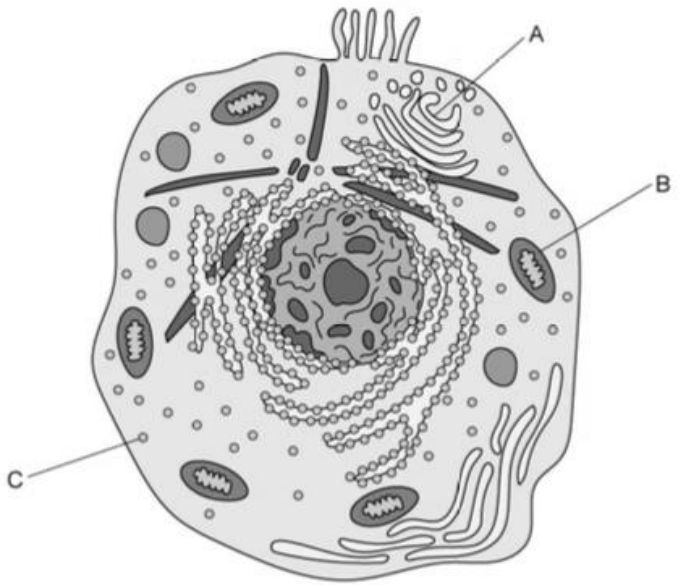
Exam question practise 1

Cells, biomolecules, membranes, gas exchange and cell cycle

1 (a) **Figure 1** below shows the structure of an animal cell.

Figure 1



State the name and function of the organelles labelled **A-C** in **Figure 1**.

(3 marks)

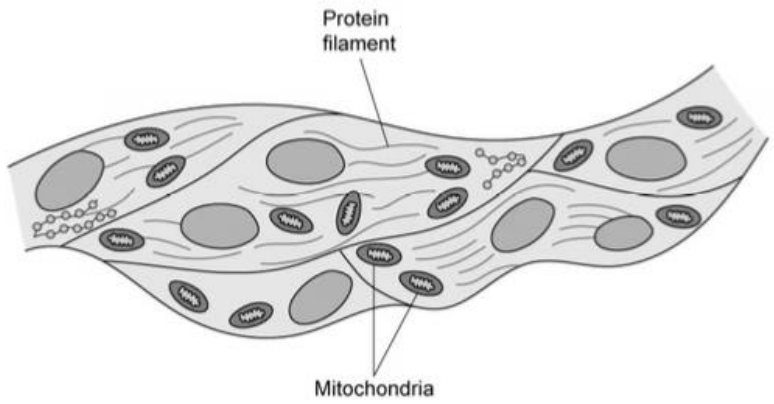
2 (a) Give the meaning of the term **specialised cell**.

.....

(1 mark)

(b) **Figure 1** below shows a diagram of a series of muscle cells.

Figure 1



State how each of the two labelled features help the muscle cells to be specialised.

.....

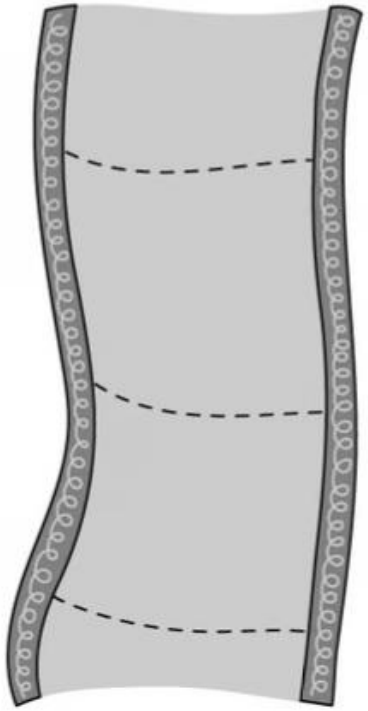
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(2 marks)

The term **specialised cell** means...

- A cell that is adapted/differentiated **AND** has special features that enable it to carry out a particular function; [1 mark]

[Total: 1 mark]



Identify and explain **one** feature visible in **Figure 2** that could help with xylem cell specialisation.

.....

.....

(2 marks)

One feature that helps with xylem cell specialisation is...

- Lack of / no / reduced cell contents; [1 mark]
- Allows free movement / of water; [1 mark]

OR

- Walls between cells have broken down; [1 mark]
- Allowing for a continuous column of water; [1 mark]

OR

- Cell walls are strengthened with lignin; [1 mark]
- Prevents xylem vessel damage/breakage **OR** strengthens xylem; [1 mark]

[Total: 2 marks]

Table 1

Cell type	Tissue	Organ	Organ system
Muscle cell	Muscle	**X**	Circulatory
Neurone	Nerve	Brain	**Y**
Rod cell	Retina	**Z**	Visual

Name the organs and systems marked **X, Y** and **Z**.

.....

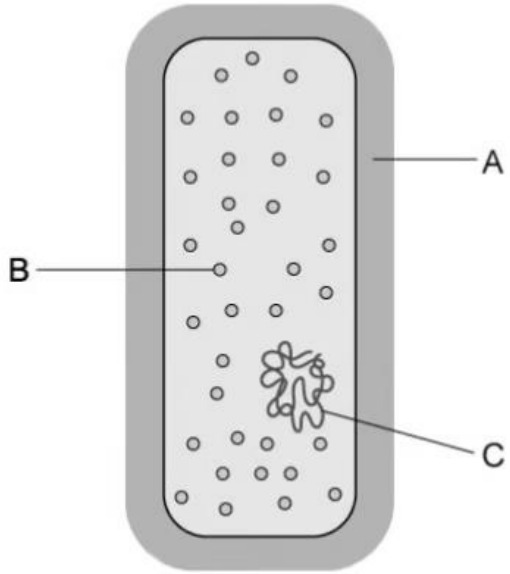
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.....

