S3 MARKING GUIDE OF BIOLOGY AND HEALTH SCIENCES ,2025-2026

SECTION A:ANSWER TO ALL QUESTIONS / 55marks

CIRCLE THE LETTER OF THE BEST ANSWER/15marks

1. D
2. A
3. C
4. B
5. C
6. C
7. C
8. A
9. B
10. C
11. B
12. B
13. B
14. B
15. C
16. **MATCH COLUMN A WITH COLUMN B/5marks**

I. B
II. A
III. C
IV. E
V. D

17. **WRITE TRUE OR FALSE./5 mark**

I. False
II. True

III.False

IV.True

V.False

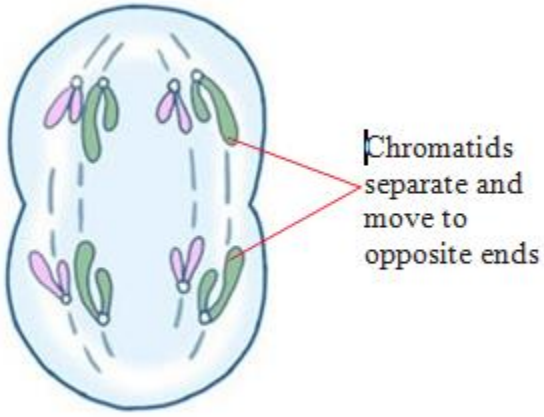
GIVE SHORT ANSWERS TO THESE QUESTIONS [30MARKS]

18.A. Anaphase description (2 marks):

During anaphase, the centromeres split and the sister chromatids are pulled apart to opposite poles of the cell by the spindle fibres (1 mark). As a result, the chromosome number at each pole doubles temporarily — each pole receives a full set of chromosomes (1 mark).

Note: Accept any two of the following points for 1 mark each: (i) centromeres split; (ii) spindle fibres shorten/pull chromatids to poles; (iii) each pole receives an equal set of chromosomes.

For drawing only,give him/her 2marks



B. Compare mitosis and meiosis by completing the table below. **/4 marks**

Feature	**Mitosis**	**Meiosis**
Number of daughter cells produced	2	4
Chromosome number in daughter cells	Full number of chromosomes is retained/Diploid (2n = 46 in humans)	The number of chromosomes is halved/Haploid (n = 23 in humans)
Type of cells produced (somatic/gametes)	Somatic (body) cells	Gametes (sex cells)

Importance	Growth, repair and asexual reproduction	Sexual reproduction; genetic variation

19.A. Balanced equation for aerobic respiration (2 marks):

$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O + ATP$ (energy)

Note: Award 1 mark for correct reactants (glucose + oxygen) and 1 mark for correct products (CO_2 + H_2O + ATP/energy). Deduct 1 mark if equation is unbalanced.

B. Two differences between aerobic and anaerobic respiration (2 marks):

- Aerobic respiration requires oxygen; anaerobic respiration does not require oxygen.
- Aerobic respiration produces much more ATP (36–38 ATP per glucose); anaerobic produces only 2 ATP per glucose.
- (Accept also) Aerobic produces CO_2 and water as final products; anaerobic in animals produces lactic acid, and in yeast produces ethanol and CO_2.

Note: Award 1 mark per correct, distinct difference. Maximum 2 marks

20.Plant Growth Responses (Tropisms) – 3 Marks

- A. Growth response shown by A (roots growing downward toward water): Hydrotropism (positive) OR Gravitropism/Geotropism (positive). [1 mark]
- B. Growth response shown by B (shoot growing upward): Negative geotropism / Negative gravitropism OR Phototropism (if growing toward light). [1 mark]
- C. Benefit to the plant of response B: The shoot grows upward towards light, which is needed for photosynthesis to produce food/energy for the plant. [1 mark]

Note: For Q20A, accept either 'hydrotropism' or 'positive geotropism/gravitropism' depending on the diagram context. For Q20B, accept 'negative geotropism' or 'phototropism'. If the student writes the correct tropism name with correct direction (positive/negative), award the mark.

21.A. Labelled diagram parts (5marks, 1 each):

A:stomach

B:small intestine(duodenum)

C:large intestine(colon)

D:small intestine(ileum)

H:coecum

Note: Accept reasonable anatomical labels consistent with the diagram position. The liver and gallbladder are visible in the diagram but not labelled A-H. Award marks based on position.

