BIOLOGY

Time allowed : 3 hours   *Maximum marks: 70*

General Instructions:

(i)   *This question paper consists of four sections* **A, B, C,** *and* **D***. Section* **A** *contains 5 questions of 1 mark each. Section* **B** *is of 10 questions of 2 marks each. Section* **C** *is of 10 questions of 3 marks each and Section* **D** *is of 3 questions of 5 marks each.*

(ii)   *All questions are compulsory.*

(iii) *There is no overall choice. However, an internal choice has been provided in one question of 2 marks, one question of 3 marks and three questions of 5 marks weightage. Attempt only one of the choices in such questions.*

(iv)   *Question numbers 1 to 5 are to be answered in one word or one sentence each.*

(v)   *Question numbers 6 to 15 are to be answered in approximately 20-30 words each.*

(vi)   *Question numbers 16 to 25 are to be answered in approximately 30-50 words each.*

(vii) *Question numbers 26 to 28 are to be answered in approximately 80-120 words each.*

QUESTION PAPER CODE 57/1/1

SECTION - A

1.   What is the importance of the epiglottis in human body ?   1

2.   What happens to the glycogen concentration in the liver cells when the level of adrenaline increases in the blood stream of humans ?   1

3.   Mention the scientific term used for modified form of reproduction in which seeds are formed without fusion of gametes.   1

4.   What does ecological niche of an organism represent ?   1

5.   It was diagnosed by a specialist that the immune system of the body of a patient has been suppressed. Name the disease the patient has been suffering from and its causative agent.   1

SECTION - B

6.   Where are casparian strips located in a plant body and what are they made up of ? Mention its function.   2

OR

What is respiration quotient (RQ) ? Under what conditions will the value of RQ be 1 ? Explain. 2

7. What is resting membrane potential of a neuron ? What is the role of sodium potassium pumps in maintaining it ? 2

8. Draw a diagram of external view of a human brain. Label the frontal lobe, temporal lobe, occipital lobe and cerebellum. 2

9. How is the milk production regulated by hormones in human female ? Explain. 2

10. Explain the significance of the auxin / cytokinin ratio in plant tissue culture. 2

11. What does S-shaped pattern of population growth represent ? How is J-shaped pattern different from it and why ? 2

12. What does secondary productivity in an ecosystem indicate ? List any two factors by which productivity is limited in aquatic ecosystems. 2

13. How do viruses enter plant body and spread to long distances within it ? Mention any two ways by which viruses spread from one plant to another. 2

14. In what form do plants absorb calcium from the soil ? List any two calcium deficiency symptoms in plants. 2

15. What is vernalisation ? How is the process of vernalisation advantageous to plants ? 2

SECTION - C

16. Explain the theory of capillarity of water translocation in plants. Can the theory explain translocation of water in 100 m tall trees ? Give one reason. 3

17. What is symbiotic nitrogen fixation ? Name the two protein components needed for this process. Explain their role. 3

OR

List the various modes of heterotrophic nutrition in plants. Explain any two modes giving one example of each. 3

18. What is biological magnification ? Explain how DDT as a water pollutant undergoes biological magnification ? 3

19. What are exotic species ? Explain with the help of two examples how the exotic species disturb the native species of an ecosystem ? 3

20. In what forms are nitrogenous wastes excreted in birds, humans and aquatic turtles respectively ? Why so, explain ? 3

21. A patient was complaining of frequent urination, excessive thirst and dehydration. His fasting glucose level was found to be normal. Name the disease and its cause. Explain why are such symptoms occurring in this patient ? 　3

22. Explain with the help of a suitable example for each of the following terms : (i) morphallaxis (ii) epimorphosis and (iii) compensatory regeneration. 　3

23. Describe the polygonum type of embryo sac. Why is it generally referred to as monosporic ? 　3

24. What is obsessive-compulsive disorder ? How is it different from borderline personality disorder ? What are the two most common obsessions that affect adolescents ? 　3

25. What is human leucocyte antigen complex ? Explain its role in organ transplantation. 　3

SECTION - D

26. Why do C_4 plants have dimorphic chloroplasts ? Explain the different steps involved in C_4 photosynthetic carbon cycle in such plants. 　5

OR

Explain the electron transport system. Where does it occur in a mitochondrion and what is the role of oxygen in it ? 　5

27. Explain the events that occur in the human heart during ventricular systole and ventricular diastole in a cardiac cycle. Name the heart sounds and mention how they are produced. 　5

OR

What is oxygen-haemoglobin dissociation curve ? Describe the role of red blood cells in the transport of oxygen and carbon dioxide by blood. 　5

28. Briefly explain the principle, procedure and the role of ELISA. 　5

OR

What is somatic hybridisation ? Explain the various steps involved in the process. Mention any two uses of somatic hybridisation. 　5

QUESTION PAPER CODE 57/1

SECTION A

1. What is diphyodont ? 　1

2. Name a plant hormone that controls apical dominance and a plant hormone that reduces it. 　1

3. Name the dominant producers in a deep aquatic ecosystem. What other name could you give to a primary consumer ? 　1

4. Expand EEG. Give one use of this technique. 1

5. What are the two kinds of forces involving water molecules that allow water to travel upward in plants ? 1

SECTION B

6. What is chemosynthesis ? Name a chemosynthetic organism. 2

OR

In what form do plants absorb zinc from the soil ? List any two zinc deficiency symptoms in plants.

7. What is pregnancy hormone ? Why is it so called ? Name two sources of this hormone in a human female. 2

8. What does the term genetic diversity refer to ? What is the significance of large genetic diversity in a population ? 2

9. Name and explain the type of barrier of innate immunity where some cells release interferons when infected. 2

10. Why is conversion of pyruvic acid to acetyl CoA called oxidative decarboxylation? Where does it occur in a cell ? 2

11. How are ephemeral plants adapted to withstand hot and dry environment ? Explain. 2

12. One bean plant is illuminated with green light and another bean plant similar in all respects (size and leaf area etc.) is illuminated with blue light. In which plant will the rate of photosynthesis be higher and in which will it be lower, if all other conditions are identical ? Give reasons. 2

13. A patient was complaining of frequent urination, excessive thirst and dehydration. His fasting glucose level was found to be normal. Name the disease and explain its cause. 2

14. Your friend was diagnosed to be suffering from depression. Write any two symptoms that led to this diagnosis. What is its cause ? 2

15. Draw a diagram of L.S. of an anatropous ovule of an Angiosperm and label the following parts : 2

(i) Nucellus

(ii) Integument

(iii) Antipodal cell

(iv) Secondary nucleus

SECTION C

16. Where does cardiac impulse originate in human heart ? How does it spread throughout the ventricular wall ?   3

OR

Name the muscles involved in inhalation in humans. Explain the mechanism which leads to the increase in the volume of the thorax during inhalation.

