# Biological Membranes (2.1.5): OCR A Level Biology Exam Questions by T

18 questions · 42 marks · about 50 minutes. Answer in the spaces, then check the mark schemes at the end.

**Question 1 · AS Paper 1 · June 2023 · Q25(b) · 3 marks**

**(b)** The presence of cholesterol is one of several factors that affect membrane fluidity.

A student examined two different cell surface membranes. One membrane had a higher concentration of cholesterol than the other membrane.

The student concluded that 'the membrane with the higher concentration of cholesterol would have less fluidity than the other membrane'.

Discuss whether the student's conclusion can be supported.

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..... **[3]**


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**Question 2 · A level Paper 1 · June 2018 · Q17(c)(i) · 2 marks**

**(c)** Fig. 17.2 is a diagram of part of the plasma membrane of a Chromista cell.

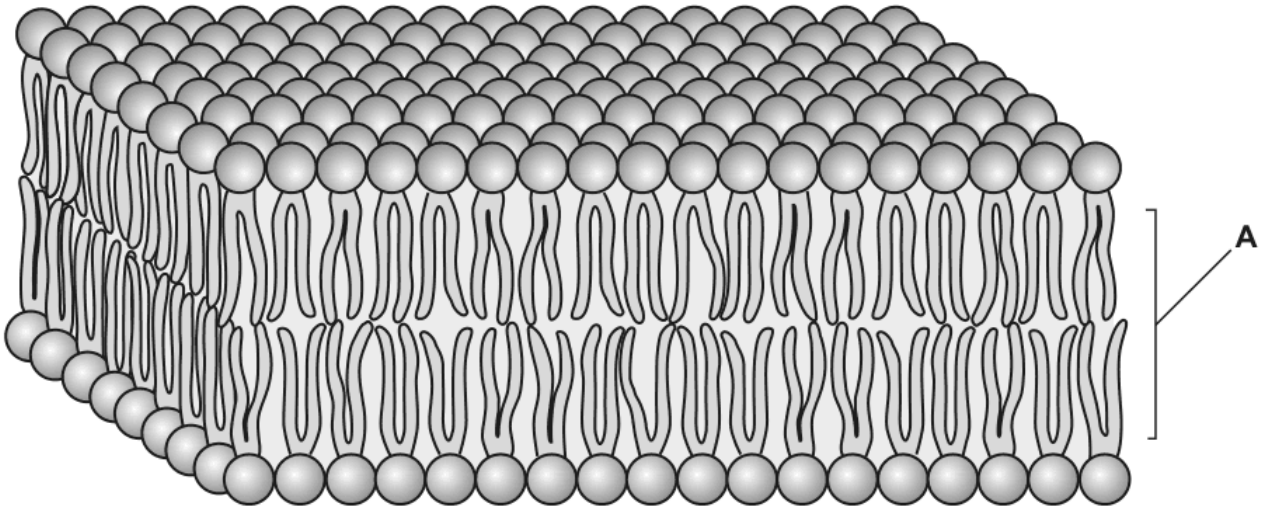



**Fig. 17.2**

**(i)** State and explain how **one** property of region **A** in Fig. 17.2 contributes to the stability of the plasma membrane.

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..... **[2]**

**Question 3 · A level Paper 1 · June 2018 · Q17(c)(ii) · 2 marks**

**(ii)** There are differences between the plasma membrane and membranes within cells.

Outline the role of membranes **within** cells.

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..... **[2]**


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**Question 4 · information from earlier in the question**

**(c)** Infection by pathogens such as bacteria and viruses often causes release of pyrogens into the blood.

Pyrogens stimulate the enzyme COX-2 to produce the compound $PGE_2$.

$PGE_2$ binds to receptors in the hypothalamus and this results in an increase in the thermogenic set point.

**(i)** Suggest the consequences of an increase in the thermogenic set point.

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..... **[2]**

**Question 4 · A level Paper 1 · June 2023 · Q20(c)(ii) · 2 marks**

**(ii)** $PGE_2$ receptors are located on the cell surface membrane.

State **two** functions of the cell surface membrane that are illustrated by the action of $PGE_2$.

