

AS Level Biology

Topic 3: Cells, Microscopy and the Immune System

AQA Biology (7401)

Question Paper

100 marks

Instructions

- Answer **all** questions.
- In calculations show your working and give your answer to an appropriate number of significant figures.
- In extended-response questions you should write in clear, well-organised continuous prose.
- There are 17 questions in this paper. The total mark is **100**.

Name: _____

Class: _____

Date: _____

Teacher: _____

1. This question is about eukaryotic cell structure.

(a) Name the organelle that is the site of aerobic respiration in a eukaryotic cell. (1)

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(b) Name the organelle responsible for modifying and packaging proteins for secretion. (1)

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(c) State the function of a ribosome. (1)

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(d) State one structural difference between rough endoplasmic reticulum and smooth endoplasmic reticulum. (1)

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2. This question is about the functions of cell organelles.

(a) Describe the structure and function of the nucleus. **(3)**

(b) Describe the structure of a mitochondrion and explain how it is adapted to its function. **(3)**

(c) Name two organelles found in plant cells that are not found in animal cells. **(2)**

3. This question is about chloroplasts.

(a) State the function of a chloroplast. **(1)**

(b) Name the stacks of membranes inside a chloroplast where the light-dependent reactions occur. **(1)**

(c) Name the fluid that surrounds the membranes inside a chloroplast. **(1)**

4. This question is about the differences between prokaryotic and eukaryotic cells.

(a) State three structures always found in a prokaryotic cell. (3)

(b) State three ways in which a prokaryotic cell differs from a eukaryotic cell. (3)

(c) Some prokaryotic cells contain plasmids. State what a plasmid is. (1)

5. Viruses are described as acellular and non-living.

(a) Name three structures found in all viruses. (3)

(b) Explain why viruses are described as acellular. (1)

6. This question is about the use of microscopes to study cells.

(a) State what is meant by the *magnification* of a microscope. (1)

(b) State what is meant by the *resolution* of a microscope. (1)

(c) Explain why a transmission electron microscope (TEM) has a higher resolution than an optical (light) microscope. (2)

(d) Give one advantage of using an optical microscope rather than an electron microscope. (1)

7. This question compares the transmission electron microscope (TEM) and the scanning electron microscope (SEM).

(a) State one advantage of a TEM over an SEM. (1)

(b) State one advantage of an SEM over a TEM. (1)

(c) Explain why specimens viewed with an electron microscope cannot be living. (2)

8. A student measured a cell using an optical microscope. The image of the cell measured 40 mm and the magnification used was $\times 400$.

- (a) Calculate the actual length of the cell in micrometres (μm). Show your working. (1 mm = 1000 μm) (3)

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- (b) The student then viewed a different structure whose actual length was 5 μm . The image measured 2 mm. Calculate the magnification of this image. (3)

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9. This question is about cell fractionation and ultracentrifugation, used to separate organelles.

- (a) Before fractionation, tissue is placed in a cold, isotonic, buffered solution. Explain why the solution must be: (i) cold, (ii) isotonic, (iii) buffered. (3)

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- (b) Describe the homogenation step of cell fractionation. (2)

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- (c) During ultracentrifugation, the sample is spun and the speed is increased in stages. Explain why the organelles separate out in order of their density (heaviest first). (3)

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10. This question is about defence against pathogens and antigens.

- (a) State what is meant by the term *antigen*. (2)

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- (b) Explain how the immune system distinguishes the body's own cells from foreign cells. (2)

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11. This question is about phagocytosis, a non-specific defence mechanism.

- (a) Describe the process of phagocytosis of a pathogen by a phagocyte. (4)

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- (b) After digesting the pathogen, the phagocyte becomes an antigen-presenting cell. Explain what this means and why it is important. (2)

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12. This question is about the cellular response involving T lymphocytes.

- (a) Describe the role of T helper cells in the immune response. (3)

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- (b) Describe the role of cytotoxic T cells. (2)

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13. This question is about the humoral response involving B lymphocytes and antibodies.

(a) Describe how a specific B cell is selected and activated when a pathogen enters the body. **(3)**

(b) Describe the role of plasma cells. **(2)**

(c) Explain the role of memory cells in the immune response. **(3)**

14. An antibody is a protein with a specific structure related to its function.

(a) State what is meant by the term *antibody*. **(1)**

(b) Describe how an antibody leads to the destruction of a pathogen by agglutination. **(2)**

15. Vaccination can provide protection against disease.

(a) Explain how a vaccine provides long-term protection (immunity) against a disease. **(3)**

(b) State the difference between *active* and *passive* immunity. **(2)**

(c) Explain what is meant by *herd immunity*. **(2)**

16. This question is about the human immunodeficiency virus (HIV).

(a) Describe how HIV replicates inside a host T helper cell. **(4)**

(b) Explain why a person with AIDS is more likely to suffer from infections. **(3)**

(c) Explain why antibiotics are not effective against viruses such as HIV. **(2)**

17. The ELISA test uses antibodies to detect the presence of a specific antigen in a sample, such as in the diagnosis of HIV.

(a) State what the abbreviation ELISA stands for. **(1)**

(b) Outline how an ELISA test can be used to show whether a specific antigen is present in a sample. **(4)**

(c) Explain why the well must be washed before the substrate solution is added. **(1)**

(d) The second antibody used in the test is described as a monoclonal antibody. Explain why monoclonal antibodies are suitable for use in diagnostic tests such as ELISA. **(3)**