(3 marks)

4 (a) **Figure 1** below shows the general structure of a prokaryotic cell.

Figure 1



Identify the structures labelled **A-C** in **Figure 1**.

.....

.....

.....

(3 marks)

The structures labelled **A-C** in **Figure 1** are named...

- **A** = Cell wall; [1 mark]
- **B** = Ribosome; [1 mark]
- **C** = DNA/chromosome/genetic material; [1 mark]

[Total: 3 marks]

3 (a) Structures V to Z are organelles within a plant cell.

- V - Nucleus
- W - Chloroplast
- X - Golgi apparatus
- Y - Mitochondrion
- Z - Cell Wall

Complete **Table 1** by identifying the correct letter next to each statement.

Table 1

Statement	Letter
Has membranes arranged in stacks and contains DNA	
Is permeable to water and all solutes	
Contains chromatin	
Produces vesicles	

.....

.....

.....

.....

(4 marks)

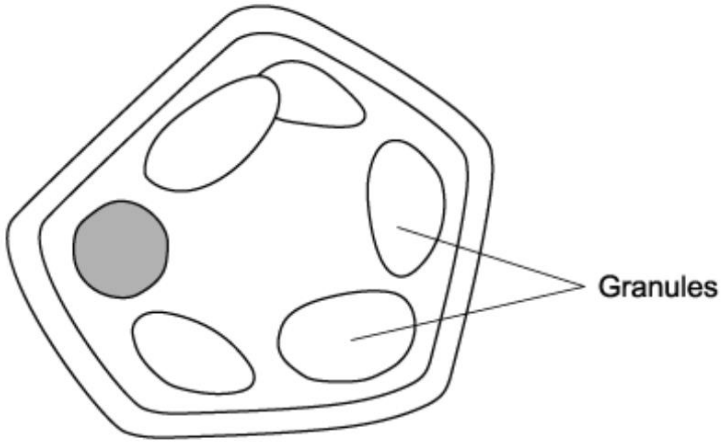
The correct letters are:

- W; [1 mark]
- Z; [1 mark]
- V; [1 mark]
- X; [1 mark]

[Total: 4 marks]

3 (a) **Figure 1** shows a cell from a garden pea.

Figure 1



Describe how you could determine if the granules contained starch.

.....

(1 mark)

(b) Name **one** polysaccharide other than starch found in a garden pea cell.

.....

(1 mark)

(c) Glucose is converted into starch for storage within plant cells, describe the reaction that takes place for this to occur.

.....

.....

.....

(3 marks)

(d) Explain **one** reason why pea cells use starch as a storage molecule rather than glucose.

.....

(1 mark)

The reaction that converts glucose into starch:

Any **three** from the following:

- Is a condensation reaction; [1 mark]
- That forms glycosidic bonds (between monomers); [1 mark]
- Chains are formed with 1–4 links/bonds; [1 mark]
- Branches are formed with 1–6 links/bonds; [1 mark]
- Water is produced (as a by-product); [1 mark]

[Total: 3 marks]

You must provide sufficient detail in order to gain all three marks here, it is not enough to just say it is a condensation reaction that occurs.

5 (a) Serial dilutions are created by taking a series of dilutions of a stock solution. The concentration decreases by the **same** quantity between each test tube. They can either be 'doubling dilutions' (where the concentration is halved between each test tube) or a desired range (e.g. 0, 2, 4, 6, 8, 10 mmol dm^{-3}).

Table 1

Glucose concentration / mmol dm^{-3}	**Volume of distilled H_2O / cm^3**	**Volume of glucose stock solution / cm^3**
0	5	
2	4	
4	3	
6	2	
8	1	
10	0	

Complete the volumes in **Table 1.**

.....

(1 mark)

[1 mark] for correct column;

Glucose concentration / mmol dm^{-3}	Volume of distilled H_2O / cm^3	Volume of glucose stock solution / cm^3
0	5	**0**
2	4	**1**
4	3	**2**
6	2	**3**
8	1	**4**
10	0	**5**

[Total: 1 mark]

The following equation can be used to find the quantity of glucose stock solution needed.

(Desired concentration ÷ concentration of stock) x volume wanted.

For example, (2 ÷ 10) x 5 = 1 cm_3 of glucose stock solution

Statement	Glycogen	Cellulose	Starch
Contains 1-6 links			
Contains α-glucose			
Contains hydrogen bonds			

.....

.....

.....

(3 marks)

[1 mark] for each correct row:

Statement	Glycogen	Cellulose	Starch
Contains 1–6 links	✓		✓
Contains α-glucose	✓		✓
Contains hydrogen bonds		✓	

[Total: 3 marks]

In questions like this, you must follow the instructions carefully - if the question asks for a tick then you must use a tick. Marking a cross (X) in a box will be counted as a blank and could therefore be marked as incorrect.

2 (a) Glycogen is a very effective storage carbohydrate. Describe and explain **three** features of glycogen that make it well suited to its role as an energy store.