1 .....

.....

2 .....

.....

**[2]**


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**Question 5 · AS Paper 2 · June 2025 · Q2(b) · 2 marks**

**(b)** State **one** similarity and **one** difference between simple diffusion and facilitated diffusion.

Similarity .....

.....

Difference .....

.....

**[2]**

Turn over

**Question 6 · AS Paper 2 · June 2025 · Q2(c) · 3 marks**

**(c)** Using your knowledge of the phospholipid bilayer in plasma membranes, explain how an increase in temperature affects the permeability of the membrane.

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..... **[3]**

**Question 7 · AS Paper 2 · June 2025 · Q2(d) · 2 marks**

**(d)** Exocytosis is an active process.

Explain why ATP is needed for exocytosis.

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..... **[2]**


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**Question 8 · A level Paper 2 · June 2019 · Q16(a)(i) · 2 marks**

## SECTION B

Answer **all** the questions.

**16** Water moves by osmosis in living organisms.

**(a) (i)** Define osmosis.

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..... **[2]**

**Question 9 · A level Paper 2 · June 2019 · Q16(a)(ii) · 3 marks**

**(ii)** Plants rely on osmosis for support.

Explain the importance of osmosis in plant support.

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..... **[3]**


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**5** *Paramecium caudatum* is a protoctist. The structure of this organism is shown in Fig. 5.

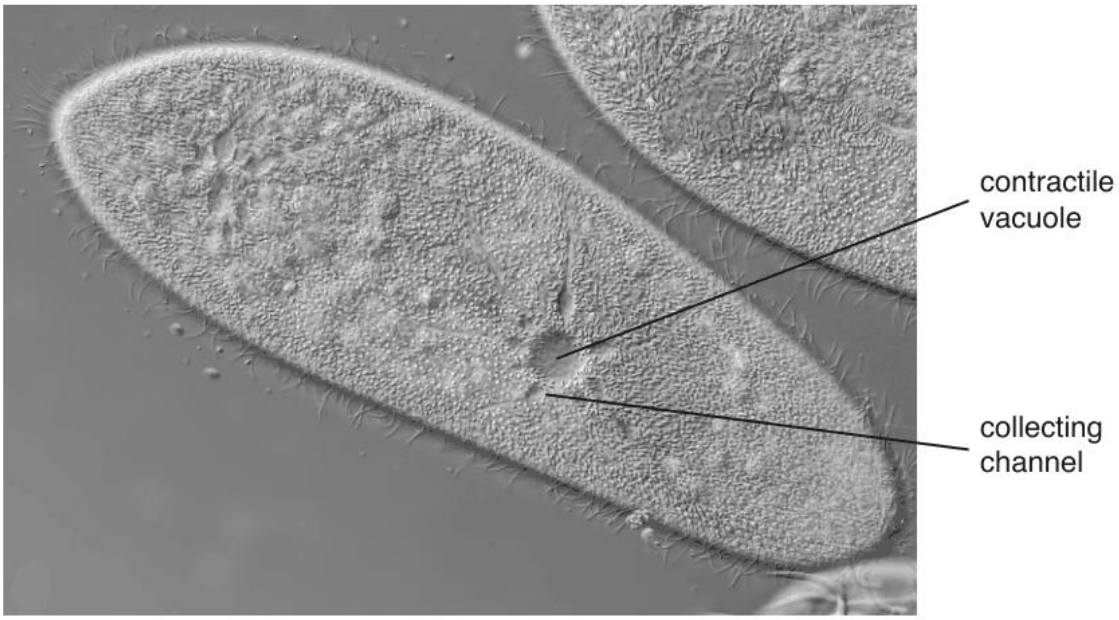



**Fig. 5**

Most species of *Paramecium* are freshwater organisms. Over a period of time water from the cytoplasm is collected by the collecting channels. They pass the water into the contractile vacuole. Once the contractile vacuole is full, it contracts, expelling the contents from the cell.