17. What is the ozone shield and why is it important ? Name the gases that cause stratospheric ozone depletion.   3

18. What is agroforestry ? How do shifting cultivation and taungya system of cultivation contribute to it ? What is the difference between these two systems ?   3

19. What is autopolyploidy ? How does colchicine induce polyploidy ? Name an autopolyploid that has succeeded as a variety.   3

20. What is cross-linking theory of ageing ? How does non-enzymatic glycosylation make senescence faster ? Explain.   3

21. Explain how 'nastic' movements differ from 'tropic' movements. Name the kind of movement seen in growing pollen tube in a flower.   3

22. Explain the symplast pathway in plants. How is apoplast pathway different from symplast pathway ?   3

23. Explain what role does vitamin A play in promoting normal vision in humans. What would happen if a child is on vitamin A deficient diet ?   3

24. What are the two factors that influence glomerulus filtration ? Explain how they do so. What is the average glomerular filtration rate in human kidneys ?   3

25. What are biopesticides ? Give the scientific name and the use of the first commercially used biopesticide in the world.   3

SECTION - D

26. Where does Calvin cycle occur in a chloroplast ? Give a schematic representation of the cycle.   5

OR

Explain the electron transport system. Where does it occur in a mitochondrion and what is the role of oxygen in it ?

27. Explain the mechanism of muscle contraction by sliding filament theory.   5

OR

What is a synapse ? How is the nerve impulse transmitted across a chemical synapse ? Explain.

28. (i) What is electroencephalography ? Describe two important applications of this technique.

(ii) Explain how a simplest type of ECG monitor is used to take an ECG of a human heart.   5

OR

(i) Where are B-cells and T-cells produced in the human body ? How do they differ from each other ? Mention any two differences.

(ii) Name any three classes of immunoglobulins in humans. Write one function of each.

Marking Scheme — Biology

General Instructions :

The Marking Scheme and mechanics of marking

1. In the marking scheme the marking points are separated by commas, one oblique line (/) indicates acceptable alternative, two obliques (//) indicate complete acceptable alternative set of marking points.

2. Any words/phrases given within brackets do not have marks.

3. Ignore spelling mistakes unless the misspelt word has another biological meaning. Ignore plurals unless otherwise stated in the marking scheme.

4. In any question exclusively on diagram no marks on any description. But in questions on descriptions, same value points may be marked on the diagrams as a subsitute.

5. All awarded marks are to be written in the left hand margin at the end of the question or its part.

6. Place a tick ( ) in red directly on the key/operative term or idea provided it is in correct context. Place "Half-tick" ½ wherever there is ½ mark in the marking scheme. (Do not place tick indiscriminately just to show that you have read the answer).

7. If no marks are awarded to any part or question put a cross (×) at incorrect value portion and mark it zero (in words only).

8. Add up ticks or the half ticks for a part of the question, do the calculation if any, and write the part total or the question total in the left hand margin.

9. Add part totals of the question and write the question total at the end. Count all the ticks for the entire question as a recheck and draw a circle around the question total to confirm correct addition.

10. If parts have been attempted at different places do the totalling at the end of the part attempted last.

11. If any extra part is attempted or any question is reattempted, score out the last one and write "extra".

12. In questions where only a certain number of items are asked evaluate only that many numbers in sequence as is asked ignoring all the extra ones even if otherwise correct.

13. Transcribe the marks on the cover page. Add up question totals. Recheck the script total by adding up circled marks in the script.

14. Points/answer given in brackets in marking scheme are not so important and may be ignored for marking.

EXPECTED ANSWERS/VALUE POINTS

SECTION A

Q.Nos. 1 - 5 are to be answered in one word or one sentence each.

1. Epiglottis prevents the entry of food into trachea / lungs. = 1   [1 mark]

2. Decreases (liver glycogen). = 1   [1 mark]

3. Apomixis / Agamospermy / Parthenogenesis. = 1   [1 mark]

4. The ecological niche (of an organism) signifies the range of conditions it can tolerate , the resources it utilises , and its functional role in the ecological system.
   (any two) = ½ + ½ = 1   [1 mark]

5. AIDS / Acquired immuno deficiency syndrome ,
   HIV / Human immuno deficiency virus. = ½ + ½ = 1   [1 mark]

SECTION B

Q.Nos. 6 - 15 are to be answered in approximately 20-30 words each.

6. Located on the (radial walls of) endodermis of root , Suberin , = ½ + ½ = 1
   Function - It blocks water and solute movement through the cell wall of the endodermis. = 1
   (If only water or solute given then ½ mark)   [1 +1 = 2 marks]

   OR

   Respiratory Quotient (RQ): The ratio of the volume of carbon dioxide liberated to the volume of oxygen consumed in respiration , = 1
   RQ is one when substrate is carbohydrate , on complete oxidation. = ½ + ½ = 1
        [1 +1 = 2 marks]

7. The resting membrane potential (of the axon) of a neuron is the potential difference between inside and outside the axon when it is "resting" i.e. not actively conducting impulses , = 1
   Each Na^+ - K^+ transport pump expels three Na^+ ions for every two K^+ ions imported. = 1
        [1 + 1 = 2 marks]

8.
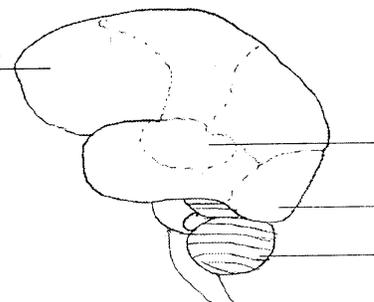
Frontal lobe = (½)
Temporal lobe = (½)
Occipital lobe = (½)
Cerebellum = (½)

Correct diagram with correct labelling $= ½ \times 4 = 2$

(No Marks without labelling) [$½ \times 4 = 2$ marks]

9. Its synthesis is stimulated by the (pituitary) hormone prolactin , $= ½$

Its release is stimulated by a rise in the level of oxytocin when the baby begins nursing , $= ½$

