Past-paper walk-through

Fluid mosaic membranes ▪ 4.1

eXercise

Questions in this set

- 9700/11 N25 Q15 ▪ 1 mark
- 9700/12 N25 Q17 ▪ 1 mark
- 9700/12 N25 Q18 ▪ 1 mark
- 9700/13 N25 Q14 ▪ 1 mark
- 9700/13 N25 Q18 ▪ 1 mark
- 9700/14 N25 Q16 ▪ 1 mark
- 9700/21 N25 Q1 ▪ 9 marks

Reading the mark scheme

- **B1** a mark that stands on its own – the point is either made or not.
- **M1** a *method* mark: the right approach, even if the number is wrong.
- **A1** an *answer* mark, and it usually needs its M mark first.
- **C1** a working mark on the way to the answer.
- // separates answers the examiner accepts equally.
- **ecf** = error carried forward: a later part is marked on your own earlier answer.
- **owtte** = "or words to that effect" – the wording need not match.

Question 15

9700/11 N25 ▪ Q15 ▪ 1 mark

15 What are the main roles of glycolipids in cell surface membranes?

1 to help cells to attach to each other to form tissues

2 to act as antigens for cell-to-cell recognition

3 to increase fluidity for the cell surface membrane

A 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

Solution 15

Answer: **B**

Why

- Glycolipids project from the outer surface, where they can be recognised by other cells.
- That lets cells attach to one another and act as antigens for recognition.
- Fluidity is controlled by cholesterol and by the fatty-acid tails, not by the glycolipids.

Question 17

9700/12 N25 ▪ Q17 ▪ 1 mark

17 What can increase the fluidity of the cell surface membrane at low temperatures?

1 double bonds between carbon atoms in the fatty acid chains

2 cholesterol

3 fatty acids having shorter chains

A 1, 2 and 3 **B** 1 and 3 only **C** 1 only **D** 2 and 3 only

Solution 17

Answer: **A**

Why

- Unsaturated fatty acids have kinks from their C=C bonds, so the tails pack loosely and stay fluid.
- Shorter tails have fewer interactions, which also keeps the membrane fluid.
- Cholesterol prevents the tails packing tightly at low temperature, so all three help.

Question 18

9700/12 N25 ▪ Q18 ▪ 1 mark

18 Which statements about the proteins and glycoproteins in cell surface membranes are correct?

1 They can allow cells to bond together to form tissues.

2 They can recognise messenger molecules like hormones.

3 They can be antigens and allow cell-to-cell recognition.

A 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

Solution 18

Answer: **A**

Why

- Membrane proteins and glycoproteins project from the surface where other cells and molecules meet them.
- They act as receptors for hormones and other messenger molecules.
- They also act as antigens and as attachment points between cells, so all three are correct.

Question 14

9700/13 N25 ▪ Q14 ▪ 1 mark

14 Which statement about phospholipids in the bilayer of a cell surface membrane is correct?

A The non-polar phosphate heads face outwards and the polar fatty acid tails face inwards.

B The polar phosphate heads face outwards and the non-polar fatty acid tails face inwards.

C The non-polar fatty acid tails face outwards and the polar phosphate heads face inwards.

D The polar fatty acid tails face outwards and the non-polar phosphate heads face inwards.

Solution 14

Answer: **B**

Why

- A phospholipid has a polar phosphate head and two non-polar fatty acid tails.
- The polar heads face the water on each side of the membrane.
- The non-polar tails turn inwards, away from the water.

Question 18

9700/13 N25 ▪ Q18 ▪ 1 mark

18 Proteins in the cell surface membranes of human cells and mouse cells were labelled with fluorescent dyes. The human cells were labelled with a red dye and the mouse cells were labelled with a green dye.

A human cell and a mouse cell were then fused to form a hybrid cell.

At first, the different dyes remained separate. After 40 minutes, the two dyes were evenly distributed in the hybrid cell surface membrane.

What explains this observation?

A All protein molecules in the cell surface membrane are fixed to structures within the cell, but phospholipid molecules move freely between them.

B Groups of protein and phospholipid molecules in the cell surface membrane are attached to each other and move together.

Question 18

C Only protein molecules in the outer layer of the cell surface membrane can move freely between phospholipid molecules.

D Protein molecules in the outer layer of the cell surface membrane and those which span the bilayer can move freely between phospholipid molecules.

