

Specialised Cells

Mark Scheme



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1. The figure below shows four different specialised cells.

a) Which cells are involved in the transport of water?

B – is the only correct answer.	1 mark
	Total: 1 mark

b) The figure below shows four different specialised cells.

Which cells provide a large surface area for absorption? Circle the letter of the correct answer.

D – is the only correct answer.	1 mark
	Total: 1 mark

c) The figure below shows a human sperm cell.

Which structure of the sperm cell digests the cell membrane of an ovum cell?

A – is the only correct answer.	1 mark
	Total: 1 mark

(Total for Question 1 is 3 marks)

2. A student entered a competition to build models of plant root hair cells. The figure below shows the plan that student used to build their model.

a) Describe how a root hair cell is adapted for its role in the absorption of water and minerals from the soil.

A description to include the following:	
Large Surface Area – Root hair cells have a long, thin, extensions . This increases the surface area in contact with the soil. A larger surface area allows for a greater area for water and minerals to be absorbed across the cell membrane.	1 mark
Concentration gradient: Root hair cells maintain a higher concentration of solutes inside the cell than in the surrounding soil water. This causes water to move into the cell by osmosis (from a region of high water concentration to a region of low water concentration).	1 mark
Thin Cell Wall – The cell wall of a root hair cell is thin. This reduces the diffusion distance for water and mineral ions to travel from the soil into the cytoplasm of the cell.	1 mark
Mitochondria – Root hair cells have numerous mitochondria. These organelles provide the energy (in the form of ATP) needed for active transport of mineral ions from the soil into the cell, against their concentration gradient.	1 mark
	Total: 4 marks

b) Explain why there are **no** chloroplasts present in root hair cells.

A explanation to include the following:	
Chloroplasts are the <u>site of photosynthesis</u> .	1 mark
No light – Root hair cells are underground in the soil. There is no light underground for photosynthesis to occur.	1 mark
Accept differently worded answers that convey the same meaning.	
	Total: 2 marks

(Total for Question 2 is 6 marks)

3. The figure below shows a sample of red blood cells as seen under an electron microscope.

Red blood cells are specialised cells.

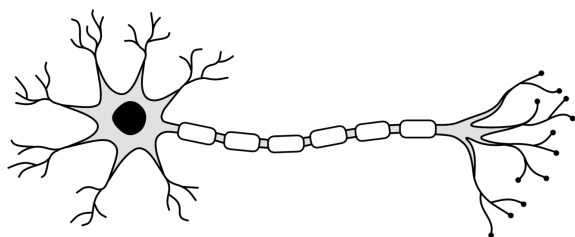
Describe the function and adaptations of a red blood cell that allow it to efficiently carry out its function.

Marking guidance		
Level	Marks	Descriptor
Level 1	1 - 2	Basic understanding. States <u>one or two relevant adaptations</u> of red blood cells. May be vague or lack detail.
Level 2	3 - 4	Good understanding. Describes <u>two or three relevant adaptations</u> with some detail. Begins to explain how these adaptations aid oxygen transport.
Level 3	5 - 6	Excellent understanding. Describes <u>all four relevant adaptations</u> with clear and detailed explanations of how each adaptation contributes to efficient oxygen transport. Demonstrates a thorough knowledge of red blood cell structure and function.

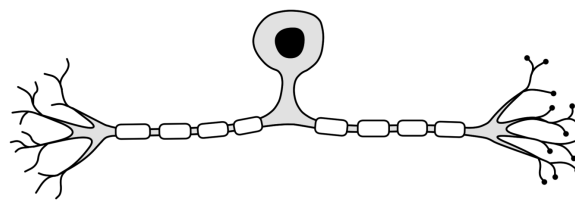
A description to include the following:	
<u>Function</u> : red blood cells carry oxygen around the body for aerobic respiration in tissues. <u>Note</u> : a link to aerobic respiration must be made for the mark.	
<u>Biconcave shape</u> – this gives the cell a larger surface area than if they were just round. This allows them to therefore carry more oxygen.	
<u>Haemoglobin</u> – this protein allows oxygen to bind the cell. This allows the cell to carry oxygen around the body in blood vessels.	
<u>No nucleus or organelles</u> – this enables red blood cells to have more room for haemoglobin and they will therefore carry more oxygen.	
<u>Small size</u> – this ability allows red blood cells to pass through capillaries which are quite narrow.	
	Total: 6 marks

(Total for Question 3 is 6 marks)

4. The figure below shows two different types of neurone cells. A motor and a sensory neurone.



Motor neurone



Sensory neurone

Neurone cells are adapted to carry electrical impulses throughout the nervous system.

