IGCSE · Edexcel · Biology

10 questions

Practice test Mark scheme

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Total Marks **/85**

1 (a) Bread contains starch.

Describe how you would test a piece of bread to show it contains starch.

Answer

To test a piece of bread to show it contains starch you would...

- (Use/add) iodine (solution); [1 mark]
- (Which would turn) blue-black/ blue / black (if starch was present); [1 mark]

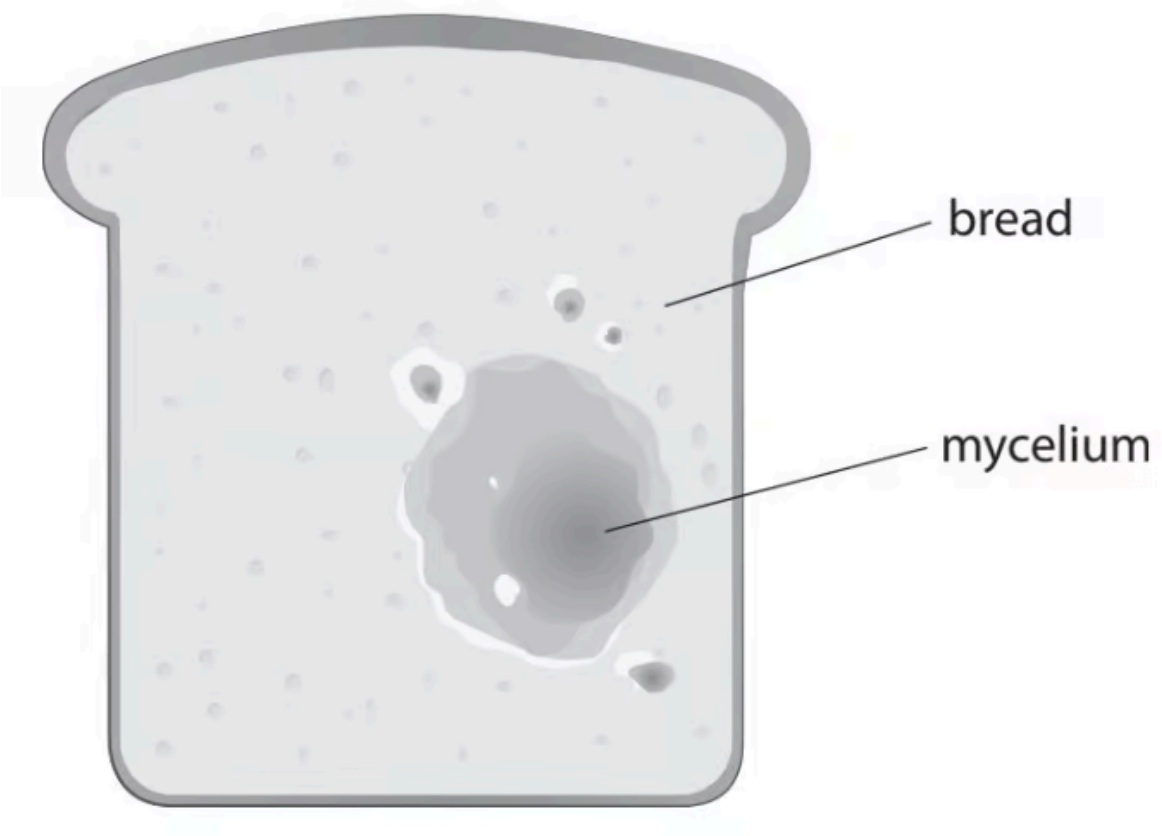
Accept *purple for blue-black.*

[Total: 2 marks]

You would also get the mark if you described the colour change as purple but the correct colour that examiners look for is blue-black.

(2 marks)

(b) The diagram shows the mycelium of an organism growing on a piece of bread.



(i) Which type of organism is shown growing on the bread?

(1)

☐	**A**	Bacterium
☐	**B**	Fungus
☐	**C**	Protoctist
☐	**D**	Virus

(ii) Which enzyme is released by the organism to digest starch?

(1)

☐	**A**	Amylase
☐	**B**	Ligase
☐	**C**	Lipase
☐	**D**	Protease

Answer

(i) **The correct answer is B because...**

Multicellular fungi are mainly made up of thread-like structures known as hyphae that contain many nuclei and are organised into a network known as a **mycelium**.