(6 marks)

(b) Starch is made of two polymers of ∝-glucose: amylose and amylopectin. Describe the structural differences between amylose and amylopectin and explain their effects on the starch molecule.

(4 marks)

(c) Outline one structural similarity and one structural difference between amylopectin and glycogen.

(2 marks)

Glycogen is an effective energy store because:

- Description of feature: It is poorly soluble; [1 mark]
- Explanation: so it won't affect water potential in cells; [1 mark]

AND

- Description of feature: It is compact/highly-branched; [1 mark]
- Explanation: so it can fit into small storage granules; [1 mark]

AND

- Description of feature: It is easily synthesised and broken down; [1 mark]
- Explanation: so rapidly responds to the hormones insulin/glucagon; [1 mark]

[Total: 6 marks]

4 (a) Participants and coaches involved in competitive sport have taken part in research into the optimum formulation of sports drinks. One such study is set out below.

Eight trained, competitive male cyclists took part in a study in which they fasted for 12 hours and were then given either water, glucose solution or a 2:1 glucose:fructose beverage immediately prior to competing in a 10-mile time-trial race. The results are shown in **Table 1**

Table 1

Drink	Total mass of monosaccharide ingested / g	Completion time of trial / minutes:seconds
Water	0	25:00
Glucose solution	30	23:32
2:1 glucose:fructose mixture	30	20:30

Calculate the percentage improvement in finishing time from using the 2:1 glucose:fructose mixture, to using glucose solution on its own.

.....

.....

(2 marks)

(b) (i) Explain the results in Table 1

(2)

(ii) Criticise the scientific methods used in the study

(2)

The percentage improvement in finishing time is:

- 182 seconds improvement (1,412 - 1,230) **OR** 3 minutes 2 seconds; [1 mark]
- As a percentage of 1412 seconds **OR** of 23.533 minutes
- 12.9% **OR** 13%; [1 mark]

[Total: 2 marks]

When working out percentage changes in time, it is helpful to convert all times into seconds for ease of mathematical calculations. A common mathematical error here would be to use minutes and state that a time of 23:32 = 23.32 minutes. A time of 23:32 is in fact 23.53 minutes, expressed as a decimal.

Table 1

Drink	Total mass of monosaccharide ingested / g	Completion time of time trial / minutes:seconds
Water	0	25:00
Glucose solution	30	23:32
2:1 glucose:fructose mixture	30	20:30

① Convert times into seconds

23:32 → (23 x60) + 32 = 1412 seconds

20:30 → (20 x60) + 30 = 1230 seconds

② Find the difference in time

1412 - 1230 = 182 seconds [1 mark]

③ Calculate percentage change

$$\text{Percentage change} = \frac{\text{final value} - \text{original value}}{\text{original value}} \times 100$$

$$\frac{182}{1412} \times 100 = -12.88\%$$

As the question is asking for percentage improvement we can remove the (-) sign.

12.9% improvement [1 mark]

(d) High-fructose corn syrup (HFCS) is a widely used material in the food industry. Fructose is discerned as sweeter than glucose by human taste buds; this gives food manufacturers the opportunity to maintain food's sweetness by using less carbohydrate material. Fructose is not metabolised in all cells (as glucose is) but is metabolised in the liver to form glycogen and can be subsequently converted to fat. Health campaigners have claimed that increased use of HFCS promotes obesity. Suggest why humans have a mechanism for metabolising fructose.

.....

.....

(2 marks)

Humans can metabolise fructose because...

Any **two** of the following:

- Fructose is a naturally-occurring monosaccharide e.g. in many fruit; [1 mark]
- Fructose has a high calorific content so is a good food source; [1 mark]
- Fructose makes up part of sucrose, so is formed naturally as a digestion product of cane/beet/table sugar; [1 mark]

[Total: 2 marks]

5 (a) Briefly describe **two** experimental methods by which the glycosidic bond in a disaccharide can be broken.

(4 marks)

The glycosidic bond in a disaccharide can be broken by:

- Method: Enzyme hydrolysis; [1 mark]
- Description of method: mix the disaccharide with enzyme at room temperature/40°C; [1 mark]
- Method: Acid hydrolysis; [1 mark]
- Description of method: boil a sample with dilute hydrochloric acid / another strong acid; [1 mark]

[Total: 4 marks]

At least one mention of hydrolysis should be present in your answer.

1 (a) Complete **Table 1** to indicate which of the substances shown in **Table 1** are proteins (or contains protein).

Table 1

Substance	Protein / Not Protein
Starch granules	
Hormones	
Stomach enzymes	
Glycogen	
Muscle tissue	
Haemoglobin	

.....

.....

(2 marks)

1a

2 marks

Complete **Table 1** to indicate which of the substances shown in **Table 1** are proteins (or contains protein).

Show more

Substances shown in **Table 1** that are proteins/not proteins...

Substance	Protein / Not Protein
Starch granules	**Not protein**
Hormones	**Protein**
Stomach enzymes	**Protein**
Glycogen	**Not protein**
Muscle tissue	**Protein**
Haemoglobin	**Protein**

- 6 rows correct; [2 marks]
- 4 or 5 rows correct; [1 mark]
- 0, 1, 2 or 3 rows correct; [0 marks]

[Total: 2 marks]

3 (a) **Table 1** shows selected aspects of protein structure and the level of protein structure to which they each belong.