Milk contains an inhibitory peptide , $= ½$

If the breasts are not emptied the peptide accumulates and inhibits milk production. $= ½$

[$½ \times 4 = 2$ marks]

10. Shoot and root regenerations are generally controlled by auxin-cytokinin balance. $= 1$

Usually an excess of auxin promotes root regeneration , whereas that of cytokinin promotes shoot regeneration. $= ½ + ½ = 1$

[$1 + 1 = 2$ marks]

11. **S-shaped growth curve:** There is initial gradual increase in population size followed by an exponential increase and then a gradual decline to a near-constant level , $= 1$

J-shaped growth curve: The population grows exponentially and after attaining the peak value the population abruptly crash , $= ½$

Due to environmental resistance / environment is ever changing / food and space are limited / end of season. $= ½$

[$1 + ½ + ½ = 2$ marks]

12. The secondary productivity indicates the rate at which food energy is assimilated at the trophic level of consumers , $= 1$

Light , oxygen , temperature , nitrogen. (any two) $= ½ + ½ = 1$

[$1 + ½ + ½ = 2$ marks]

13. A virus enter through wounds / vector , $= ½$

Viruses ultimately reach Phloem , and are then transported to long distances within the plant $= ½$

Spread of viruses:
(i) through vegetative propagules
(ii) mechanical, through sap of infected plants
(iii) through seed
(iv) through pollen
(v) by insect vectors
(vi) by mites / nematodes & fungi

(any two) $= ½ + ½ = 1$ [$½ + ½ + ½ + ½ = 2$ marks]

14. Calcium ions / Ca^{2+}, = 1

Symptoms: Stunted growth , necrosis of young meristematic regions (such as root tips or young leaves). = ½ + ½ = 1

[1 + ½ + ½ = 2 marks]

15. Vernalisation is a method of inducing (early) flowering by pre-treatment of seeds with a certain (1^0 C to 10^0 C) low temperature , = 1

Accelerates growth of seedlings, results in early flowering (in some specific plants). = ½ + ½ = 1

[1 + ½ + ½ = 2 marks]

SECTION C

Q.Nos. 16 - 25 are to be answered in approximately 30-50 words each.

16. Capillarity refers to rise of water in , narrow / thin xylem vessels in a plant , due to forces of adhesion , and cohesion = ½ × 4 = 2

No, = ½

Force of gravity acts against the capillary action / Capillarity. = ½

[2 + ½ + ½ = 3 marks]

17. **Symbiotic nitrogen fixation :** The nitrogen fixation which occurs in plants (leguminous) in association with a nitrogen fixing microorganism (bacteria / cyanobacteria) = 1

Components needed :

(i) Enzyme Nitrogenase, convert atmospheric N_2 to NH_3 = ½ + ½ = 1

(ii) Leghaemoglobin , Oxygen scavenger = ½ + ½ = 1

[1 + 1 + 1 = 3 marks]

OR

Parasitic , saprophytic , symbiotic and insectivorous. (any three or four) = 1

(any one or two) = ½

Parasitic - In this type of nutrition plants obtain all or part of their food from living tissues of another plant (host) with which they maintain physical contact = ½

Example. Parasitic phanerogams like *Cuscuta* / any other relevant example = ½

Saprophytic - In this type of nutrition organisms grow on decaying animal or vegetal matter and absorb the organic food from it = ½

Example. Monotropa / fungi like *Agaricus* / bacteria like *Bacillus vulgaris* = ½

Symbiotic - In this type of nutrition organisms live in close physical association and are of mutual benefit to each other = ½

Example. Lichen / *Mycorrhiza* = ½

Insectivorous - In this type of nutrition there are some green plants , which obtain their nourishment partly from the soil and atmosphere and partly by catching and digesting small insects $= \frac{1}{2}$

Example. *Drosera / Utricularia / Nepenthes* $= \frac{1}{2}$

(any two modes + its example) $= 1 + 1 = 2$

[1 + 2 = 3 marks]

18. **Biological magnification:** The phenomenon through which certain pollutants get accumulated in tissues in increasing concentrations , along the food chain $= \frac{1}{2} + \frac{1}{2} = 1$

    DDT concentration increases in the phytoplankton relative to the concentration in water, zooplankton contained greater DDT than phytoplankton , in different fish the DDT concentration increased relative to the concentration in zooplankton, birds showed greater DDT concentration relative to that in fish. $= \frac{1}{2} \times 4 = 2$

    [1 + 2 = 3 marks]

19. **Exotic species:** A species which is not native to the region in which it occurs ,$= 1$
    (i)   Nile perch an exotic predatory fish introduced into lake Victoria (South Africa) threatens the entire ecosystem of the lake by eliminating several native species of the small cichlid fish species ,
    (ii) Introduction of water hyacinth has threatened the survival of many aquatic species in lakes and rivers, as this plant multiplies very fast and clogs the water bodies ,
    (iii) *Lantana camara* has invaded forestlands in many parts of India and it competes strongly with the native species.
    (any two) $= 1 + 1 = 2$

    [1 + 2 = 3 marks]

20. **Birds :** Uric acid , because they have very limited access to water , $= \frac{1}{2} + \frac{1}{2} = 1$

    Humans : Urea , because they get as much water as is required for the elimination of urea, $= \frac{1}{2} + \frac{1}{2} = 1$

    Aquatic turtles: Both urea and ammonia , because they live in water and get as much water as is required for the elimination of urea and ammonia. $= \frac{1}{2} + \frac{1}{2} = 1$

    [1 + 1 + 1 = 3 marks]

21. Diabetes insipidus , $= 1$

    (Only Diabetes $=$ no mark)

    Due to deficiency of Vasopressin / ADH / Antidiuretic hormone , $= 1$

    Less reabsorption of water in the kidneys / DCT / CT ,$= \frac{1}{2}$

    More loss of water $= \frac{1}{2}$

    [1 + 1 + ½ + ½ = 3 marks]

22. (i) **Morphallaxis:** It is re-patterning or remodelling of existing tissues and the reestablishment of boundaries. This type of regeneration involves little new growth and the regenerated individual initially becomes very tiny , $= \frac{1}{2}$

Example. Fragments of *Hydra* develop units of full-grown *Hydra* , $= \frac{1}{2}$

(ii) **Epimorphosis:** It involves dedifferentiation of adult structures in order to form an undifferentiated mass of cells. These cells are highly proliferating , $= \frac{1}{2}$