A is incorrect because mycelium is not found in bacterial cells.

C is incorrect because mycelium is not found in protoctista.

D is incorrect because mycelium is not found in a virus

(ii) **The correct answer is A because...**

Amylase is a type of carbohydrase enzyme that digests starch into maltose.

B is incorrect because ligase is an enzyme that can catalyse the joining (ligation) of two large molecules by forming a new chemical bond.

C is incorrect because lipase is an enzyme that digests fats (lipds) into fatty acids and glycerol.

D is incorrect because proteases are a group of enzymes that digest proteins into amino acids.

Just because this question is not about humans, the same principles and knowledge applies to enzymes here. All living organisms make enzymes to support their survival.

[Total: 2 marks]

(2 marks)

2 (a) Organisms must transport substances to and from the external environment.

Identify **one** substance which cells must transport across the cell membrane to support cell functions.

Answer

A substance that cells must transport across the cell membrane might include:

Any **one** from the following:

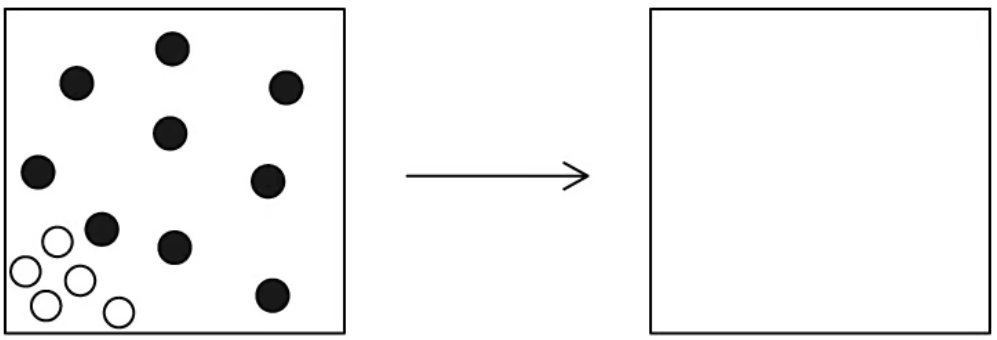
- Carbon dioxide / oxygen; [1 mark]
- Glucose / amino acids / fatty acids + glycerol; [1 mark]
- Mineral ions / water; [1 mark]

[Total: 1 mark]

There are many substances that cells need which exceed the list given in this mark scheme. The substances named in this question are key to the most fundamental processes that take place in cells, including photosynthesis and respiration.

(1 mark)

(b) The diagram shows particles of two gases.



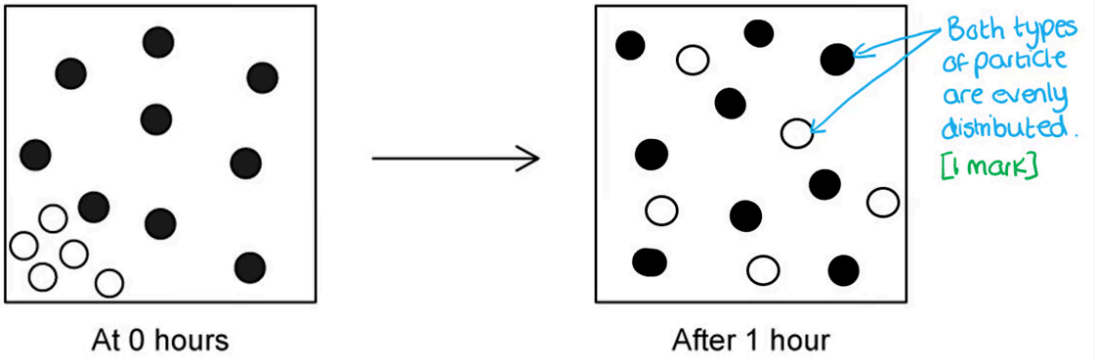
Complete the diagram by drawing the arrangement of the gas particles after 1 hour.

Answer

The gas particles should appear as follows:

- The particles should be evenly distributed in the space; [1 mark]

[Total: 1 mark]



(1 mark)

(c) Name the process shown in part (b).

Answer

The process in part (b) is...