Solution 18

Answer: **D**

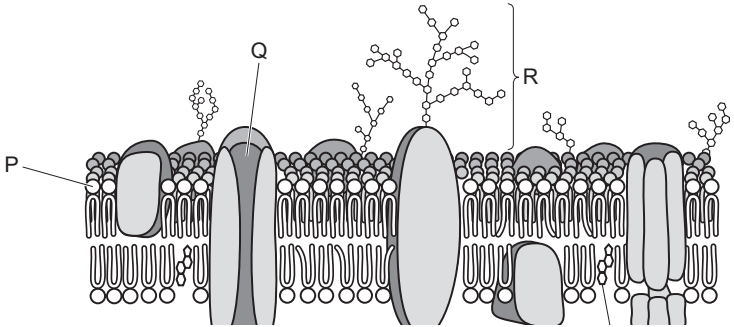
Why

- Membrane proteins can move sideways because the bilayer is fluid.
- Fusing the two cells lets the red and green proteins mix across the whole surface.
- Given time and a warm enough temperature the colours become evenly intermingled.

Question 16

9700/14 N25 ▪ Q16 ▪ 1 mark

16 The diagram shows a section through a cell surface membrane.



Question 16

What is a correct role for a labelled molecule?

A P is involved in controlling membrane stability.

B Q is involved in active transport.

C R is involved in cell signalling.

D S is involved in diffusion of ions.

Solution 16

Answer: **C**

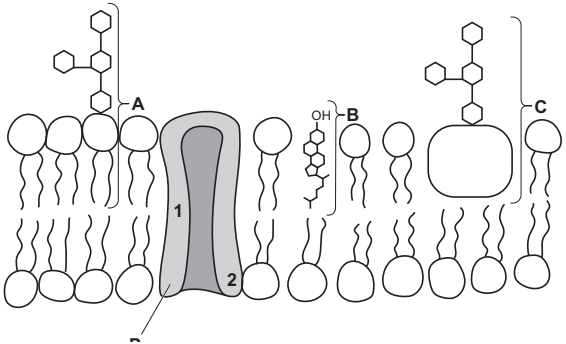
Why

- Match each label to its position: phospholipids form the bilayer, cholesterol sits between the tails.
- A protein spanning the membrane with a carbohydrate chain outside is a receptor for cell signalling.
- Channel proteins allow diffusion of ions, but that is passive, not active transport.

Question 1

9700/21 N25 ▪ Q1 ▪ 9 marks

1 Fig. 1.1 shows a diagram of the fluid mosaic model of the structure of the cell surface membrane.



Question 1

P

Fig. 1.1

(a) Name the structures labelled **A**, **B** and **C** in Fig. 1.1.

Question 1

Question 1

Question 1

[3]

(b) Draw an arrow on Fig. 1.1 to show the movement of a molecule across the membrane into the cell by facilitated diffusion. [2]

(c) Explain how the fluidity of the membrane would change if the proportion of unsaturated fatty acids in the phospholipid bilayer increased.

Question 1

(d) The R-groups of amino acids give them different properties.

Suggest how the properties of the R-groups of the amino acids at position **1** of **P** may differ from the R-groups of the amino acids at position **2**.

Question 1

[Total: 9]

Solution 1

(a)

Mark scheme

- A glycolipid ;
- B cholesterol ;
- C glycoprotein ;
- 3

Solution 1

(b) Mark scheme

- 1
- arrow through protein ;
- 2
- direction of arrow correct ;
- 2
- 9700/21
- October/November 2025

Solution 1

(c) Mark scheme

- any three from:
- fluidity (of membrane) increases ;
- unsaturated fatty acids have double bonds ;
- (double bonds) cause the fatty acid chain to, kink / bend / AW ;
- unsaturated fatty acids cannot lie as close together as saturated fatty acids A ora
- or
- ref. to increased distance between phospholipids / AW ;

Solution 1

- ref. to weakening the hydrophobic interactions between, fatty acid chains / cholesterol ;
- 3

Solution 1

(d)

Mark scheme

- any one from:
- position 1 has amino acids with, hydrophobic / non polar / AW, R-groups ;
- position 2 has amino acids with, hydrophilic / polar / ionic / AW, R-groups;
- A ref. to amine and carboxyl groups as appropriate
- 1