B. Identification (4 marks, 1 each):

- i. Largest gland in the body: Liver

- ii. Organ where protein digestion begins: Stomach
- iii. Organ that releases digestive juice into the small intestine: Pancreas
- iv. Organ where bile juice is stored: Gallbladder

22.Skin Diagram – 4 Marks

- A. Organ identified: Skin [1 mark]
- B. Importance of the skin: Protection against pathogens/physical damage; temperature regulation; prevention of water loss; sensory reception; synthesis of Vitamin D. [Accept any one valid function – 1 mark]

C. Named parts A, B, C, D (4 marks —1 each correct answer):

A:Sebaceous gland

B:hair

C:blood capillaries

D:adipose tissues(fat cells)

SECTION B: 30 Marks (Attempt ANY THREE Questions – 10 marks each)

23. Taenia (Tapeworm) and Alimentary Canal – 10 Marks

- A. Type of nutrition displayed by Taenia: Parasitic nutrition [1 mark]
- B. Part of alimentary canal the larvae need to reach and why: The small intestine (duodenum/jejunum), because it is the site of digestion and absorption of nutrients, which the tapeworm absorbs directly through its body wall. [2 marks: 1 for correct organ, 1 for correct reason]
- C. One danger faced by Taenia larva in its journey: Destruction by stomach acid (HCl/pepsin); or being killed by immune cells; or digestive enzymes in the mouth/oesophagus. [1 mark — accept any one valid danger]

D. Dental formula for an adult human (3 marks):

I 2/2 C 1/1 PM 2/2 M 3/3 = 16 × 2 = 32 teeth

Note: Award 1 mark for correct incisor formula, 1 mark for correct canine and premolar formula, 1 mark for correct molar formula and total. Accept written form: Incisors 2/2, Canines 1/1, Premolars 2/2, Molars 3/3.

E. Three health practices for the digestive system (3 marks, 1 each):

- Washing hands before eating and after using the toilet.
- Eating a balanced diet with adequate fibre to prevent constipation.
- Drinking clean/safe water to prevent waterborne infections.
- Avoiding eating undercooked meat (e.g., pork) to prevent parasitic infections like Taenia.
- Regular deworming.

Note: Accept any three valid digestive health practices.

24. Asexual vs Sexual Reproduction – 10 Marks

Award 1 mark per complete and correct row (feature + both correct descriptions). Minimum 5 rows required for full marks. Maximum 10 marks.

Feature	Asexual Reproduction	Sexual Reproduction
Number of parents	One	Two
Gametes involved	No	Yes (male and female gametes)
Genetic variation	No – offspring are genetically identical (clones)	Yes – offspring are genetically different
Type of cell division	Mitosis	Meiosis (for gamete formation)
Speed	Rapid	Slower
Energy required	Less energy	More energy
Adaptability	Low (less variation)	High (genetic variation increases adaptability)
Examples	Binary fission, budding, spore formation, vegetative propagation	Fertilisation in animals and plants
Organisms	Bacteria, yeast, Amoeba, Hydra, some plants	Most animals, flowering plants, fungi

25.Endangered Species and Environmental Protection – 10 Marks

A(i). Definition of endangered species (2 marks):

An endangered species is a species (plant or animal) that is at a very high risk of becoming extinct in the near future due to a dramatic decline in its population, habitat destruction, or other threats. [1 mark for definition, 1 mark for reference to extinction risk/declining population]

A(ii). Importance of protecting endangered species (2 marks):

- To maintain biodiversity and ecological balance.
- Many species have medicinal, agricultural, or economic value.

- Preventing extinction is irreversible — once lost, a species cannot be recovered.
- Endangered species are often keystone species whose loss affects entire ecosystems.

Note: Award 1 mark per valid reason, maximum 2 marks.

B. School activities for environmental protection (3 marks, 1 each):

- Tree planting / reforestation activities on school grounds.
- Waste sorting and recycling programmes.
- Environmental clubs/awareness campaigns.
- Cleaning campaigns (umuganda) around school.
- Water conservation practices.

Note: Accept any three activities relevant to school context and REB environmental education.

C. Disadvantages of environmental degradation (3 marks, 1 each):

- Loss of biodiversity and extinction of species.
- Soil erosion and loss of fertile land, reducing agricultural productivity.
- Climate change due to deforestation and increased CO2 emissions.
- Contamination of water sources, leading to waterborne diseases.
- Reduced rainfall and prolonged droughts.

26: Blood Groups and Transfusion – 10 Marks

A. Importance of determining blood types (1 mark):

To prevent transfusion reactions — mismatched blood types cause agglutination (clumping) of red blood cells, which can lead to haemolysis, organ failure, and death. [1 mark]

B. Universal donor and universal recipient (1 mark):

- Universal donor: Blood group O (negative) — can donate to all blood groups because its red blood cells lack A, B, or Rh antigens.
- Universal recipient: Blood group AB (positive) — can receive blood from all groups because they have no antibodies against A or B antigens.

Note: Award 0.5 mark each, or 1 mark if both are correctly stated.

C. Blood transfusion compatibility table (8 marks — 0.5 per correct cell):

DONOR \ RECIPIENT	A	B	AB	O
A	✓	✗	✓	✗
B	✗	✓	✓	✗
AB	✗	✗	✓	✗
O	✓	✓	✓	✓

Note: ✓ = compatible (transfusion possible); ✗ = incompatible. Key rule: Donor antigens must not match recipient antibodies. O can donate to all. AB can receive from all.