- (Simple / gaseous) diffusion; [1 mark]

[Total: 1 mark]

This couldn't be osmosis as there are no water particles or partially permeable membrane.

(1 mark)

(d) Which of the following is an example of simple diffusion?

□	**A**	Movement of water into the root of a plant
□	**B**	Movement of mineral ions into the root of a plant
□	**C**	Movement of oxygen into the leaf of a plant
□	**D**	Movement of glucose into the epithelial cells of villi in the small intestine

Answer

The correct answer is C, movement of oxygen into the leaf of a plant.

B and **D** are both examples of where substances move from a low concentration to a higher concentration requiring the process of active transport.

A is referring to water molecules passing across a partially permeable membrane and therefore relates to osmosis.

[Total: 1 mark]

(1 mark)

3 (a) Which of the following correctly shows the levels of organisation in an organism in order of size from the smallest to the largest?

☐	**A**	Organelle, cell, organ, tissue, organ system
☐	**B**	Organelle, cell, tissue, organ, organ system
☐	**C**	Cell, organelle, tissue, organ, organ system
☐	**D**	Cell, tissue, organelle, organ, organ system

Answer

The levels of organisation from the smallest to the largest is **B**.

This is because organelles are found within cells, a group of cells makes up a tissue, a group of tissues makes up an organ, and several organs make up an organ system.

[Total: 1 mark]

(1 mark)

(b) State the meaning of the term **organ**.

Answer

The term organ can be defined as follows...

- A group/collection of tissues...; [1 mark]
- ...working together to carry out a function; [1 mark]

[Total: 2 marks]

The term organ is one that you will be very familiar with, but it is essential that you can give the biological definition; an organ is a group of tissues that work together to perform a particular function, E.g. the heart contains muscle tissue, elastic tissue and connective tissue, all of which work together to pump the blood.

(2 marks)

(c) Name an example of an organ found in the following groups of organisms:

(i) Plants

(1)

(ii) Animals

(1)

Answer

(i) An example of an organ found in plants is...

Any **one** of the following:

- Stem; [1 mark]
- Root; [1 mark]
- Flower; [1 mark]
- Bulb; [1 mark]
- Tuber; [1 mark]
- Leaf; [1 mark]
- Fruit; [1 mark]

(ii) An example of an organ found in animals is...

Any **one** of the following:

- Brain; [1 mark]
- Skin; [1 mark]
- Heart; [1 mark]
- Lung; [1 mark]
- Liver; [1 mark]

- Kidney; [1 mark]
- Small / large intestine; [1 mark]
- Stomach; [1 mark]
- Eye; [1 mark]
- Ear;

Accept other examples of animal organs, e.g. from the reproductive system.

[Total: 2 marks]

There are many examples to choose from here, so make sure that you can name a few examples of organs in both plants and animals.

(2 marks)

(d) Give two differences between organisms in the plant group and organisms in the animal group.

Answer

Differences between organisms in the plant and animal groups include...

Any **two** of the following:

- Plants carry out photosynthesis / have chloroplasts / make their own food **WHILE** animals do not / feed on other organisms; [1 mark]
- Plants have (cellulose) cell walls **WHILE** animals do not; [1 mark]
- Plants store carbohydrates as starch **WHILE** animals store carbohydrates as glycogen; [1 mark]
- Plants do not have a nervous system / nervous co-ordination **WHILE** animals do; [1 mark]
- Plants (usually) grow in one place / are immobile / not motile **WHILE** animals can (usually) move from place to place / are mobile/motile; [1 mark]

[Total: 2 marks]

This question covers content from section 1 on the variety of living organisms.

(2 marks)

4 (a) Plant roots absorb water from soil.

This water is transported to the leaves and then moves into the air.

Identify which of these processes is used to absorb water from the soil.

☐	**A**	Active transport
☐	**B**	Diffusion
☐	**C**	Evaporation
☐	**D**	Osmosis

Answer

The correct answer is D because...

Osmosis is always how water moves from the soil into the roots. Osmosis involves the movement of water from a high water potential area to a low water potential across a partially permeable membrane.

A is incorrect because water is not transported by the process of active transport.

B is incorrect because osmosis is a form of diffusion but water specifically moves by osmosis.

C is incorrect because water does not evaporate from the soil into the roots of the plant. The water in the roots of the plant is liquid, not a gas.

