response show high peak response because its effects are localized while hormonal response show low peak response because the hormones are diluted to reached the whole body
- Nervous response show brief response they trigger specific response at local receptors while hormonal response triggers unspecific response through changes in gene expression. Also hormones take long to be broken down.

45. (a) State the difference between photosynthetic bacteria and chemosynthetic bacteria (02marks)

Chemosynthetic bacteria synthesise of organic compounds from carbon dioxide and water using energy from oxidation of inorganic materials such as hydrogen sulphide, ammonia and iron II while photosynthetic bacteria synthesise of organic compounds from carbon dioxide and water using energy from light.

(b) How are photosynthetic bacteria adapted to carrying out photosynthesis? (04 marks)

(c) Using an example, explain the significance of chemosynthetic bacteria in an ecosystem. (04marks)

- Chemosynthetic bacteria e.g. Azobacter fix nitrogen into the soil.
- Saprotrophic bacteria cause decay of waste materials and lead to formation of humus and recycling of minerals.
 - Chemosynthetic bacteria e.g. Nitrosomonas and nitrobacter convert organically combined nitrogen (e.g. protein) to nitrate which are absorbed by plants.
- They are produce food for other organism in ecosystem

46. (a) How is the body protected from pathogen reinvasion through active immunity? (02marks)

Exposure of the body pathogens activates the appropriate antibody producing cells that multiply and fight that particular organism in case the pathogen reinvades body.

(b) Describe how the following protect the human body from entry of pathogens.

(i) ear (01marks)

Earwax contains free movement of pathogens and also contains antimicrobial agent

(ii) anus (01marks)

- Contains strong muscles that keep the anus closed

(d) What is the role of lymph nodes in prevention of diseases in animals? (02marks)

The lymph nodes monitor and cleanse the lymph flowing into them for pathogens, produce and store lymphocytes and other immune system cells that attack and destroy harmful substances like bacteria

(e) State four roles played by the body's immune system. (04marks)

- Keeps invaders (like germs) from entering the body.
- Identifies and tags pathogens in the body
- Destroys pathogens by engulfing them or by use of antibodies.
- Store memory cells that produce an enhanced response to repeated infection by the same type of microorganism.

- Removes dead, faulty and cancer cells

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