27.Digestion – 10 Marks

a. Physical vs Chemical Digestion (2 marks):

- Physical (mechanical) digestion: The breakdown of food into smaller pieces by physical means (chewing/mastication, churning in stomach) WITHOUT changing the chemical composition of the food. No enzymes involved. [1 mark]
- Chemical digestion: The breakdown of large food molecules into smaller, soluble molecules by the action of digestive enzymes. Chemical bonds are broken and new, simpler molecules are formed (e.g., starch → glucose). [1 mark]

d. Two digestive glands that produce amylase (2 marks):

- Salivary glands (produce salivary amylase) [1 mark]
- Pancreas (produces pancreatic amylase) [1 mark]

e. Role of amylase in food digestion (2 marks):

Amylase catalyses the hydrolysis of starch (a complex carbohydrate / polysaccharide) into simpler sugars — first into maltose (a disaccharide), and ultimately into glucose (a monosaccharide), which can be absorbed into the bloodstream. [1 mark for substrate, 1 mark for product/function]

(iii) Effect of increasing temperature (0°C to 60°C) on salivary amylase activity (1 mark):

Activity increases from 0°C to an optimum temperature (approximately 37°C); beyond the optimum, activity decreases sharply as the enzyme denatures (loses its shape), and at 60°C, activity is negligible/zero because the enzyme is fully denatured. [1 mark]

c. Why most food needs to be digested before absorption (1 mark):

Most food molecules (proteins, starch, fats) are too large and insoluble to pass through the walls of the alimentary canal / intestinal epithelium. Digestion breaks them into small, soluble molecules (amino acids, glucose, fatty acids) that can be absorbed by diffusion or active transport. [1 mark]

f. Two features of the small intestine that aid its function (2 marks):

- Villi and microvilli (brush border): Greatly increase the surface area for absorption of digested food molecules. [1 mark]
- Rich blood supply (capillary network in villi): Maintains a concentration gradient, ensuring rapid absorption of glucose and amino acids into the bloodstream. [1 mark]
- (Accept also) Long length (~6–7 m) providing greater surface area and time for digestion and absorption.

SECTION C: 15 Marks (Compulsory – Q28)

28.Blood Composition and Circulation – 15 Marks

a. Composition of blood (4 marks):

- Plasma (approximately 55% of blood volume): A pale yellow liquid composed mainly of water (~90%), dissolved substances including glucose, amino acids, hormones, carbon dioxide, mineral salts, urea, and plasma proteins (fibrinogen, albumin, globulins). [1 mark]
- Red blood cells (erythrocytes): Biconcave, disc-shaped, lack a nucleus; contain haemoglobin for oxygen transport. Most numerous blood cells. [1 mark]
- White blood cells (leucocytes): Larger, nucleated cells; part of the immune system. Include phagocytes (neutrophils, monocytes) and lymphocytes. [1 mark]
- Platelets (thrombocytes): Small cell fragments, no nucleus; essential for blood clotting. [1 mark]

b. How blood cells (red blood cells) transport oxygen (4 marks):

- Oxygen diffuses from the alveoli of the lungs into the blood capillaries across the thin alveolar and capillary walls. [1 mark]
- In the red blood cells, oxygen combines with haemoglobin to form oxyhaemoglobin in a reversible reaction. [1 mark]
- Oxygenated blood is carried from the lungs to the heart via the pulmonary vein, then pumped to all body tissues via the arteries. [1 mark]
- In respiring tissues where oxygen concentration is low, oxyhaemoglobin dissociates, releasing oxygen which diffuses into the cells for aerobic respiration. [1 mark]

c. Adaptations of red blood cells for oxygen transport (2 marks):

- Biconcave disc shape: Increases surface area-to-volume ratio for faster diffusion of oxygen. [1 mark]
- No nucleus: Allows more space for haemoglobin, maximising oxygen-carrying capacity. [1 mark]

- (Accept also) Flexible/thin cell membrane allowing RBCs to squeeze through narrow capillaries; large quantity of haemoglobin.

d. How circulation carries out transport and defence (2 marks):

- Transport: Blood carries oxygen, glucose, amino acids, hormones, and other nutrients from organs of absorption (lungs, small intestine) to all body cells; it also carries carbon dioxide and metabolic waste (urea) from cells to excretory organs (lungs, kidneys). [1 mark]
- Defence: White blood cells (phagocytes) engulf and destroy pathogens by phagocytosis; lymphocytes produce antibodies that neutralise antigens. Plasma also contains antibodies and proteins involved in clotting, preventing entry of pathogens. [1 mark]

e. Why animal cells burst in water but plant cells do not (3 marks):

- When placed in pure water (hypotonic solution), water enters the cell by osmosis because the cell's water potential is lower than the surrounding water. [1 mark]
- Animal cells lack a cell wall. As water enters, the cell swells and eventually bursts (lysis) because there is no rigid structure to resist the internal pressure. [1 mark]
- Plant cells have a strong, rigid cellulose cell wall. As water enters, the cell becomes turgid and the cell wall exerts an opposing pressure (wall pressure / turgor pressure) that prevents the cell from bursting. The plant cell is said to be fully turgid. [1 mark]

END OF MARKING GUIDE

Prepared in accordance with REB Biology and Health Sciences Senior 3 Curriculum