[Total: 1 mark]

(1 mark)

(b) Name the tissue that transports water to the leaves.

Answer

The tissue that transports water to the leaves is...

- Xylem/xylem vessels; [1 mark]

[Total: 1 mark]

(1 mark)

(c) Separate: Biology Only

Name the process that moves water vapour into the air.

Answer

The process that moves water vapour into the air is...

- Transpiration / evaporation / diffusion / evapotranspiration; [1 mark]

[Total: 1 mark]

(1 mark)

(d) Separate: Biology Only

Identify which of these reduces the movement of water from the leaves into the air.

☐	**A**	High light intensity
☐	**B**	Low air humidity
☐	**C**	Low air temperature
☐	**D**	Windy conditions

Answer

The correct answer is C because...

Low air temperature reduces the movement of water from the leaves into the air because the water molecules have lower kinetic energy.

A is incorrect because high light intensity increases the movement of water because it causes more stomata to open underneath the leaf to allow for more CO_2 to enter the leaf for photosynthesis.

B is incorrect because low air humidity increases the movement of water because it increases the diffusion gradient for water to move out of the leaf.

D is incorrect because windy conditions increase the movement of water because it increases the diffusion gradient for water to move out of the leaf.

[Total: 1 mark]

(1 mark)

(e) Give two uses of water in a plant.

Answer

Two uses of water in a plant are...

Any **two** of the following:

- Support/turgor / maintaining the rigid structure of plant cells; [1 mark]
- Photosynthesis; [1 mark]
- Cooling; [1 mark]
- Reactions/solvent / transport of mineral ions/named mineral ion; [1 mark]

[Total: 2 marks]

Transpiration is not a *use* of water in the plants because it is how plants lose water, although it does contribute to cooling.

(2 marks)

5 (a) Different groups of organisms have different features.

Complete the table by placing a tick [✓] in the boxes to show which features are present in each group of organisms.

Some have been completed for you.

Group	Cells have a cell wall	Cells are eukaryotic	Can carry out saprotrophic nutrition
Fungi			
Bacteria	✓		
Plant		✓	

Answer

The completed table is as follows...

Award 1 mark for each correct **row**:

Group	Cells have a cell wall	Cells are eukaryotic	Can carry out saprotrophic nutrition
Fungi	✓	✓	✓
Bacteria	✓		✓
Plant	✓	✓	

[Total: 3 marks]

(3 marks)

(b) Plants are able to store carbohydrates in their cells as starch or sucrose.

(i) Explain how plants are able to synthesise starch.

(2)

(ii) Describe the test that could be carried out to determine whether or not a plant cell contains starch.

(2)

Answer

(i) Plants synthesise starch by...

- (Joining together) glucose; [1 mark]
- (Excess) from photosynthesis; [1 mark]

Starch is a biological molecule that is made from many **molecules of glucose joined together** in a chain. Plants **make glucose during photosynthesis** and then the molecules of glucose are **joined together to produce starch**.

(ii) A test to identify starch in a plant cell is...

- Add iodine; [1 mark]
- Cells should turn blue/black in the (presence of starch); [1 mark]

[Total: 4 marks]

(4 marks)

(c) One of the features of plant cells is that they contain chloroplasts.

Suggest why root hair cells in plants do not contain chloroplasts.

Answer

Root hair cells do not contain chloroplasts because...

Any **two** of the following:

- Chloroplasts absorb light energy for photosynthesis / carry out photosynthesis using light energy; [1 mark]
- Root hair cells do not have light / are underground; [1 mark]
- Chloroplasts are not involved in the absorption of water/minerals from the soil (which is the role of root hair cells); [1 mark]