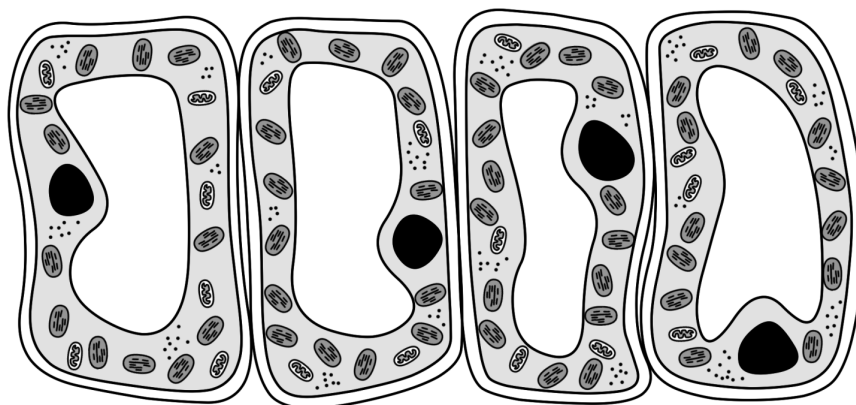
State the function of both motor and sensory neurones and describe the adaptations of neurones that allow them to efficiently carry out its function.

Marking guidance		
Level	Marks	Descriptor
Level 1	1 - 2	Basic understanding. States one or two relevant adaptations of neurones. May be vague or lack detail
Level 2	3 - 4	Good understanding. Describes several relevant adaptations with some detail. Begins to explain how these adaptations aid impulse transmission.
Level 3	5 - 6	Excellent understanding. Describes multiple relevant adaptations with clear and detailed explanations of how each adaptation contributes to efficient impulse transmission. Demonstrates a thorough knowledge of neurone structure and function.

A description to include the following:	
<u>Long axon</u> – to carry the impulse to the target organ.	
<u>Myelin sheath</u> – this insulates the axon and speeds up the rate of transmission of the impulse.	
<u>Neurotransmitter molecules</u> – these are chemicals that allow impulses to travel from neurone to neurone.	
<u>Many dendrites</u> – this increases the surface area of the neurone to receive neurotransmitter molecules from another neurone.	
Marking note: the student must use the term impulse in the correct context at least once to be able to score six marks in this question.	
	Total: 6 marks

(Total for Question 4 is 6 marks)

5. A student entered an art project and wanted to use a repeating design that used palisade cells. The figure below shows the diagram of the cells that the student intended to use in their pattern.



- a) Describe the function of the chloroplast in a palisade cell.

A description to include the following:	
Chloroplasts are the <u>site of photosynthesis</u> .	1 mark
	Total: 1 mark

- b) Explain why palisade cells contain a large number of chloroplasts.

A description to include any two of the following:	
<u>To maximise light absorption</u> – having a large number of chloroplasts in each cell increases the amount of light energy that will be captured for photosynthesis.	1 mark
<u>More chlorophyll</u> – more chloroplasts mean more chlorophyll. Chlorophyll is the green pigment that absorbs light energy for photosynthesis.	1 mark
<u>More photosynthesis</u> – more chloroplasts mean more photosynthesis can occur.	1 mark
	Total: 2 marks

- c) Palisade cells have a large vacuole. Explain the role of the vacuole in a palisade cell and describe how it contributes to the cell's overall function

A description to include any two the following:	
<u>Storage of water</u> – the vacuole is involved in storing water for the cell.	1 mark
<u>Maintains the shape of the cell</u> – the vacuole is involved in maintaining the shape of the cell.	1 mark
	Total: 2 marks

Palisade cells are surrounded by a cell wall.

- d) State what the cell wall of a plant cell is made of and give function of the cell wall in a palisade cell.