Example. Regeneration of a lost limb in *Salamander* (amphibian) , $= \frac{1}{2}$

(iii) **Compensatory regeneration:** The cells divide but do not form an undifferentiated mass of cells or tissues ; they produce cells similar to themselves and maintain their differentiated functions. $= \frac{1}{2}$

Example. The regeneration of mammalian liver or kidney. $= \frac{1}{2}$

$$[\frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} = 3 \text{ marks}]$$

23. **Polygonum type embryo sac:** Embryo sac in angiosperms is generally eight nucleate structure (seven - celled structure). Out of the eight nuclei formed by three successive divisions of the functional megaspore three get organised at the micropylar end as egg apparatus , three at the chalazal end as antipodals , and two at the centre as polar nuclei or secondary nucleus (2n) , The egg apparatus consists of two synergids and an egg cell (This is monosporic type of development generally refered to as the polygonum type). $= \frac{1}{2} \times 4 = 2$

Only one megaspore of the tetrad becomes functional / viable that develops into the embryo sac. $= 1$

$$[2 + 1 = 3 \text{ marks}]$$

24. **Obsessive-compulsive disorder:** Affected persons show irresistible obsessions and compulsions, They are compelled to perform an action or an idea despite their own attempt to resist it (compulsion). $= \frac{1}{2} + \frac{1}{2} = 1$

Borderline personality disorder: This is an emotionally unstable personality disorder, which is characterised by impulsivity / unpredictable moods / outbursts of emotion / behavioural explosions / quarrelsome behaviour / and conflicts with others. $= \frac{1}{2} + \frac{1}{2} = 1$

The familiar obsessions are violence , worry about infection by germs or dirt. $= \frac{1}{2} + \frac{1}{2} = 1$

$$[1 + 1 + 1 = 3 \text{ marks}]$$

25. **Human leukocyte antigen complex:** General name of group of genes in the human major histocompatibility complex region on human chromosome 6 , the products of these genes determine histocompatibility / compatibility between donor and recipient tissues in organ transplants. $= 1 + 1 = 2$

The success of organ transplant depends on proper matching of histocompatibility antigens (that occur on all cells of the body) of the donor and the recipient. = 1

[2 + 1 = 3 marks]

SECTION D

Q.Nos. 26 - 28 are to be answered in approximately 80-120 words each.

26. The presence of two types of cells allows the occurence of light reactions and carbon reactions separately in each type / the release of O_2 takes place in the mesophyll while the CO_2 fixation catalysed by Rubisco occurs in the bundle sheath cells = 1

C_4 Carbon-cycle - Fixation of carbon dioxide into C_4 acid / oxalic acid , in mesophyll cells , transport of C_4 acid from mesophyll to bundle sheath cells , decarboxylation of C_4 acid in bundle sheath cells , increased concentration of CO_2 in bundle sheath , transport of C_3 acid to mesophyll cells , with regeneration of initial CO_2 acceptor , refixing of CO_2 through Calvin cycle to synthesis glucose. $= \frac{1}{2} \times 8 = 4$

(Diagrammatic representation may be accepted in lieu of the explanation)
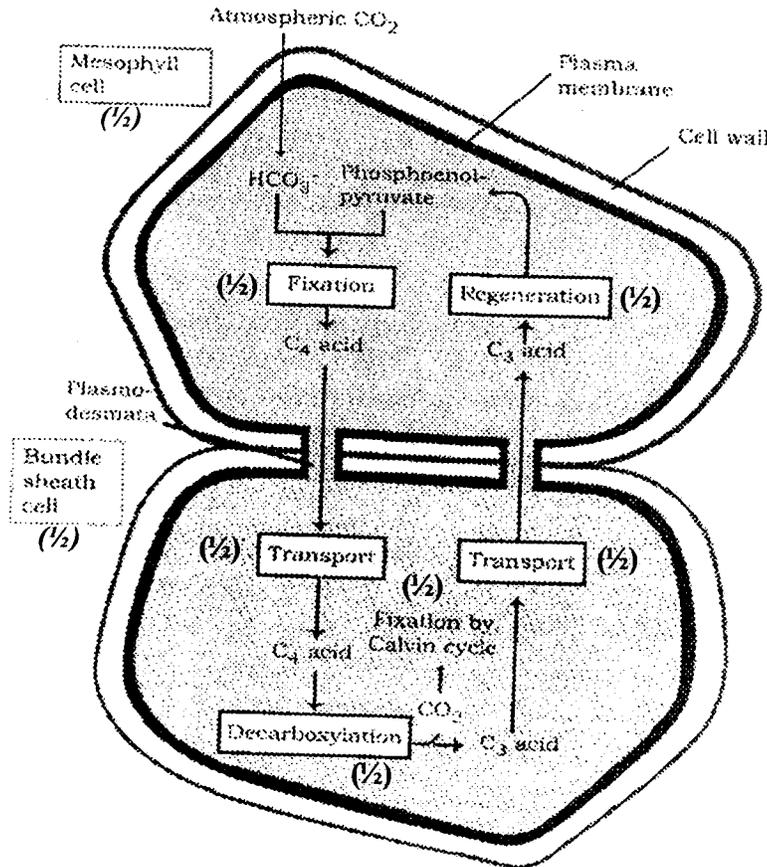
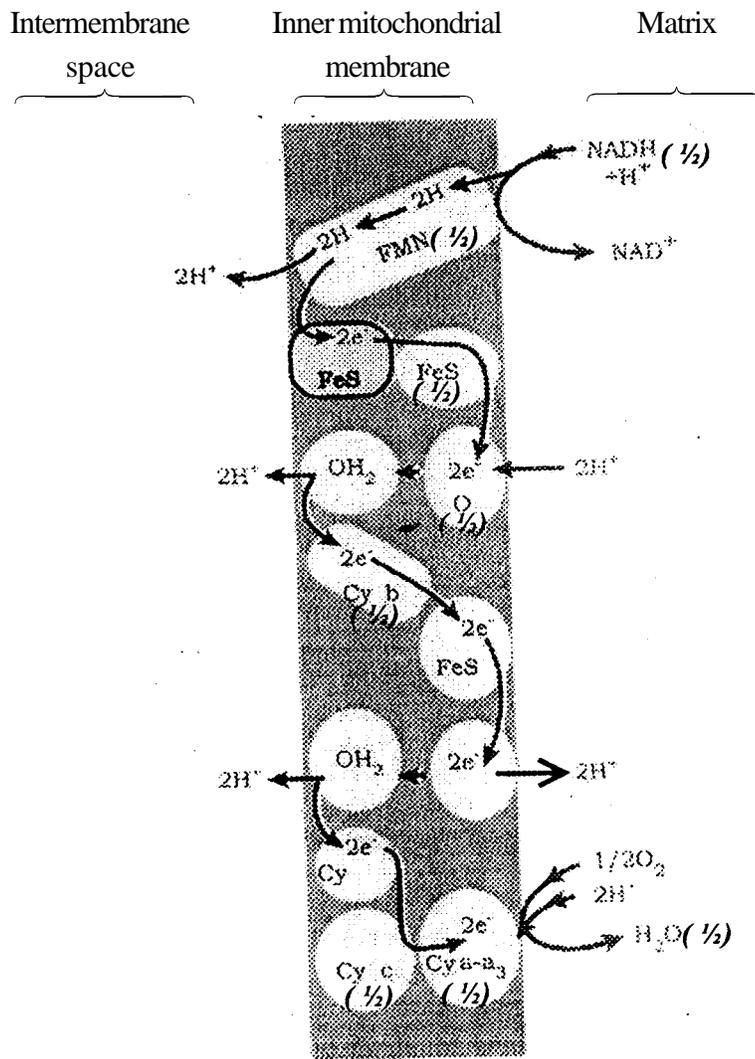$= \frac{1}{2} \times 8 = 4$