Table 1

Aspect of protein structure	**Level of structure / primary, secondary, tertiary, quaternary**
α-helix	secondary
Disulfide bridge	
Sequence of amino acids	
?-pleated sheet	
Separate polypeptide chains interacting	
Hydrogen bonds	
Ionic bonds	

Complete **Table 1** using the terms, **primary**, **secondary**, **tertiary** and/or **quaternary**. The first row has been completed for you.

.....

.....

.....

(3 marks)

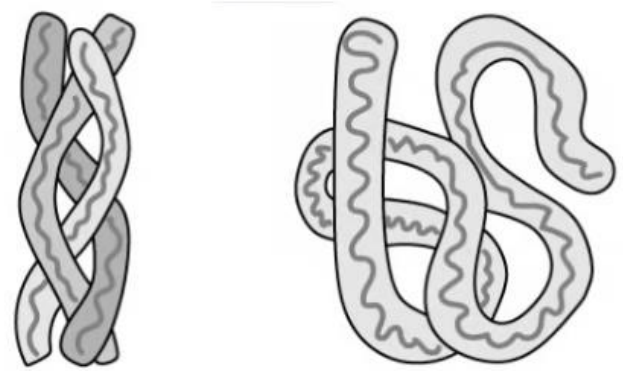
The completed **Table 1** should be as follows...

Aspect of protein structure	Level of structure / primary, secondary, tertiary, quaternary
α-helix	secondary
Disulfide bridge	**tertiary**
Sequence of amino acids	**primary**
β-pleated sheet	**secondary**
Separate polypeptide chains interacting	**quaternary**
Hydrogen bonds	**secondary and tertiary**
Ionic bonds	**tertiary**

- 6 rows correct; [3 marks]
- 4 or 5 rows correct; [2 marks]
- 2 or 3 rows correct; [1 mark]
- 0 or 1 row correct; [0 marks]

[Total: 3 marks]

(b) Two types of protein are shown in **Figure 1**. They are labelled Protein **A** and Protein **B**.



Protein A

Protein B

Identify which of **A** or **B** is a globular protein and give a reason for your choice.

.....

.....

(2 marks)

(c) The Biuret test is a biochemical test for proteins. State the colour change observed in a positive Biuret test.

.....

(1 mark)

(d) The Biuret test is a qualitative test for proteins. Explain why the Biuret test is referred to as 'qualitative'.

.....

.....

(2 marks)

The globular protein is...

- Protein **B**; [1 mark]
- Because it has a more 3-D/spherical structure **OR** Protein A has long strands (and is therefore fibrous); [1 mark]

[Total: 2 marks]

Globular means 'globe-shaped' or spherical. Proteins like haemoglobin and immunoglobulins are shaped in this way, as are many membrane proteins. Fibrous proteins arrange themselves in fibres as the name suggests; these include keratin and collagen.

(d) **Table 1** shows some different types of chemical bond that form in proteins.

Table 1

Bond type	Bond strength / 1 = strongest, 3 = weakest
Hydrogen bonds	
Ionic bonds	
Disulfide bonds	

Complete **Table 1** by ranking the bonds **1**, **2**, and **3** according to their bond strength.

.....

.....

(2 marks)

Table 1 completed as follows...

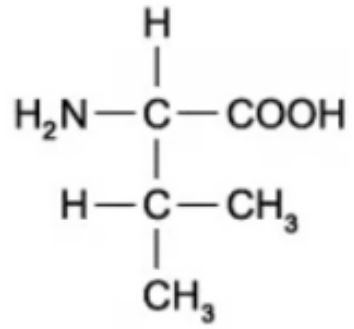
Bond type	Bond strength / 1 = strongest, 3 = weakest
Hydrogen bonds	**3**
Ionic bonds	**2**
Disulfide bonds	**1**

- 3 correct; [2 marks]
- 1 correct; [1 mark]
- 0 correct; [0 marks]

[Total: 2 marks]

Disulfide bonds are full covalent bonds, so are the strongest of the bonds within the structure of a protein. This is followed by ionic bonds and then hydrogen bonds.

Figure 1



Valine
(Val, V)

Draw a circle around the part of the molecule that would be identical in all amino acids.

.....

(1 mark)

(c) Some washing powders contain molecules that break down and hydrolyse the peptide bonds between amino acids. The degree to which a protein is broken down can be called the degree of hydrolysis (DH). The DH value is calculated using the equation

$$\text{DH} = \frac{100 \times \text{Number of peptide bonds hydrolysed}}{\text{Total number of peptide bonds present}}$$

Washing powder was applied to a molecule of protein. The DH value after exposure to the washing powder was 28 and a total of 140 peptide bonds were hydrolysed. Calculate the number of amino acids in the protein.

.....

(1 mark)

- 500 peptide bonds present
- (Meaning there is) 501 amino acids in the protein; [1 mark]

[Total: 1 mark]

Remember that there is always one more amino acid than there are peptide bonds!

① Rearrange equation

$$DH = \frac{100 \times \text{Number of peptide bonds hydrolysed}}{\text{Total number of peptide bonds present}}$$

$$\text{Total number of peptide bonds present} = \frac{100 \times \text{Number of peptide bonds hydrolysed}}{DH}$$

② Sub in known values — We know these from the question.

$$\frac{100 \times 140}{28} = \frac{14000}{28} = 500 \text{ peptide bonds}$$

③ Work out no. of amino acids from no. of peptide bonds

500 + 1 = 501 amino acids. [1 mark]

(b) DNA polymerases are a vital group of enzymes. Different variations are found in all living cells. DNA polymerases are responsible for replicating DNA during semi-conservative replication.