Plant cell walls are made of cellulose.	1 mark
Plant cell walls give <u>structure and support</u> to the cell.	1 mark
	Total: 2 marks

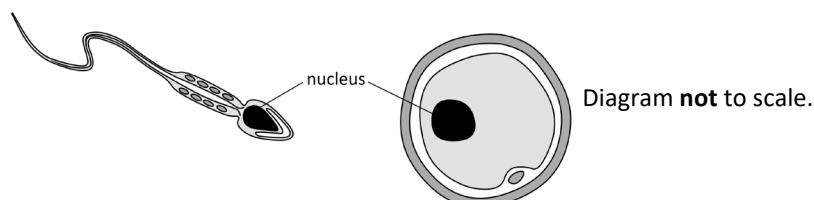
(Total for Question 5 is 7 marks)

6. Humans reproduce sexually.

a) In terms of gametes, describe what is meant by sexual reproduction.

A description to include the following:	
Sexual reproduction is the <u>fusion</u> of two gametes	1 mark
To produce a zygote.	1 mark
	Total: 2 marks

b) The figure below shows the human gametes, sperm and ovum.



Describe **two similarities** between the sperm cell and the ovum cell.

A description to include any two the following:	
Similarity 1: Both have a nucleus.	1 mark
Description: which contains haploid / half the number of chromosomes / genetic information.	1 mark
Similarity 2: Both contain mitochondria.	1 mark
Description: to provide energy / carry out aerobic respiration.	1 mark
Similarity 3: Both have a cell membrane.	1 mark
Description: which controls what enters and leaves the cell.	1 mark
Similarity 4: Both contain cytoplasm.	1 mark
Description: where chemical reactions take place.	1 mark
	Total: 4 marks

c) In terms of how the gametes are adapted for their roles.

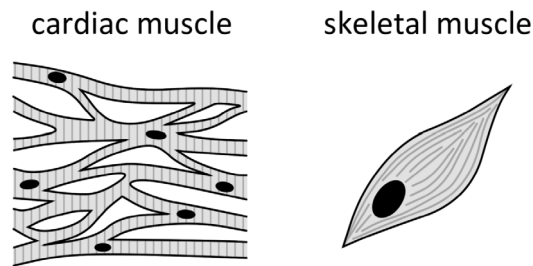
Describe **two differences** between the sperm cell and the ovum cell.

A description to include any two the following:	
Sperm cells have:	
Difference: A flagellum (do not accept tail).	
Description: which is used to move the sperm.	
Difference: An acrosome	
Description: which digests an opening into the ovum cell.	
Ova have:	
Difference: A cell membrane	
Description: which only allows <u>one</u> sperm to enter.	
Difference: A large amount of cytoplasm.	
Description: this provides the energy for the dividing embryo.	
	Total: 4 marks

(Total for Question 6 is 10 marks)

7. The figure below shows a small section of cardiac muscle and skeletal muscle.

Using your own knowledge and the figures below. Compare and contrast the function and adaptations of cardiac muscle and skeletal muscle. Your answer should include details of their roles in the body



Marking guidance		
Level	Marks	Descriptor
Level 1	1 - 2	Identifies one or two relevant characteristics or functions of either cardiac or skeletal muscle.
Level 2	3 - 4	Describes several characteristics and/or functions of both cardiac and skeletal muscle, but may lack clear comparisons or contrasts. Shows some understanding of how structure relates to function
Level 3	5 - 6	Provides a clear and detailed comparison and contrast of cardiac and skeletal muscle, including their functions, adaptations, and structural suitability. Explains how their structures are specifically adapted to their roles. Uses appropriate scientific terminology accurately. Demonstrates a thorough understanding of the differences and similarities between the two muscle types..

A description to include the following:	
Function of cardiac muscle – pumping oxygenated blood around the body.	
Function of skeletal muscle – movement of the body. Accept any correct muscle movement that moves the skeleton as an example.	
Adaptations of cardiac muscle: - Is made of branched muscle fibres. - Huge numbers of mitochondria for aerobic respiration. - Does not tire. Cardiac muscle does not get tired.	
Adaptations of skeletal muscle: - Is made of long muscle fibres. - Tendons – skeletal muscles have tendons which join the muscles to bones.	
	Total: 6 marks

(Total for Question 7 is 6 marks)