[1 + 4 = 5 marks]

OR

The electron transport chain includes (several) cytochromes , iron-sulphur proteins, and a ubiquinone , the chain starts with a flow of electrons from NADH (moving on to) FMN (NADH dehydrogenase), which in turn flows to FeS - protein, this moves on to ubiquinone which receives reducing equivalents via $FADH_2$ (generated during oxidation of succinate by enzyme succinate dehydrogenase) , the reduced ubiquinone (ubiquinol) is then oxidised with the transfer of electrons to cytochrome bc_1 complex , from here the electrons move on to Cyt a-a_3 (two copper centres) , $= ½ \times 8 = 4$

(Diagrammatic representation may be accepted in lieu of the explanation)

$= ½ \times 8 = 4$

Inner mitochondrial membrane , $= ½$

Role of oxygen: Oxygen acts as the final hydrogen / electron acceptor. $= ½$

$[4 + ½ + ½ = 5$ marks$]$

27. **Ventricular systole:** Both the AV valves closed , (Rise in ventricular pressure) semilunar valves open , blood pumped into respective major arteries, $= \frac{1}{2} \times 3 = 1\frac{1}{2}$

Ventricular diastole: (Fall in ventricular pressure) semilunar valves close to prevent back flow of blood from aortas , both AV valves open , flow of blood from both atria to respective ventricles , $= \frac{1}{2} \times 3 = 1\frac{1}{2}$

The first sound lubb is created by the closure of the atrioventricular valves , immediately after the start of the ventricular systole , The second sound dup / dubb is created by the closure of the semilunar valve , at the end of the ventricular systole. $= \frac{1}{2} \times 4 = 2$

$[\ 1\frac{1}{2} + 1\frac{1}{2} + 2 = 5 \ marks]$

OR

Oxygen-haemoglobin dissociation curve: It is a curve that shows the relationship between the partial pressure of oxygen (horizontal axis) and the percent oxygen saturation of haemoglobin (vertical axis). $= \frac{1}{2}$

Role of red blood cells: Oxygen diffuses into red blood cells and , combines loosely with the Fe^{2+} ions of haemoglobin to form oxyhaemoglobin. (Each of four Fe^{2+} ions in the haemoglobin molecule can bind with one molecule of oxygen ; so, oxyhaemoglobin carries 1 to 4 molecules of oxygen according to its degree of saturation with oxygen) $= 1 + 1 = 2$

Carbon dioxide reacts with water to form carbonic acid (H_2CO_3) , the enzyme carbonic anhydrase found in the erthrocytes catalyses this reaction.

Instantaneously after its formation carbonic acid dissociates into Hydrogen (H^+) and bicarbonate (HCO) ions,

The most of bicarbonate ions (HCO) formed within the erythrocytes diffuse out into the plasma along a concentration gradient. (H^+ combine with haemoglobin to form the haemoglobinic acid (H.Hb). In response , chloride ions (Cl^-) diffuse from plasma into the erythrocytes to maintain the ionic balance) , it is also transported in the form of carbamino haemoglobin. $= \frac{1}{2} \times 5 = 2\frac{1}{2}$

$[\ \frac{1}{2} + 2 + 2\frac{1}{2} \ = 5 \ marks]$

28. The sample containing the suspected antigen is immobilised on an ELISA plate , the antibody specific to the antigen is added and allowed to react with the immobilsed antigen in the sample , the unreacted antibody molecules are washed off , an anti-immunoglobulin is added and allowed to react with the antibody bound to the antigen , the anti-antibody is linked to an appropriate enzyme (e.g. peroxidase) , the unreacted anti-antibody is washed away , and the substrate for the enzyme is added along with the other required reagents , the activity of the enzyme yields a coloured product and the intensity of the colour is directly proportional to the quantity of antigen (It is a very rapid assay and can detect antigens in nanograms).$= \frac{1}{2} \times 8 = 4$

ELISA usually detects infection by HIV / STD / Hepatitis - B $= 1$

$[4 + 1 = 5 \ marks]$

Somatic hybridisation: The process of producting somatic hybrids is known as somatic hybridisation = 1.