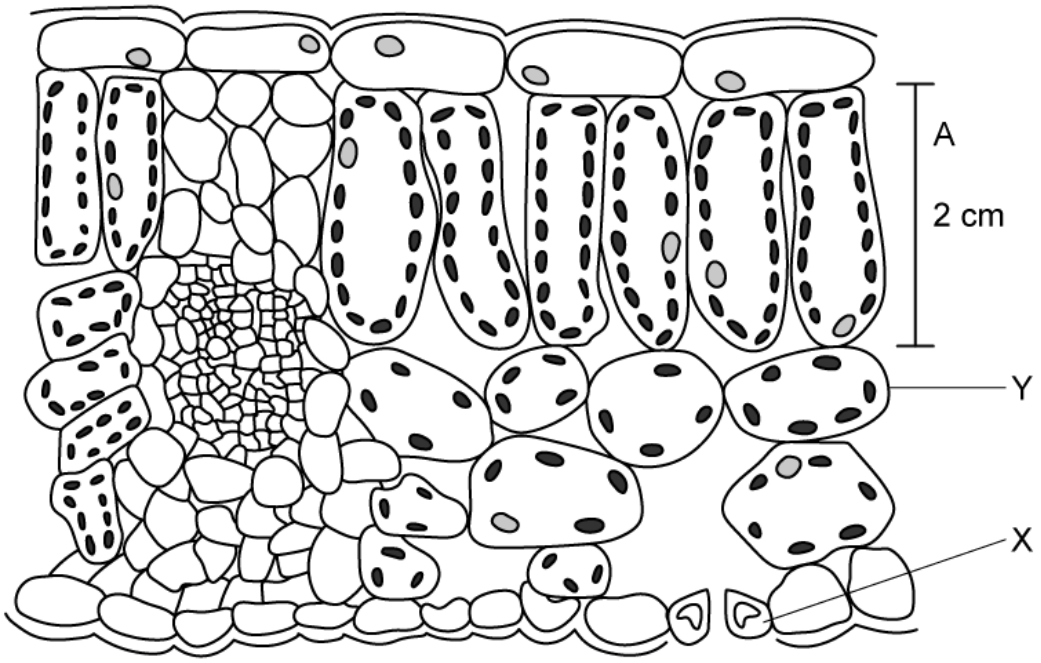
[Total: 2 marks]

It is also important to remember that chloroplasts are not unique to plant cells, for example, some protoctists can also contain chloroplasts.

(2 marks)

6 (a) Separate: Biology Only

The image shows the cross section of a leaf.



(i) Identify the cells labelled **X** and **Y**.

(2)

(ii) Describe how the arrangement of cells such as Y help to maximise gas exchange in the leaf.

(2)

Answer

(i) X and Y are...

- X = guard cells; [1 mark]
- Y = spongy mesophyll cells; [1 mark]

(ii) The spongy mesophyll cells are arranged to maximise gas exchange as follows:

- They are loosely packed **OR** there are air spaces between cells; [1 mark]

- This allows movement of gases / allows gases to diffuse into/out of the leaf; [1 mark]

[Total: 4 marks]

(4 marks)

(b) Separate: Biology Only

Complete the table by adding an **X** to correctly identify the processes involved in controlling the opening and closing of the stomata.

	Water moves in to guard cells	**Water moves out of guard cells**	**Cells become flaccid**	**Cells become turgid**
Stomata open				
Stomata close				

Answer

The table should be completed as follows...

Award 1 mark for each correct **row**:

	Water moves in to guard cells	**Water moves out of guard cells**	**Cells become flaccid**	**Cells become turgid**
Stomata open	**X**			**X**
Stomata close		**X**	**X**	

[Total: 2 marks]

Although this is a straightforward recall question, the content that it covers can be tricky to remember. The mechanism by which stomata open and close can feel a little bit counterintuitive, so make sure that you spend time learning it.

(2 marks)

(c) Separate: Biology Only

Explain why plants only absorb carbon dioxide during the day.

Answer

Plants only absorb carbon dioxide during the day because...

- Carbon dioxide is required / is a reactant for photosynthesis; [1 mark]
- Plants can only photosynthesise when there is light (i.e. during the daytime); [1 mark]

[Total: 2 marks]

(2 marks)