**(a)** Explain why *Paramecium* needs to expel water when in fresh water.

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..... **[2]**


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**(b)** An experiment was carried out in which the frequency of vacuole contraction was observed when *Paramecium* was bathed in different concentrations of sodium chloride solution. The results are shown in Table 5.

| Concentration of sodium chloride solution ($mol\,dm^{-3}$) | Mean number of contractions ($min^{-1}$) |
|---|---|
| 0.00 | 6.5 |
| 0.01 | 6.2 |
| 0.03 | 5.7 |
| 0.05 | 4.9 |
| 0.10 | 4.4 |
| 0.15 | 3.9 |
| 0.20 | 1.2 |

**Table 5**

**(i)** Calculate the percentage decrease in the mean number of contractions as the concentration of sodium chloride solution increases from 0.00 $mol\,dm^{-3}$ to 0.15 $mol\,dm^{-3}$.

percentage decrease = ..... % **[2]**


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**Question 11 · AS Paper 2 · June 2019 · Q5(b)(iv) · 2 marks**

**(iv)** The experiment described in **Table 5** was extended to find out the effect of reducing the dissolved oxygen concentration on the mean number of contractions at each concentration of sodium chloride.

When the dissolved oxygen concentration of the solution was reduced, the mean number of contractions was lower at each concentration of sodium chloride.

Suggest an explanation for these findings.

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..... **[2]**

**Question 12 · A level Paper 1 · June 2023 · Q21(b)(i) · 3 marks**

**(b)** Plants are often watered with a solution containing minerals to help them grow.

While preparing a class practical a technician accidentally watered some sunflower plants with a mineral concentration that was 1000 times higher than normal.

**(i)** Explain why the plants wilted, even though they were given a lot of water.

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..... **[3]**


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**Question 13 · A level Paper 1 · June 2023 · Q21(b)(ii) · 2 marks**

**(ii)** The teacher suggested that the same effect would be seen if the plants had been watered with a solution containing cyanide ions that inhibit ATP synthesis.

Explain whether the teacher was correct.

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..... **[2]**

**Question 14 · information from earlier in the question**

**1** The cells in beetroot contain a red pigment called betalain. The plasma membrane of the beetroot cell is impermeable to betalain.

A group of students set out to investigate how temperature affects the structure and permeability of the plasma membrane of beetroot cells. The method they used is shown below.

- Cut some pieces of beetroot.
- Place them in a flask containing 100 $cm^3$ of distilled water.
- Stand this flask in a water bath and increase the temperature at 10 °C intervals.
- Take a sample of water from the flask 5 minutes after each new temperature is reached.
- Measure the absorbance of the water samples taken using a blue filter in the colorimeter.

**(a)** A second group of students made improvements to this method. One of the improvements they made was to carry out two further trials at each temperature.

Suggest **two** further improvements they could have made **and** give a reason for the improvements you have suggested.