Explain why most cellular enzymes like DNA polymerases are made predominantly from protein.

.....

.....

.....

.....

.....

(5 marks)

Any **five** of the following:

- The structure/shape of a protein relates directly to its function; [1 mark]
- The structure/shape of a protein is determined by the primary structure / amino acid sequence(of the one or more polypeptides the protein is made from) [1 mark]
- The primary structure will fold into a tertiary structure which has a 3D shape; [1 mark]
- This shape/folding of the primary structure is determined by the bonds that occur between amino acids within the primary sequence; [1 mark]
- These bonds include hydrogen, ionic and disulfide bonds;[1 mark]
- If the order of amino acids is changed (within the polypeptide chain) then this affects the bonds that form between amino acids; [1 mark] altering the shape; [1 mark]

[Total: 5 marks]

- It is essential that you are able to relate the **structure** of proteins to its **functions/properties**
- Remember that each protein has its own particular shape and therefore function within a cell, and that **shape is determined by the sequence of amino acids** within the polypeptide chain and how they interact with each other
- **Peptide bonds** only hold amino acids together in the polypeptide chain, they **don't directly influence the 3D structure**, but they are responsible for holding the amino acids in a certain order which affects where hydrogen, ionic and disulfide bonds form

3 (a) Explain how the secondary structure of a protein contributes to its overall 3-D shape.

(4 marks)

(b) Collagen is the most abundant protein in the human body, and is an important element in connective tissue such as skin, bones, teeth and tendons. Collagen contains repeating triplets of the amino acids glycine, proline and hydroxyproline, resulting in a tightly-coiled helix. Glycine is the simplest amino acid, with a single hydrogen atom as its R group, whereas proline and hydroxyproline have large organic R groups.

Suggest and explain a role for glycine as part of the repeating structure.

(2 marks)

Contribution of the secondary structure of protein on its overall 3–D shape:

Any **four** of the following:

- Due to hydrogen bonding; [1 mark]
- Between C=O group and N–H group (of separate amino acids); [1 mark]
- Every four amino acids along the chain; [1 mark]
- The protein forms a right-handed, α-helix; [1 mark]
- A β-pleated sheet forms by folding the chain back on itself in a zig-zag plane; [1 mark]
- Both provide bulk to the protein / extend its 3–D shape; [1 mark]

[Total: 4 marks]

You must avoid the temptation to describe the tertiary structure in detail; this will be ignored and will gain zero marks, even though the tertiary structure is responsible for the fine detail of a protein's overall shape. Restrict your answer to the **alpha-helix** and the **beta-pleated sheet**, which are the two elements of secondary structure in the specification.

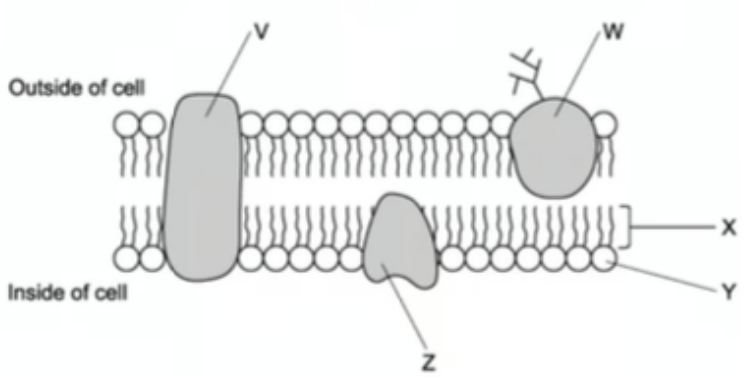
Glycine's role in collagen...

- Is at the centre of the helix / to give strength and stability; [1 mark]
- Has a small R group making it a compact amino acid / to fit into a tight space; [1 mark]

[Total: 2 marks]

5 (a) The diagram in **Figure 1** shows part of a plasma membrane.

Figure 1



Complete **Table 1** below by writing the letter from the diagram which refers to each part of the membrane.

Table 1

Part of membrane	**Letter**
Contains carbon and hydrogen only	
Surface/extrinsic protein	

.....

.....

(2 marks)

- Each correct row; [1 mark]

Table 1

Part of membrane	Letter
Contains carbon and hydrogen only	X
Surface/extrinsic protein	W

[Total: 2 marks]

Structure X is the fatty acid hydrocarbon chain of a phospholipid. The fatty acid chains only contain carbon and hydrogen.

1 (a) Explain the terms 'fluid' and 'mosaic' in the Fluid Mosaic model of membrane structure. Give one advantage of the structure being fluid.

(3 marks)

(b) Give **four** functions of proteins that occupy the plasma membrane.

