S4 Biology Practice Paper: Cell Structure and Function, Enzymes and Metabolism, Cell Division and Genetics, Nutrition and Digestion, Gas Exchange and Transport, Ecosystems and Energy Flow

S4 | Biology | Time: 75 minutes | Total: 100 marks | 24 questions

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Section A Cell Structure and Function

Part A: 4 to 5 marks each, 17 marks in total.

1. State three structures present in plant cells but absent in animal cells. [4]

2. A microscope has a x10 eyepiece and a x40 objective. A cell image measures 8 mm. Find the actual length in micrometres. [4]

3. Compare cube-shaped cells of side 2 cm and 4 cm. Find the surface area to volume ratio of each and state which diffuses more efficiently. [5]

4. State one main function each of the mitochondrion, ribosome, chloroplast and cell membrane. [4]

Section B Enzymes and Metabolism

Part B: 4 to 5 marks each, 17 marks in total.

5. What is an enzyme? Use the lock and key model to explain how an enzyme acts on its substrate. [4]

6. An enzyme acts at 2.0 units at 20 C and 4.0 units at 30 C. Find Q10 and explain why the rate falls sharply at 60 C. [5]

7. Pepsin works best at pH 2 and trypsin at pH 8. How much do the optima differ, and where does each act? [4]

8. Compare competitive and non-competitive inhibitors, and state which type is relieved by raising substrate concentration. [4]

Section C Cell Division and Genetics

Part C: 4 to 5 marks each, 18 marks in total.

9. A human body cell has 46 chromosomes. After DNA replication how many chromatids does one chromosome contain, and how many chromosomes does each daughter cell have after mitosis? [5]

10. How many gametes arise by meiosis from a cell with 2n = 46, how many chromosomes does each gamete carry, and what is the zygote chromosome number? [4]

11. In the cross Aa x Aa, what is the ratio of dominant to recessive phenotypes, and how many of each are expected among 400 offspring? [4]

12. For XX x XY parents, what is the ratio of males to females, and how many males among 300 offspring? [5]

Section D Nutrition and Digestion

Part D: 4 to 5 marks each, 17 marks in total.

13. Give one food test and its positive result for starch, reducing sugar, protein and fat. [4]

14. A person needs 8400 kJ per day, 30% of it from fat. Fat supplies 39 kJ per gram. Find the daily fat intake. [4]

15. At which pH are salivary amylase, pepsin and pancreatic enzymes most active, and state two features of villi that aid absorption. [5]

16. A person is 1.5 m tall and weighs 45 kg. Find the BMI using mass in kg divided by the square of height in metres. [4]

Section E Gas Exchange and Transport

Part E: 4 to 5 marks each, 17 marks in total.

17. State three structural features of alveoli that suit gas exchange. [4]

18. Describe the changes in the intercostal muscles, ribs, diaphragm and thoracic volume during inhalation. [4]

19. Stroke volume is 70 mL and heart rate is 72 beats per minute. Find the cardiac output in litres per minute. [4]

20. State one function of each of the four components of blood, and explain why heart rate rises during exercise. [5]

Section F Ecosystems and Energy Flow

Part F: 3 to 4 marks each, 14 marks in total.

21. Producers fix 10000 kJ. Using the ten per cent law, find the energy at the primary, secondary and tertiary consumer levels, and their total. [4]

22. State two processes that remove carbon dioxide from the atmosphere and two that release it in the carbon cycle. [3]

23. Why is the pesticide DDT most concentrated in top consumers of a food chain? [3]

24. Why is an ecological pyramid usually upright, and what is the role of decomposers? [4]