Improvement and reason 1

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Improvement and reason 2

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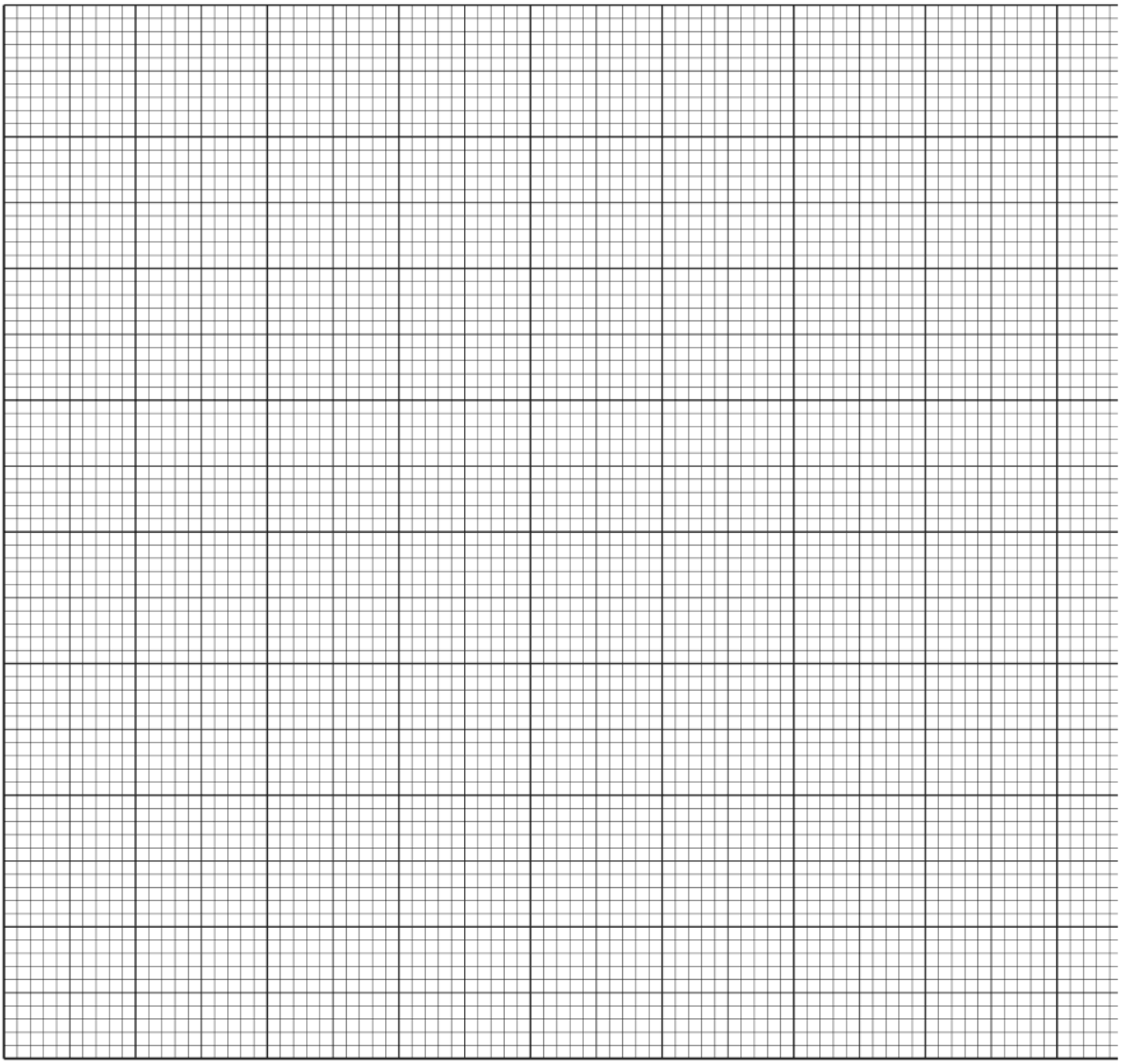
**[4]**


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**(c) (i)** The table shows the results obtained by the second group of students.

| Temperature (°C) | Absorbance (%) | | | |
|---|---|---|---|---|
| | Trial 1 | Trial 2 | Trial 3 | Mean |
| 10 | 0 | 0 | 0 | 0.0 |
| 20 | 0 | 0 | 0 | 0.0 |
| 30 | 2 | 3 | 2 | 2.3 |
| 40 | 6 | 5 | 7 | 6.0 |
| 50 | 9 | 7 | 7 | 7.7 |
| 60 | 46 | 45 | 47 | 46.0 |
| 70 | 78 | 78 | 80 | 78.7 |

Plot a graph of the results from the table on the grid.



**[3]**


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**Question 14 · AS Paper 2 · June 2022 · Q1(d) · 2 marks**

**(d)** In a second experiment, students followed the same method but used pieces of beetroot that had been frozen for several days and then defrosted. They were surprised when their results differed from the students that had been given fresh beetroot.

Suggest how their results would **differ** from those given in the table **and** provide an explanation.

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..... **[2]**

**Question 15 · AS Paper 2 · June 2024 · Q3(b) · 1 mark**

**(b)** Temperature and concentration are two factors that affect the rate of diffusion.

State **one other** factor that affects the rate of diffusion.

..... **[1]**

Turn over


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**Question 16 · AS Paper 2 · June 2024 · Q3(c)(ii) · 4 marks**

**(ii)** Outline the method that the students would use to carry out an investigation into the effect of **temperature** on the diffusion rate in their model cells.

