

AS Level Biology

Topic 4: Cell Division and Transport Across Cell Membranes

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 the cell cycle.

(a) Name the stage of the cell cycle in which DNA is replicated.

(1)

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(b) State two events, other than DNA replication, that occur during interphase.

(2)

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(c) Name the two main events that occur after interphase to complete the cell cycle.

(2)

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2. This question is about the stages of mitosis.

(a) Describe what happens during *prophase*. (2)

(b) Describe what happens during *metaphase*. (2)

(c) Describe what happens during *anaphase*. (2)

(d) Describe what happens during *telophase*. (2)

3. This question is about the importance of mitosis.

(a) State two reasons why mitosis is important to a multicellular organism. (2)

(b) Explain why it is important that mitosis produces two genetically identical daughter cells. (2)

4. A student examined a root tip and counted the number of cells in each stage of the cell cycle. Out of 200 cells, 160 were in interphase.

(a) Calculate the percentage of cells in interphase. (1)

(b) The mitotic index is the proportion of cells undergoing mitosis. Calculate the mitotic index for this sample. Give your answer to 2 decimal places. (2)

(c) Suggest what a high mitotic index in a sample of tissue might indicate. (1)

5. Uncontrolled cell division can lead to the formation of tumours.

(a) Explain how uncontrolled mitosis can lead to the formation of a tumour. (2)

(b) Some cancer treatments work by disrupting the cell cycle. Suggest how a drug that prevents the formation of spindle fibres could be used to treat cancer. (2)

6. This question is about binary fission in prokaryotic cells.

(a) Describe the process of binary fission in a prokaryotic cell. (3)

(b) State one way in which binary fission differs from mitosis. (1)

7. This question is about the structure of the cell-surface membrane, described by the fluid-mosaic model.

(a) Explain why the model of the membrane is described as 'fluid'. (1)

(b) Explain why the model is described as a 'mosaic'. (1)

(c) Describe the arrangement of the phospholipids in the membrane. (2)

(d) State the role of cholesterol in the cell-surface membrane. (2)

8. Substances can cross cell membranes by diffusion.

(a) Define the term *diffusion*. (2)

(b) Explain why oxygen can diffuse directly through the phospholipid bilayer. (2)

(c) State three factors that affect the rate of diffusion across a membrane. (3)

9. This question is about facilitated diffusion.

- (a) Explain why some substances must enter cells by facilitated diffusion rather than by simple diffusion through the bilayer. **(2)**

- (b) Describe how a channel protein allows ions to cross the membrane by facilitated diffusion. **(2)**

- (c) Describe how a carrier protein transports a molecule such as glucose across the membrane by facilitated diffusion. **(2)**

10. This question is about osmosis.

- (a) Define *osmosis*. **(3)**

- (b) State the water potential of pure water in kPa. **(1)**

- (c) Explain why the addition of solute to pure water lowers its water potential. **(1)**

11. A student placed plant tissue into solutions of different concentrations and measured the change in mass.

- (a) Explain what would happen to a plant cell placed in a solution with a lower (more negative) water potential than the cell. **(3)**

- (b) Describe and explain what would happen to an animal cell (e.g. a red blood cell) placed in pure water. **(3)**

- (c) In this type of experiment, the point where there is no change in mass can be used to estimate the water potential of the tissue. Explain why. **(2)**

12. This question is about active transport.

- (a) Define *active transport*. **(2)**

- (b) Explain why active transport requires ATP but facilitated diffusion does not. **(2)**

- (c) Suggest why a cell that carries out a large amount of active transport contains many mitochondria. **(2)**

13. In the small intestine (ileum), glucose is absorbed into epithelial cells by co-transport with sodium ions.

- (a) Describe how a sodium-potassium pump creates a sodium ion concentration gradient across the membrane of an epithelial cell. (2)

- (b) Describe how glucose is then absorbed from the gut lumen into the epithelial cell by co-transport. (3)

- (c) Explain why this is described as an example of indirect active transport. (1)

14. A student investigated the effect of solute concentration on the change in mass of potato tissue. Five potato cylinders of equal mass were placed in sucrose solutions of different concentrations for one hour.

- (a) State the independent variable and the dependent variable in this investigation. (2)

- (b) State two variables that should be kept constant to make this a valid investigation. (2)

- (c) Explain why the student calculated the percentage change in mass rather than the actual change in mass. (2)

- (d) Describe how the student could use a graph of percentage change in mass against sucrose concentration to find the concentration at which the potato has the same water potential as the solution. (2)

15. This question is about the role of membrane proteins.

(a) Membranes contain receptor proteins. Describe the role of a receptor protein. **(2)**

(b) Some membrane proteins act as antigens. State the function of an antigen on a cell-surface membrane. **(1)**

(c) Explain how increasing temperature can increase the permeability of a cell membrane. **(3)**

16. This question is about meiosis and the production of gametes. (You are not required to describe the detailed stages.)

(a) State the type of cell division that produces gametes. **(1)**

(b) Explain why gametes must be produced by a division that halves the chromosome number. **(2)**

(c) State two ways in which mitosis differs from meiosis. **(2)**

17. This question is about adaptations of exchange surfaces involving membranes.

- (a) Explain how having a large number of microvilli on the surface of an epithelial cell increases the rate of absorption. **(2)**

- (b) Explain why a cell that absorbs glucose by facilitated diffusion will absorb it faster if it has more carrier proteins in its membrane. **(2)**

- (c) An epithelial cell that absorbs amino acids by active transport is found to contain many mitochondria and a folded (microvilli) membrane. Explain how each of these features increases the rate of absorption. **(4)**