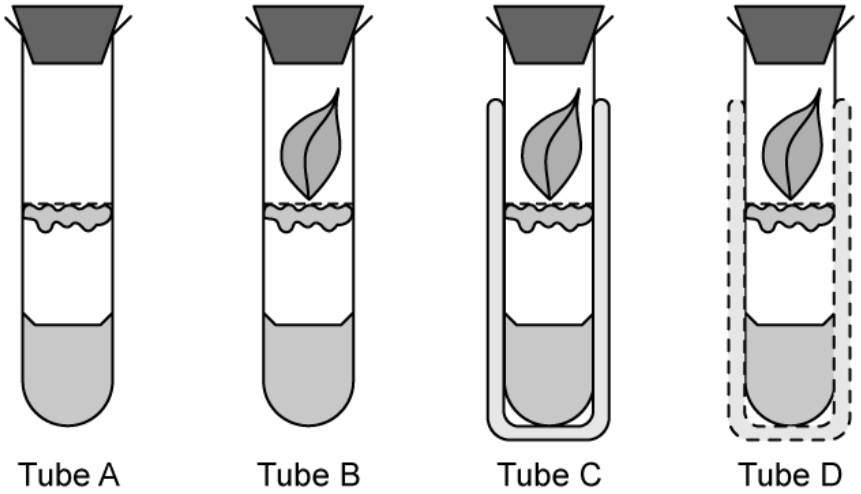
(d) Separate: Biology Only

Some students set up an investigation into the effect of light on gas exchange in plants.They set up four boiling tubes as follows:

- Tube **A** contained no leaf
- Tube **B** contained a leaf and was placed in sunlight
- Tube **C** contained a leaf but sunlight was blocked out using tin foil
- Tube **D** contained a leaf but sunlight was partially blocked out using gauze

The students used hydrogen carbonate indicator to show the changes in carbon dioxide level for the four tubes over 30 minutes. Hydrogen carbonate indicator is an orange

solution that turns yellow when carbon dioxide levels are high, and purple when carbon dioxide levels are low.



Explain the outcome that will be observed for the following:

(i) Tube B.

(2)

(ii) Tube C.

(2)

Answer

(d) (i) The outcome for tube B will be as follows...

Any **two** of the following:

- Tube B will turn purple; [1 mark]
- The leaf is photosynthesising faster than it is respiring (because bright light is available); [1 mark]
- The leaf is using up carbon dioxide faster than it is respiring (because bright light is available); [1 mark]

(ii) The outcome for tube C will be...

Any **two** of the following:

- Tube C will turn yellow; [1 mark]
- The leaf is respiring faster than it is photosynthesising / has stopped photosynthesising but is still respiring (due to being in the dark); [1 mark]
- The leaf is producing carbon dioxide faster than it is using it (due to being in the dark); [1 mark]

[Total: 4 marks]

This is a practical that you should have some familiarity with, though the question does provide you with all the information needed to answer the question. You need to consider the balance between the rate of photosynthesis and the rate of respiration. In bright light photosynthesis will always occur at a higher rate than respiration.

Note that this is an **explain** question, so you need to say **why** the result will occur for full marks.

(4 marks)

7 (a) Which of the following statements relating to respiration is **not** correct?

□	**A**	Respiration produces ATP
□	**B**	Respiration involves the breaking of bonds within biological molecules
□	**C**	Respiration occurs in animals but not in plants
□	**D**	Respiration releases energy in the form of heat

Answer

The correct answer is C because...

Respiration is one of the MRS C GREN life processes, and it occurs (in some form) in the cells of **all living organisms**. It is an essential chemical reaction that releases the energy needed by organisms for survival. The confusion around plants often comes from the fact that plants carry out photosynthesis; remember that **plants carry out respiration as well as photosynthesis** (in fact photosynthesis produces the glucose that plants then use in respiration).

A is a correct statement because the energy released during respiration is then stored within the bonds of a molecule known as ATP. The energy can be released quickly from ATP for any process that needs it.

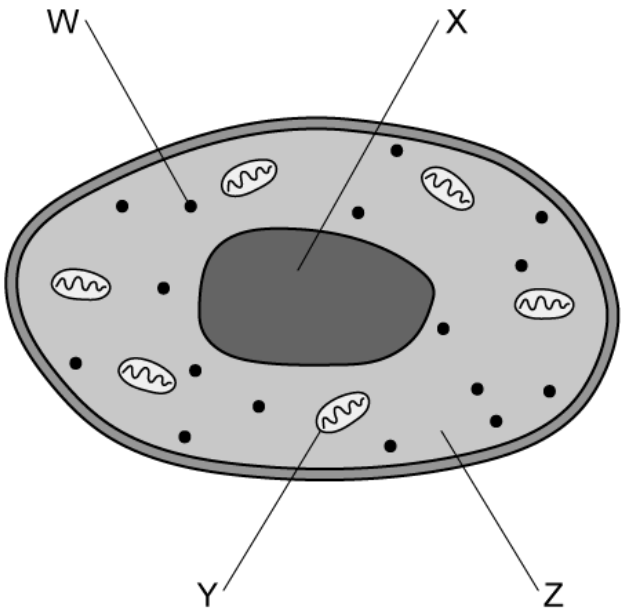
B is a correct statement because the bonds in glucose are broken during respiration, releasing the chemical energy stored within them.