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..... **[4]**


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**Question 17 · AS Paper 2 · June 2024 · Q3(d) · 3 marks**

**(d)** The table below shows some results from a model cell investigation.

| Temperature (°C) | Concentration of glucose found outside the dialysis tubing after two minutes (mol $dm^{-3}$) |
|---|---|
| 10 | 1.5 |
| 20 | 3.6 |
| 30 | 4.7 |
| 40 | 5.8 |

Explain these results in terms of the effect of temperature on the rate of diffusion.

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..... **[3]**

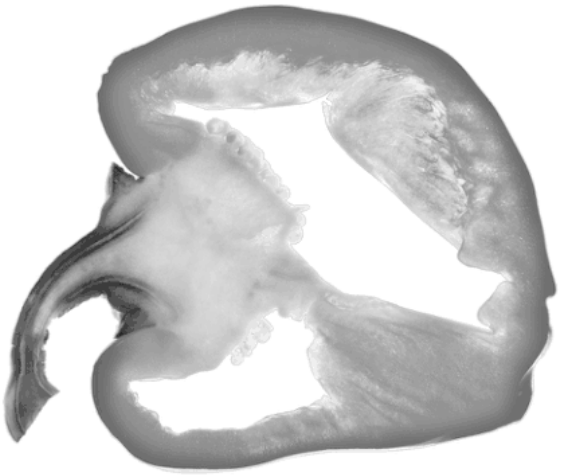
Turn over


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**Question 18 · information from earlier in the question**

**5** A student investigates water potential in the cells of a bell pepper, *Capsicum annuum*.

A slice of bell pepper is shown in the image.



The student:

- prepares several concentrations of sucrose solution
- cuts pieces of pepper and records the mass of each piece
- places pieces of pepper in each sucrose solution
- removes the pieces after 30 minutes and dries them
- records the mass of each piece.

**(a)** The student makes sucrose solutions of different concentrations by diluting a stock solution.

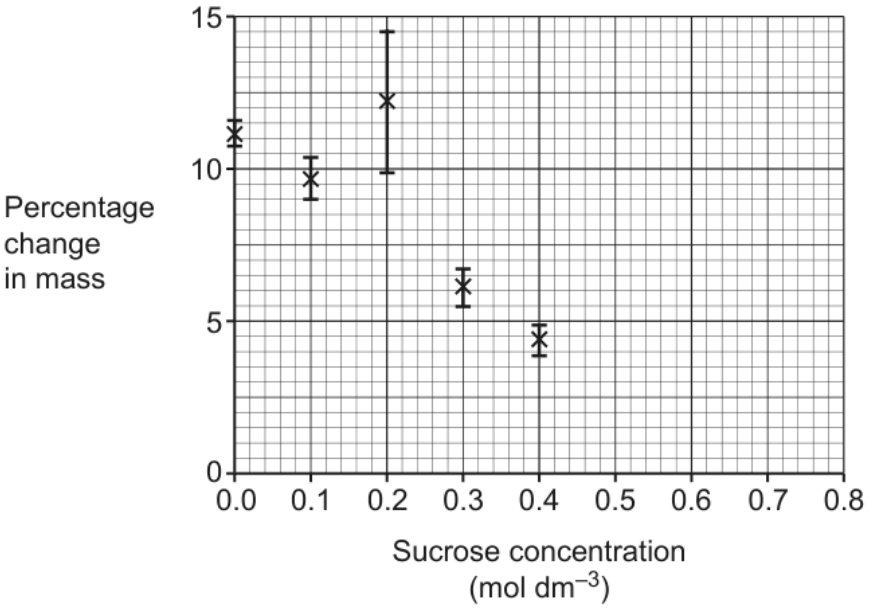
State a piece of equipment, with a higher resolution than a measuring cylinder, that the student should use to transfer solutions during the dilution procedure.

..... **[1]**


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**Question 18 · A level Paper 3 · June 2025 · Q5(d) · 2 marks**

**(d)** The graph shows the results of the experiment.




Use the graph to estimate the concentration of sucrose solution that has the same water potential as the pepper tissue.