Steps involved:

The first step in somatic hybridisation is the removal of cell wall, by digestion with a combination of pectinase and cellulase, (these enzymes attack the chemical constituents of the primary wall and middle lamella) the plant cells lacking cell wall are called protoplasts, fusion between protoplasts of the selected parents , is induced by a solution of polyethylene glycol (PEG) / by a very brief high voltage electric current , and form a somatic hybrid cell. (When the somatic hybrids are cultured on a suitable medium they regenerate cell walls and begin to divide to finally produce plantlets). $= \frac{1}{2} \times 6 = 3$

(OR diagrammatic representation may be accepted in lieu of the explanation)
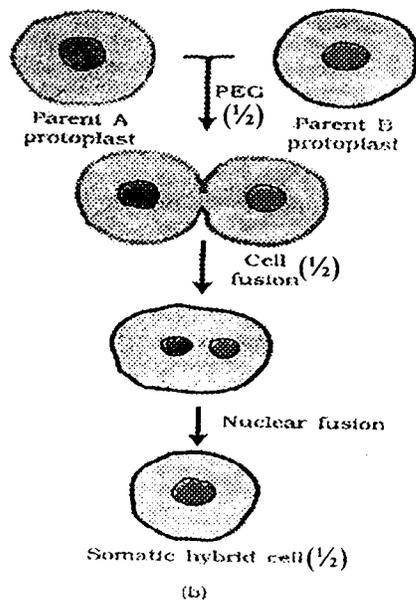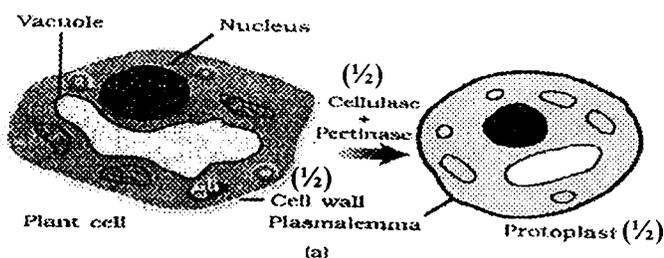
$= \frac{1}{2} \times 6 = 3$

Usefulness of somatic hybridisation:

Somatic hybridisation allows the production of hybrids between lines and species that cannot be produced normally by means of sexual hybridisation ,

Somatic hybrids may be used for gene transfer / transfer of cytoplasm / production of useful allopolyploids. $= \frac{1}{2} + \frac{1}{2} = 1.$

[1 + 3 + 1 = 5 marks]

QUESTION PAPER CODE 57/1

EXPECTED ANSWERS/VALUE POINTS

SECTION A

Q.Nos. 1 - 5 are to be answered in one word or one sentence each.

1.   A type of dentition (found in most mammals) in which a set of deciduous teeth /
      milk teeth is shed and replaced by a second set / permanent teeth. = 1   [1 mark]

2.   Auxin / IAA / IBA , Cytokinin. = ½ + ½ = 1   [1 mark]

3.   Phytoplanktons , Herbivore. = ½ + ½ = 1   [1 mark]

4.   Electroencephalogram , maps regions of abnormal brain activity associated with
      tumours / trauma / hematomas / epilepsy / seizure disorders / periods of
      unconsciousness / confusion. = ½ + ½ = 1   [1 mark]

5.   Adhesion , cohesion. = ½ + ½ = 1   [1 mark]

SECTION B

Q.Nos. 6 - 15 are to be answered in approximately 20-30 words each.

6.   The process of carbohydrate synthesis in which the organisms use chemical reactions
      to obtain energy from inorganic compounds = 1

      Nitrosomonas / Nitrobacter / Sulphur bacteria / Iron bacteria / Hydrogen
      bacteria = 1

                                                                     [1 + 1 = 2 marks]

OR

      Zn^{2+} / Zinc ion = 1
      Deficiency symptoms - malformed leaves / inter-veinal chlorosis in leaves /
      stunted growth / reduction in size of internodes / consequent rosette type of growth
      (any two) = 1

                                                                     [1 + 1 = 2 marks]

7.   Progestrone = ½
      It is required continually during the entire period of gestation or pregnancy. It is
      therefore called pregnancy hormone = ½
      Placenta = ½
      Ovary / Corpus luteum = ½

                                                           [½ + ½ + ½ + ½ = 2 marks]

8.   Genetic diversity refers to the variation of genes within species = 1
      The genetic diversity enables a population to adapt to its environment / to respond
      to natural selection = 1

                                                                     [1 + 1 = 2 marks]

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9.   Physiological Barrier = 1

Factors like body temperature , pH and diverse body secretions , check growth of many pathogenic micro organisms. For example , fever response inhibits growth of numerous pathogens. The acid in the stomach kills many bacteria that come in with the food and from the breathing tract. Lysozyme present in secretions , such as tears , catalyses the hydrolysis of molecules in the cell walls of bacteria , and interferon induces antiviral state in non-infected cells.

(any one explained) = ½ + ½ = 1   [1 + 1 = 2 marks]

10.   Because pyruvate is first decarboxylated , and then oxidised by the enzyme (pyruvate dehydrogenase) = 1

It occurs in the mitochondria = 1

                                               [1 + 1 = 2 marks]

11.   They complete their life cycle quickly during the rainy season , and survive in the form of seeds in the following dry season = 1 + 1 = 2   [2 marks]

12.   The plant under the blue light will carry on photosynthesis at a greater rate , than the one under the green light = ½ + ½ = 1

Blue light is absorbed by chlorophyll , green light is reflected = ½ + ½ = 1

                                               [1 + 1 = 2 marks]

13.   Diabetes insipidus = 1 (only Diabetes No marks)

It is due to the deficiency of vasopressin / ADH / Antidiuretic hormone , which regulates the absorption of water in the kidneys / DCT / CT = ½ + ½ = 1

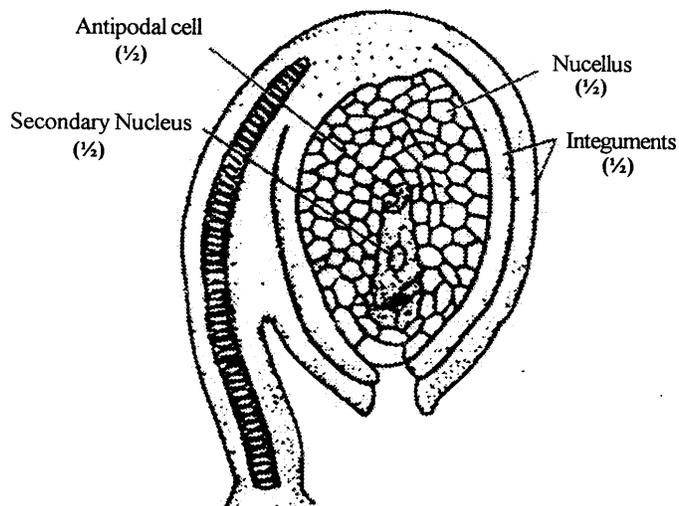   [1 + 1 = 2 marks]

14.   Symptoms: Low spirit / hopelessness / low self esteem / decline in interest / lack of sleep / lack of appetite (any two) = ½ + ½ = 1

The cause may be failure in examination / a death in the family / losing a job / any other suitable example (any one) = 1

                                               [1 + 1 = 2 marks]

15.