(4 marks)

Fluid is used because

- Phospholipids / embedded proteins can move around (within a monolayer) relative to each other; [1 mark]

Mosaic is used because

- The phospholipids/proteins resemble a mosaic image when looked at from above; [1 mark]

Plus **one** of the following:

Advantage of the structure being fluid:

- Is that membrane proteins can migrate/diffuse to areas where they are needed; [1 mark]
- Membrane-bound organelles can fuse together **OR** be separated e.g. vesicles forming/fusing with the cell membrane via exo/endocytosis; [1 mark]

[Total: 3 marks]

2 (a) Explain how **three** different factors can affect the fluidity of membranes

(6 marks)

Any **three** pairs from:

Three factors that affect the fluidity of membranes are…

- Temperature; [1 mark]
- High temperatures cause molecules to vibrate more / be more separated / more fluid; [1 mark]

OR

- Proportion of saturated fatty acids in the phospholipid tails; [1 mark]
- Higher proportion of saturated fatty acids increases intermolecular forces / fatty acid chains pack closer together / makes the membrane less fluid; [1 mark]

OR

- Cholesterol content (of the bilayer); [1 mark]
- Cholesterol inserts itself between phospholipid tails / higher cholesterol increases the fluidity **OR** cholesterol can stabilise the membrane at high temperatures; [1 mark]

OR

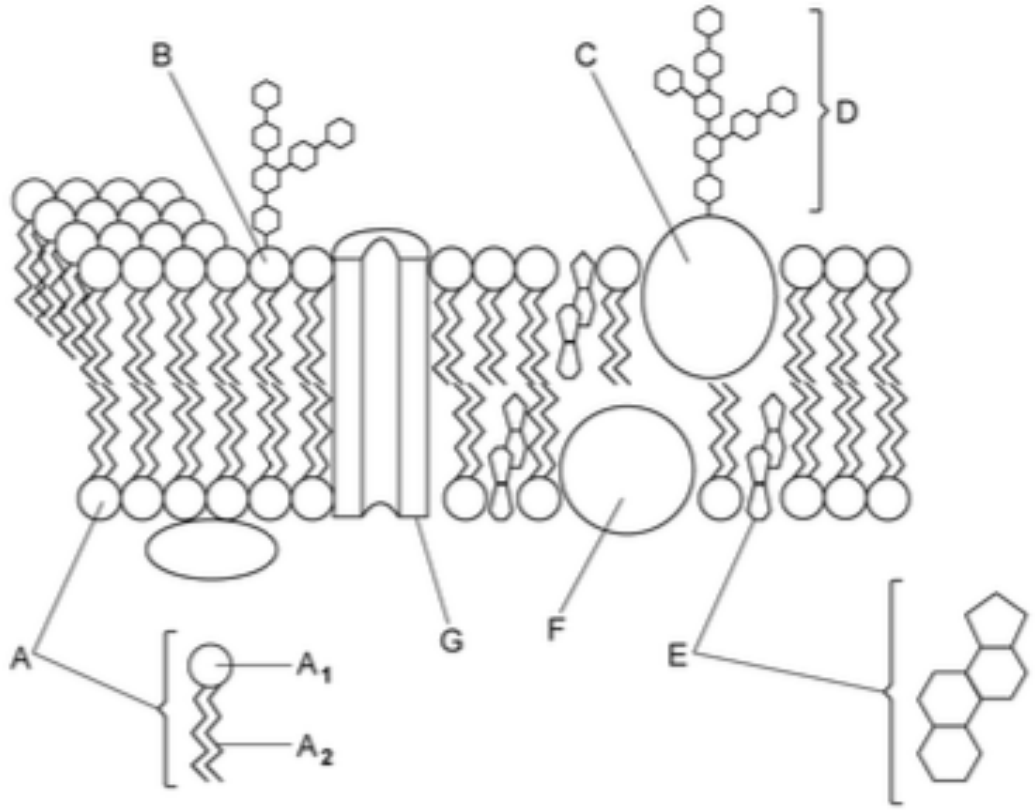
- Length of the fatty acid tails; [1 mark]
- Longer fatty acid tail length causes lesser fluidity / more rigidity – greater intermolecular interactions between fatty acid tails; [1 mark]

Accept converse arguments in each case.

[Total: 6 marks]

Cholesterol has a dual role in regulating fluidity; as well as increasing fluidity at low temperatures (allowing cells to function in cold habitats) cholesterol helps to bind phospholipid tails together at high temperatures, helping to stop the membrane becoming too fluid. This helps in maintaining impermeability and hence the overall cell stability is improved.

(b) Identify the structures labelled in **Figure 1**. In each case, state **one** function of the structure that has been identified.



Structure	Name	Function
A1		
A2		
B		
C		
D		
E		
F		
G		

- Rows A_1 **AND** A_2 correct; [1 mark]
- Rows B, C and D correct; [2 marks]
- Rows E, F and G correct; [2 marks]

Structure	Name	Function
A1	**Phospholipid head**	**Attracts water and polar solutes**
A2	**Phospholipid tail**	**Attracts lipid soluble / hydrophobic molecules OR barrier to polar molecules**
B	**Glycolipid**	**Receptor / antigen / recognition**
C	**Carbohydrate molecule**	**Receptor / antigen / recognition**
D	**Glycoprotein**	**Receptor / antigen / recognition**
E	**Cholesterol**	**Regulates membrane fluidity / assists impermeability**
F	**Extrinsic / peripheral protein**	**To bind carbohydrates OR act as receptors on their own**
G	**Intrinsic / intermembrane channel/carrier protein**	**Osmosis / active transport / diffusion**

[Total: 5 marks]

(d) Distinguish between the features of channel proteins and carrier proteins and their roles in membrane transport.

(4 marks)

The differences between channel and carrier proteins are...