Concentration of sucrose solution = ..... mol dm$^{-3}$ **[2]**

Turn over


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## Mark schemes

**Question 1 · AS Paper 1 · June 2023 · Q25(b) · 3 marks**

| | | | |
|---|---|---|---|
| | **(b)** | | *Idea that* the temperature would need to be known to conclude what effect cholesterol has ✓<br>(cholesterol) increases fluidity at low temperatures ✓<br>(cholesterol) decreases fluidity at , high temperatures / body temperature / 36-38°C ✓<br>one example of other factor that affects fluidity ✓ |
| | | | **Total** |

| | |
|---|---|
| **3 max** | e.g.. the effect of cholesterol is dependent on temperature<br>**IGNORE** temperature needs to be controlled<br>temperature, concentration of saturated fatty acids, concentration of unsaturated fatty acids, relative proportions of saturated and unsaturated fatty acids, presence of solvent |
| **5** | |

**Question 2 · A level Paper 1 · June 2018 · Q17(c)(i) · 2 marks**

| | | |
|---|---|---|
| **(c)** | **(i)** | **2 max**<br>***property***<br>hydrophobic (region / fatty acid tails) ✓<br>***explanation***<br>(helps to) form bilayer / separates two aqueous regions ✓<br>***property***<br>(region) contains cholesterol ✓<br>***explanation***<br>regulates (membrane) fluidity / AW✓ |

**IGNORE** stability for explanations

***property*** MUST be linked to its ***explanation***


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**Question 3 · A level Paper 1 · June 2018 · Q17(c)(ii) · 2 marks**

| | | |
|---|---|---|
| (c) (ii) | compartmentalisation<br>**OR**<br>form / surround , (named) organelles ✓<br>purpose of / need for , compartments / separation ✓<br>sites of , chemical reactions / electron carriers / photophosphorylation / chemiosmosis / oxidative phosphorylation ✓<br>provide attachment sites for , enzymes / pigments ✓<br>allow formation of concentration gradients ✓ | |
| | | **Total** |

| | |
|---|---|
| **2 max** | e.g. separating organelles from cytoplasm<br>e.g. form vesicles for transport is **MP1** and **MP2**<br>**ALLOW** ETC for electron carriers<br>**ALLOW** correctly named enzyme e.g. ATP synthase |
| **11** | |

**Question 4 · A level Paper 1 · June 2023 · Q20(c)(ii) · 2 marks**

| | | | | |
|---|---|---|---|---|
| **20 (c) (ii)** | (membrane acts in) cell signalling ✓<br>(membrane) controls , entry / exit , to cell ✓ | **2** | 1.2, 2.5 |

| |
|---|
| **ALLOW** cell communication<br>**ALLOW** is partially permeable / selectively permeable / acts as a barrier |


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**Question 5 · AS Paper 2 · June 2025 · Q2(b) · 2 marks**

| | | |
|---|---|---|
| | **(b)** | *similarity*<br>both are passive processes<br><br>**OR**<br>both allow movement of molecules down a concentration gradient ✓<br><br>*difference – must be comparative*<br>facilitated diffusion allows the transport of larger molecules<br><br>**OR**<br>only facilitated diffusion can use,<br>transport / carrier / channel, proteins ✓ |

| | | |
|---|---|---|
| **2** | **1.2** | **ALLOW** neither require an input of, energy / ATP<br><br>**ALLOW** movement of molecules from high concentration to low concentration<br>**IGNORE** follow / along, the concentration gradient<br><br>**ALLOW** ORA |


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**Question 6 · AS Paper 2 · June 2025 · Q2(c) · 3 marks**

| | | | |
|---|---|---|---|
| **(c)** | | **3 max** | **2.5** |

*affect*
(membrane becomes) <u>more</u> permeable / AW ✓

*explanation*
<u>phospholipid</u> molecules will gain (more) kinetic energy ✓

(so) more gaps form between the (phospholipid) molecules ✓

(so) more (small) molecules can cross the membrane ✓

(if temperature increases further) phospholipids, lose mechanical stability / may melt, which increases the permeability (even) more ✓