                                              = ½ × 4

                                                [2 marks]

SECTION C

Q.Nos. 16 - 25 are to be answered in approximately 30-50 words each.

16. Cardiac impulse originates from the sinoatrial node (SA node) = 1

    The cardiac impulse first reaches the atrioventricular or AV node = ½

    Then passes along the AV bundle , and its branches to reach the Purkinje fibres in the ventricles = ½ + ½ = 1

    The Purkinje fibres conduct the impulse to the ventricular muscle fibres to cause their contraction = ½

    [1 + ½ + 1 + ½ = 3 marks]

    OR

    (External) Intercostal muscles , diaphragm = ½ + ½ = 1

    Inhalation happens when the intercostal muscles contract and pull the ribcage upwards and outwards. At the same time the diaphragm contracts and flattens , pushing down the abdominal organs. = 1 + 1 = 2

    [1 + 2 = 3 marks]

17. The ozone shield is defined as (a chemically distinct) region within the stratosphere, that protects the earth's surface from the Sun's harmful ultraviolet radiation = 1 + 1 = 2

    CFCs / chloroflorocarbon , CH_4 / methane, N_2O / nitrous oxide (any two) = ½ + ½ = 1

    [2 + 1 = 3 marks]

18. Agroforestry (includes a variety of land uses where) woody species grown in combination with herbaceous crops (in same time or in different time sequence) = 1

    Shifting cultivation: The system in which a small area of the forest is cleared (by burning and felling) cultivated for 1-5 years and then abandoned as soil fertility and crop yield fall and weeds encroach = ½

    Taungya system: Involves growing agricultural crops between rows of planted trees (sal teak) = ½

    In shifting cultivation the forest area is cleared = ½
    In taungya the forest area is maintained = ½

    [1 + ½ + ½ + ½ + ½ = 3 marks]

19. The presence of more than two (diploidy) of the monoploid chromosome sets / genomes characteristic of the species is generally refered to as autopolyploidy = 1

    Colchicine prevents the formation of spindle apparatus during mitosis. As a result, there is no anaphase movement of the chromatids , and all the chromatids of a dividing cell become included in the same nucleus = ½ × 3 = 1½

    An autotriploid variety of tea. = ½

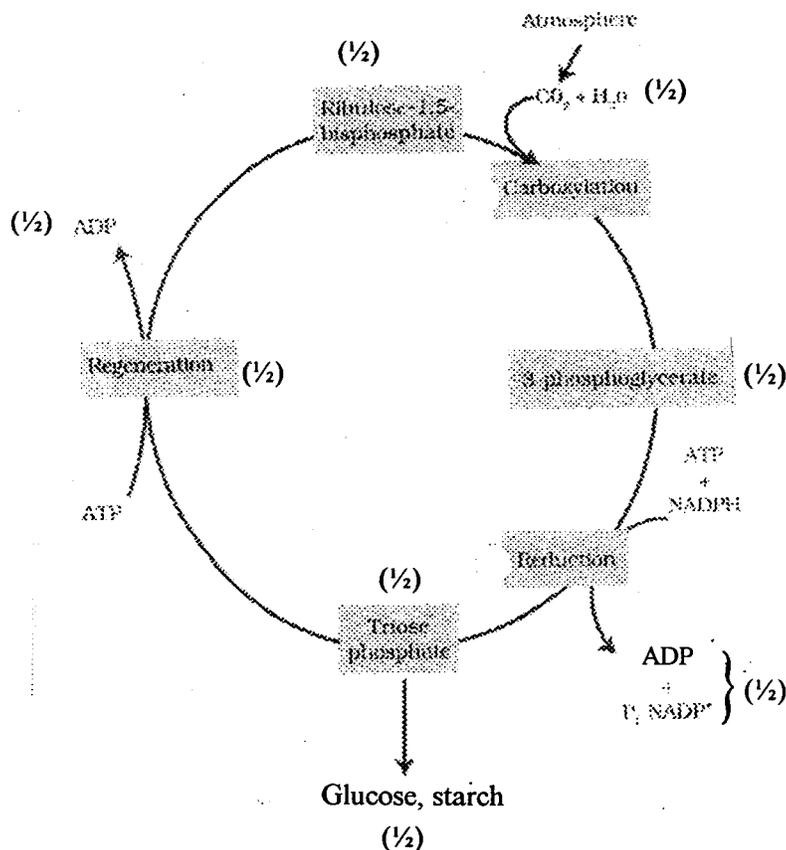   [1 + 1½ + ½ = 3 marks]

20. **Crosslinking theory:** This theory postulates that an accumulation of crosslinked proteins damages cells and tissues (slowing down bodily processes and results in ageing) = 1

Non-enzymatic glycosylation: Glucose molecules attach themselves to proteins without the assistance of an enzyme , and initiate a chain of reactions that ends in proteins binding together or crosslinking , in consequence changing their biological and structural roles , appear to toughen tissues and may cause some of the deterioration associated with ageing. $= ½ + ½ + ½ + ½ = 2$

[1 + 2 = 3 marks]

21. **Nastic movements:** When curvature is produced by diffused stimuli , and affects the whole plant uniformly $= ½ + ½ = 1$

Tropic movements: When curvature is produced by directive stimuli , and does not affect the whole plant $= ½ + ½ = 1$

Chemotropism = 1

[1 + 1 + 1 = 3 marks]

22. The symplastic movement occurs from cell to cell through the plasmodesmata = 1

The apoplastic pathway occurs exclusively through the cell wall without crossing any membranes , while the symplastic pathway occurs from cell to cell through the plasmodesmata = 1 + 1 = 2

[1+ 2 = 3 marks]

23. Vitamin A forms the retinal pigments $= ½$ // such as rhodopsin of rod cells , and iodopsin of cone cells of the retina = 1 + 1 = 2

Vitamin A deficiency can lead to blindness / Night blindness / Xerophthalmia (any one) = 1

[2 + 1 = 3 marks]

24. Glomerulus filtration depends on two key factors:

    (i)   the net hydrostatic pressure difference between the lumen of the capillary and the lumen of the Bowman's capsule and

    (ii) the colloidal osmotic pressure of plasma $= ½ + ½ = 1$

    The former favours filtration , and the latter opposes it $= ½ + ½ = 1$

    The glomerular filtration rate (GFR) is about 125-ml per minute / 125 ml min^{-1} =1

[1 + 1 + 1 = 3 marks]

25. Biopesticides are those biological agents that are used for control of weeds / insects / pathogens = 1

Bacillus thuringiensis = 1

(It produces insecticidal Cry protein). Spores of this bacterium kill larvae of certain insects = 1

[1 + 1 + 1 = 3 marks]

SECTION D

Q.Nos. 26 - 28 are to be answered in approximately 80-120 words each.