Any **four** of the following:

- Channel proteins are an open 'pore' that can allow polar/hydrophilic molecules to pass through e.g. aquaporins; [1 mark]
- Carrier proteins change shape/conformation, channel proteins do not; [1 mark]
- Active transport requires carrier proteins - these have a site of ATP hydrolysis; [1 mark]
- Carrier proteins can be active or passive / channel proteins are always passive; [1 mark]
- Carrier proteins can transport up or down the concentration gradient / channel proteins always transport down the concentration gradient; [1 mark]

[Total: 4 marks]

It's a part of having good exam technique to realise that the command word 'distinguish' means, 'highlight the differences. So try and avoid listing features that both types of protein have in common, such as, 'both are transmembrane / intrinsic proteins' as this would not be a relevant difference between the two types of protein.

1 (a) Explain two adaptations of alveoli that enable rapid gas exchange.

.....

.....

(2 marks)

Any **two** of the following:

- The alveolar epithelium is only one cell thick **SO** there is a short diffusion pathway/reduces the diffusion distance; [1 mark]
- Many alveoli **SO** there is a large surface area; [1 mark]
- There is a large/extensive network of capillaries / good blood supply **SO** maintaining the concentration gradient; [1 mark]

[Total: 2 marks]

Make sure not to just name two adaptations, you need to **explain how** they help gas exchange take place. Also take care when reading the question, in this particular one they have said the plural "alveoli". In other questions they may specify the singular "alveolus". In that situation you would not get a mark for saying there are a large number of alveoli.

(b) In normal and healthy lungs an oxygen concentration gradient is maintained between the alveoli and the lung capillaries.

Explain how this is maintained.

.....

.....

(2 marks)

Oxygen concentration gradient is maintained by:

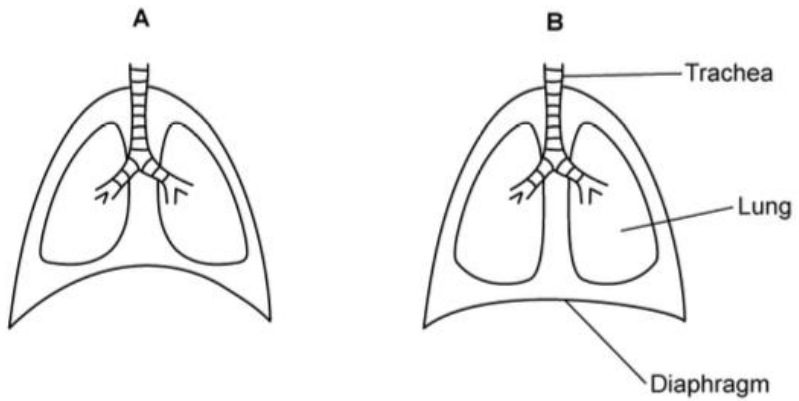
- Ventilation brings in air with a high oxygen concentration **AND** removes air with a low oxygen concentration; [1 mark]
- Blood with a high oxygen concentration is removed from the lungs **AND** blood with a low concentration is brought into the lungs; [1 mark]

[Total: 2 marks]

A large surface area, the maintenance of a concentration gradient and short diffusion distance are three of the requirements for an efficient exchange surface.

6 (a) **Figure 1** shows how the lungs look at two different points of ventilation, **A** and **B**.

Figure 1



State and explain which diagram represents the lungs during inhalation.

.....

(1 mark)

(b) Explain how the lungs are adapted to allow the rapid exchange of oxygen. You must include a description of how oxygen is exchanged into the bloodstream.

.....

.....

.....

.....

.....

(5 marks)

The diagram which represents the lungs during inhalation is:

- Diagram **B** because the diaphragm is contracted / the lung volume is larger; [1 mark]

[Total: 1 mark]

The lungs are adapted to allow rapid exchange of oxygen as:

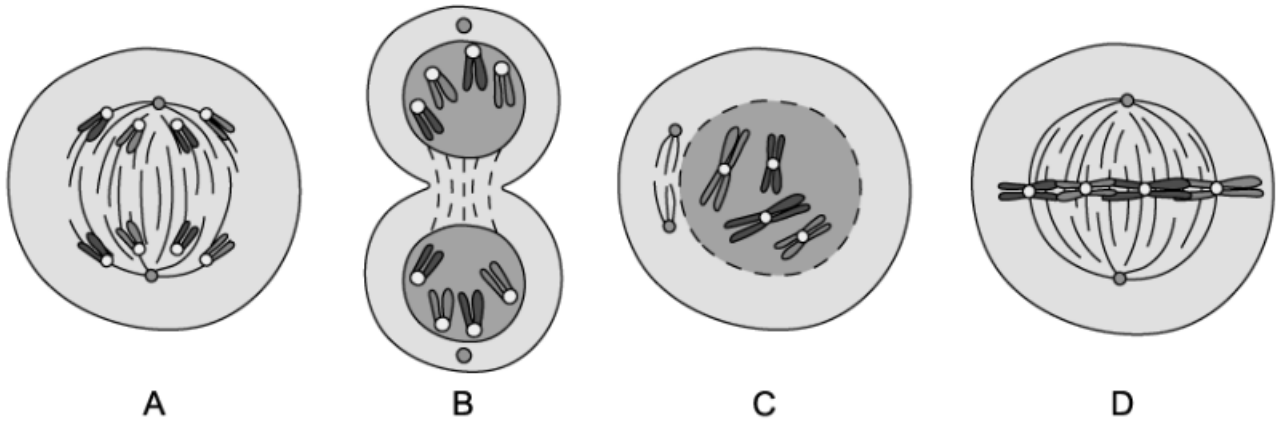
Any **five** from the following:

- The lungs have many alveoli / the alveoli lungs are folded **SO** this creates a large surface area; [1 mark]
- The alveoli are surrounded by many capillaries **SO** there is a good blood supply; [1 mark]
- The blood coming into the lungs (from the pulmonary artery) has a higher concentration of carbon dioxide **SO** the concentration gradient is maintained between the alveoli; [1 mark]
- The walls of the alveoli / capillaries are only one cell thick **SO** this provides a short diffusion pathway; [1 mark]
- Ventilation maintains a concentration gradient **SO** the air breathed in always a has a higher concentration of oxygen compared to the air inside the lungs / the air in the lungs has a higher contraction of carbon dioxide compared to the atmosphere; [1 mark]
- The features all increase the rate of diffusion; [1 mark]

[Total: 5 marks]

(c) **Figure 1** below shows the stages of mitosis in the incorrect order.

Figure 1



List the stages **A**, **B**, **C** and **D** from **Figure 1** with the numbers 1 - 4 to indicate the order in which they occur in mitosis.

.....

5 (a) **Table 1** below contains some information about cell division in eukaryotic and prokaryotic cells.

Table 1

Eukaryotic cells	Prokaryotic cells
2 daughter cells produced	2 daughter cells produced
Daughter cells are genetically identical to parent	**A**
B	Circular chromosome and plasmids are replicated
Carry out mitosis	**C**
Nuclear membrane breaks down during cell division	**D**

Use your knowledge of cell division to complete **Table 1**

.....

.....

.....

.....

(4 marks)

The gaps marked **A–D** contain...

- **A** = Daughter cells are genetically identical to parent; [1 mark]
- **B** = Linear chromosomes are replicated; [1 mark]
- **C** = Carry out binary fission; [1 mark]
- **D** = Cells do not contain a nuclear membrane; [1 mark]

[Total: 4 marks]

2 (a) A student is confused by two similar terms they learnt about in class: 'chromosome' and 'chromatid'. They can no longer remember the difference between the two terms.

The student asks you for help.

i) Describe what chromosomes are.

(1)

ii) Describe what chromatids are.

(2)

.....

.....

.....

(3 marks)

i) Chromosomes are:

- Molecules of DNA associated with proteins/histones; [1 mark]

ii) Chromatids are:

- Replicates/copies of a chromosome joined at the centromere; [1 mark]

[Total: 2 marks]

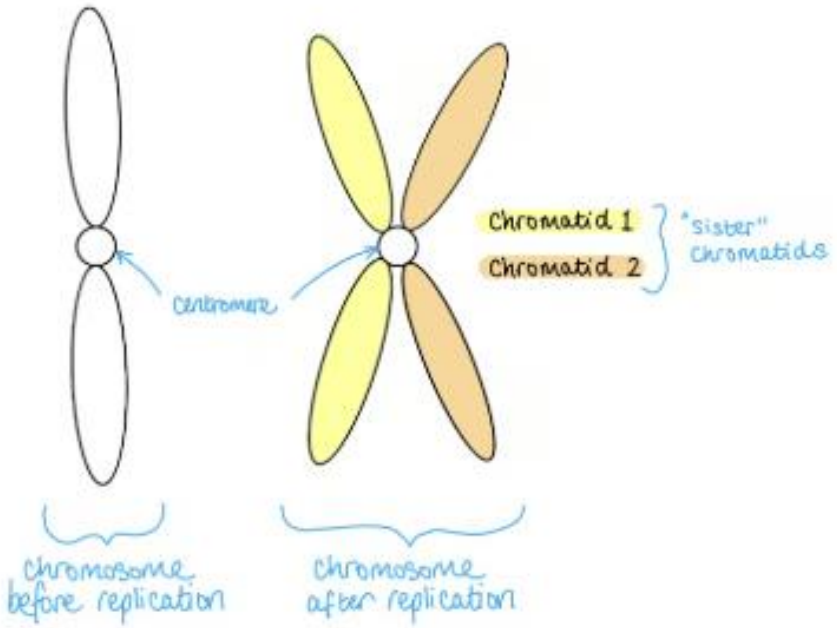
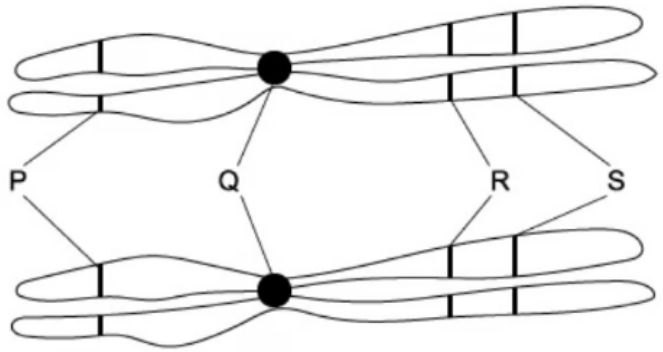


Figure 1



Regarding the diagram in **Figure 1**:

(i) State what **P**, **R** and **S** represent.

(1)

(ii) Describe what happens to **Q** during anaphase.

(2)

.....

.....

(2 marks)

1 (a) During interphase in eukaryotic cells, DNA replication takes place. Explain why one strand of DNA replicates continuously, whereas the opposite strand replicates discontinuously.

(5 marks)