**IGNORE** any reference to proteins becoming denatured

**ALLOW** 'phospholipid bilayer becomes more permeable'

**ALLOW** larger gaps form between (phospholipid) molecules
**ALLOW** phospholipid molecules become less closely packed together


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**Question 7 · AS Paper 2 · June 2025 · Q2(d) · 2 marks**

| | | | |
|---|---|---|---|
| | **(d)** | (as) <u>energy</u> is needed, for movement of (secretory) vesicles along cytoskeleton ✓<br>*reference to* using motor proteins ✓<br>(as) <u>energy</u> is needed, for membrane fusion ✓<br>hydrolysis / breakdown, of ATP to, provide / release, energy ✓ | |
| | | **Total** | |

| | | |
|---|---|---|
| **2 max** | **1.2** | **IGNORE** references to 'active process' (in Q stem)<br>**IGNORE** 'energy is required' unqualified<br>**IGNORE** any reference to endocytosis<br>**DO NOT ALLOW** 'make / create / produce, energy' |
| **12** | | |

**Question 8 · A level Paper 2 · June 2019 · Q16(a)(i) · 2 marks**

| | | | | |
|---|---|---|---|---|
| **16** | **(a)** | **(i)** | <u>diffusion</u> / <u>net</u> movement , of water across a , partially / selectively , permeable membrane ✓<br>down a , <u>water potential</u> / <u>Ψ</u> , gradient ✓ | **2** |

**IGNORE** semi

**ALLOW** from a high water potential to a more negative Ψ
**IGNORE** water concentration
**IGNORE** along

**Question 9 · A level Paper 2 · June 2019 · Q16(a)(ii) · 3 marks**

| | | |
|---|---|---|
| **(ii)** | water enters vacuole ✓<br><u>pressure</u> against cell wall ✓<br>turgor (pressure) ✓<br>turgid cell<u>s</u> (support plant) ✓ | **3 max** |


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**Question 10 · AS Paper 2 · June 2019 · Q5(a) · 2 marks**

| | | | |
|---|---|---|---|
| 5 | (a) | *any two from:*<br>to maintain (normal / optimum) water potential (of cell / cytoplasm)<br>**or**<br>to stop, cell / it / *Paramecium,* bursting ✓<br>water moves into, *Paramecium* / it / cell / cytoplasm, by <u>osmosis</u> ✓<br>water potential / ψ, higher outside (cell) ✓ | 2 |

**DO NOT ALLOW** linked to plasmolysis

**ALLOW ora** ψ lower inside (cell)
**IGNORE** outside vacuole for external context

**Question 11 · AS Paper 2 · June 2019 · Q5(b)(iv) · 2 marks**

| | | |
|---|---|---|
| **(iv)** | (less) oxygen for <u>aerobic</u> respiration ✓<br>(less) energy / ATP, for (vacuole) contraction ✓ | |
| | **Total** | |

| | |
|---|---|
| **2** | **ALLOW** is an active process for 'energy'<br>**IGNORE** active transport<br>**DO NOT ALLOW** energy created / produced |
| **11** | |


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**Question 12 · A level Paper 1 · June 2023 · Q21(b)(i) · 3 marks**

| | | | | |
|---|---|---|---|---|
| 21 | (b) | (i) | the (fertiliser) solution would lower water potential (of soil) ✓<br><br>water moves out of (root) cells (into soil) by osmosis<br>**OR**<br>less water enters (root) cells (from soil) by osmosis ✓<br><br>plant loses more water than it gains / AW ✓<br><br>(in aerial parts of plant) turgor (pressure) is reduced ✓ | **max 3** |

| | |
|---|---|
| 2.3 | **ALLOW** water potential of root cells would be higher than soil<br><br>**ALLOW** down water potential gradient for osmosis<br><br>**ALLOW** (leaf) cells are , flaccid / plasmolysed |