26.   In stroma = 1

Atmosphere

(½)

Ribulose-1,5-bisphosphate

$CO_2 + H_2O$ (½)

Carboxylation

(½)   ADP

Regeneration   (½)

3-phosphoglycerate   (½)

ATP + NADPH

ATP

Reduction

(½)

Triose phosphate

ADP + Pi NADP⁺ } (½)

Glucose, starch

(½)

$[1 + 4 = 5 \text{ marks}]$

OR

The electron transport chain includes (several) cytochromes , iron-sulphur proteins, and a ubiquinone , the chain starts with a flow of electrons from NADH $\rightarrow$ (moving on to) FMN (NADH dehydrogenase) , which in turn flows to FeS - protein , this moves on to ubiquinone through the activity of enzyme succinate dehydrogenase , the reduced ubiquinone (ubiquinol) is then oxidised with the transfer of electrons to cytochrome bc_1 complex , from here the electrons move on to Cyt $a-a_3$ (two copper centres) , $= ½ \times 8 = 4$

inner mitochondrial membrane , $= ½$

Role of oxygen: Oxygen acts as the final hydrogen / electron acceptor. $= ½$

$[4 + ½ + ½ = 5 \text{ marks}]$

27.   During contraction, the actin and myosin filaments slide past each other to reduce the length of the sarcomeres $= ½$

The actin filaments move inwards towards the centre of the sarcomere , i.e., deeper into the A-bands $= ½$

The heads of the myosin filaments operate as 'hooks' ; attaching to the F-actin they form cross-bridges , then change their relative configuration , and pull the actin filaments further deep into the A-band $= \frac{1}{2} \times 4 = 2$

As a result the Z-lines limiting the sarcomeres , are drawn closer together. But the length of the A-band remains unchanged $= \frac{1}{2} + \frac{1}{2} = 1$

Actually the I-bands reduce in length. However the net result is the shortening of the sarcomere $= \frac{1}{2}$

The actin filaments slide out from the A-band , resulting in the lengthening of the sarcomere $= \frac{1}{2}$

$$[\tfrac{1}{2} + \tfrac{1}{2} + 2 + 1 + \tfrac{1}{2} + \tfrac{1}{2} = 5 \text{ marks}]$$

OR

A synapse is a junction between axon terminal of one neuron and dendrite of another neuron or with sites on muscle or secretory cells, a narrow intercellular gap separating the axon tip and the target cell called a synaptic cleft $= \frac{1}{2} + \frac{1}{2} = 1$

Chemical synapse consist of a bulbous expansion of a nerve terminal called synaptic knob which contains numerous tiny round sacs called synaptic vesicles, each vesicle contains neurotransmitter substance responsible for the transmission of nerve impulse across the synapse $= \frac{1}{2} + \frac{1}{2} = 1$

A wave of depolarisation reaches the presynaptic membrane & voltage-gated calcium channels concentrated at the synapse open & Ca^{2+} ions then diffuse into the terminal from the surrounding fluid & Ca^{2+} ions stimulate synaptic vesicles in the terminal to move to the terminal membrane , fuse with it and then rupture thereby of neurotransmitter chemicals from vesicles at the tip by exocytosis into the cleft $= \frac{1}{2} + \frac{1}{2} = 1$

These neurotransmitters rapidly pass to the other side of the gap & then combine with specific receptor molecules on the membrane of the target cell , which is called the postsynaptic membrane & they cause a second electrical current passing on its signal $= \frac{1}{2} + \frac{1}{2} = 1$

To end the signal the synaptic blobs reabsorb some neurotransmitters and enzymes in the synapse neutralise others , the nature of the messenger neurotransmitters can be different in different synapses permitting different kinds of responses either excitatory or inhibitory in nature $= \frac{1}{2} + \frac{1}{2} = 1$

$$[1 + 1 + 1 + 1 + 1 = 5 \text{ marks}]$$

28. (i) **Electroencephalography:** A technique which measures and maps transient electrical signals generated by neuronal depolarisation in the brain , and records this as an electroencephalogram (EEG) = 1

Applications:

(a) The EEG is used to map regions of abnormal brain activity associated with tumours, trauma , haematomas , epilepsy and other seizure disorders and periods of unconsciousness and confusion.

(b) This is also used in the determination of brain death. = 1 + 1 = 2

(ii) The simplest type of ECG monitor is a cardioscope = ½

Three electrodes are connected via a conductive electrolyte gel to the patient for detecting electrical signals = ½

Two of the electrodes are on the chest above the heart , and the third is a reference connection to the limbs = ½

The signal collected is amplified before being displayed on a CRT oscilloscope screen or recorded on a sensitive chart recorder = ½

[1 + 2 + ½ + ½ + ½ + ½ = 5 marks]

OR

(i) They are produced in the bone marrow = 1

Differences between B Cells & T Cells: (Any two) = 1 × 2 = 2

B Cells	T Cells
(a) B Cells mature in the bone marrow.	(a) T Cells mature in the thymus tissue.
(b) They differentiate into plasma cells that synthesise the antibodies that circulate in the blood and react with the specific antigens.	(b) They either directly attack the antigens or stimulate B Cells to produce antibodies.
(c) B Cells are responsible for the humoral response of the immune system.	(c) T Cells are responsible for cellular responses.
(d) They do not respond to organ transplant.	(d) They respond to organ tranplant.

(ii) Different classes of immunoglobulins : (any two with corresponding function) = ½ × 4 = 2

a) IgA. It assists in protection from inhaled and ingested pathogens.

(b) IgD. It is present on lymphocyte surface as receptors ; activation of B Cells.

(c) IgE. It is concerned with allergic reactions ; it binds to mast cells and can trigger inflammatory responses.

(d) IgG. It is the most abundant antibody; stimulation of phagocytes and complement system ; can cross the placenta from mother to foetus, and protects the offspring during the first few weeks after birth.

(e) IgM. It helps in activation of B cells.

*(Instead of three, any two to be evaluated)

[1 + 2 + 2 = 5 marks]