**Question 13 · A level Paper 1 · June 2023 · Q21(b)(ii) · 2 marks**

| | | | | |
|---|---|---|---|---|
| 21 | (b) | (ii) | | *correct because* |
| | | | **1** | ATP is required for active transport of mineral ions into , root (cells) / xylem ✓ |
| | | | **2** | (so) no water potential gradient (into root / xylem) / AW ✓ |
| | | | | *incorrect because* |
| | | | **3** | cyanide (ions) may not have entered roots ✓ |
| | | | **4** | plant cells may be tolerant to cyanide ions ✓ |
| | | | **5** | concentration of cyanide ions may not be high enough (to inhibit ATP synthesis) ✓ |

| | |
|---|---|
| **max 2** | 3.1<br>**ALLOW** more mineral ions remain in soil |

**Question 14 · AS Paper 2 · June 2022 · Q1(d) · 2 marks**

| | | | |
|---|---|---|---|
| 1 | (d) | | **1** percentage / absorbance / mean, higher ✓<br><br>**2** water / ice, expansion, breaks / damages, membrane **OR** ice crystals, puncture / damage, membrane ✓ |

| | | |
|---|---|---|
| 2 | AO 3.3 | **1 DO NOT ALLOW** absorption for 'absorbance'<br>**1 ALLOW** ORA percentage / absorbance / mean, lower, for first experiment / in table |


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**Question 15 · AS Paper 2 · June 2024 · Q3(b) · 1 mark**

| | | |
|---|---|---|
| **(b)** | surface area / diffusion distance ✓ | **1** |

**ALLOW** thickness / width, of membrane/exchange surface
**IGNORE** volume ratio


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**Question 16 · AS Paper 2 · June 2024 · Q3(c)(ii) · 4 marks**

| | |
|---|---|
| **(ii)** | **1** add glucose (solution) to the, dialysis tubing / model cell ✓<br>**2** knot / secure dialysis tubing, before / after, addition of glucose ✓ |
| | **3** place (tubing) in a water bath and remove sample (around tubing) at, certain / specified / set, time interval(s) ✓<br>**4** add Benedict's (solution) to sample to test for glucose ✓<br>**5** use colorimeter to obtain, absorption / transmission, values ✓<br>**6** use calibration curve to estimate the <u>concentration</u> of glucose ✓<br>**7** repeat at / use, different temperatures ✓ |

| | |
|---|---|
| **max 4** | **ALLOW** Visking tubing for dialysis tubing throughout<br>**1 ALLOW** tubing containing glucose (solution) |
| | **3 ALLOW** glucose solution for 'sample'<br>**3 IGNORE** remove sample from inside the dialysis tubing<br>**3 ALLOW** dialysis tubing added to, test tube/beaker, of water<br>**4 IGNORE** adding Benedict's to the dialysis tubing<br>**4 ALLOW** look at colour with Benedicts to see how much glucose is present |


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**Question 17 · AS Paper 2 · June 2024 · Q3(d) · 3 marks**

| | | | |
|---|---|---|---|
| | **(d)** | | **1** as temperature increase the kinetic energy of the glucose molecules increases ✓<br>**2** (increased temperature causes) glucose molecules, move / diffuse (from dialysis tubing) at a faster rate ✓<br>**3** correct analysis of figures with units from table ✓<br>**4** greater rate between 10°C and 20°C ✓ |
| | | | **Total** |

| | |
|---|---|
| **max 3** | **ALLOW** ORA for MP 1- 3<br>**IGNORE** ref to phospholipid bilayer<br>**2 ALLOW** as temperature increases the rate of glucose diffusion increases<br>**2 DO NOT ALLOW** increased rate of glucose diffusion in context of increased permeability of membrane.<br>**3 e.g.** from 20°C-40°C increase in temp, the glucose concentration increases by 1.1 moldm$^{-3}$ |
| **13** | |


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| | | |
|---|---|---|
| **5** | **(d)** | **FIRST CHECK THE ANSWER ON ANSWER LINE**<br>**If answer = 0.65 (mol $dm^{-3}$) award two marks** |

| | | |
|---|---|---|
| **2** | 2.4 | **ALLOW** any answer in the range **0.60 to 0.70**, to 1 or 2 significant figures<br>**ALLOW** 1 mark for correct answer in the range to more than 2 significant figures<br><br>If answer incorrect, **ALLOW one mark** for evidence of extrapolating data points to find the intercept with the x-axis, using a straight line. |


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