D is a correct statement because some of the energy released during respiration is in the form of heat. This heat energy can be used by some organisms to assist in the regulation of body temperature

[Total: 1 mark]

(1 mark)

(b) The diagram shows an animal cell.



(i) Identify the letter, from **W**-**Z**, that indicates the sub-cellular structure where respiration takes place.

(1)

(ii) Name the sub-cellular structure identified in part (i),

(1)

Answer

(i) The sub-cellular structure where respiration takes place is....

- Y; [1 mark]

(ii) The name of the structure is the...

- Mitochondrion/mitochondria; [1 mark]

[Total: 2 marks]

(2 marks)

(c) Complete the following sentence about respiration:

glucose	chemical	protein	cell
muscle	temperature	nerve	

Respiration releases energy from ..... . The energy release can be used in life processes such as ..... reactions, ... contraction and maintaining a constant body ..... .

Answer

The sentence should be completed as follows...

- Respiration releases energy from **glucose**; [1 mark], to be used in life processes such as **chemical**; [1 mark] reactions, **muscle**; [1 mark] contraction and maintaining a constant body **temperature**; [1 mark].

[Total: 4 marks]

The energy stored in glucose is **chemical energy**. This energy is transferred to other forms of energy once it is released during the process of respiration.

(4 marks)

(d) Complete the table with a (✓) or a (**X**) to show the products and reactants of aerobic respiration in animals.

	Product	Reactant
Oxygen		
Carbon dioxide		
Lactic acid		
Glucose		
Water		
Ethanol		

Answer

The table should be completed as follows...

Award 1 mark for each correct **column**:

	Product	Reactant
Oxygen	**X**	✓
Carbon dioxide	✓	**X**
Lactic acid	**X**	**X**
Glucose	**X**	✓
Water	✓	**X**
Ethanol	**X**	**X**

[Total: 2 marks]

It is important to make sure you read the instructions carefully and fill every box with either a (✓) or a (**X**). Leaving blank spaces will result in the marks being lost.

You must also note here that the question is asking you about **aerobic respiration** in **animals**; answers relating to anaerobic respiration or respiration in other groups of organisms will be incorrect.

(2 marks)

8 (a) Write the balanced symbol equation for respiration

Answer

The balanced symbol equation for respiration is as follows...

Award 1 mark for correct **reactants** and 1 mark for correct **products**:

- $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$; [2 marks]

[Total: 2 marks]

(2 marks)

(b) Some scientists wanted to investigate respiration rates in different areas of a plant.

They measured carbon dioxide production in the roots and leaves of a plant at night time.

The table shows the rate of carbon dioxide production that they measured.

Part of the plant	Mean rate of carbon dioxide production / $cm^3\ m^{-2}\ s^{-1}$
Leaves	0.042
Root	0.056

Calculate the percentage difference in carbon dioxide production in the leaves compared to the roots.

Answer

The percentage difference is...

- (-) 0.014; [1 mark]
- (0.014 ÷ 0.056) x 100; [1 mark]

- = - 25 % **OR** 25 % (less carbon dioxide produced in the leaves compared to the roots); [1 mark]

[Total: 3 marks]

Part of the plant	Mean rate of carbon dioxide production / $cm^3\ m^{-2}\ s^{-1}$
Leaves	0.042
Root	0.056

Percentage change in root compared to leaves = $\frac{\text{Difference in } CO_2 \text{ produced between leaves \& root}}{CO_2 \text{ produced in root}} \times 100$

$= 0.042 - 0.056 = -0.014$ ← $0.014 cm^3 m^{-2} s^{-1}$ less in the leaves compared to root.

$= \frac{-0.014}{0.056} \times 100 = -25\%$

↑ 25% less CO_2 produced in leaves compared to root

(3 marks)

(c) The carbon dioxide readings shown in the table in part (b) were all taken during the night time.

Suggest a reason for this.

Answer

The readings were taken in the night time because...

- Photosynthesis does not occur in the dark / without light; [1 mark]
- Carbon dioxide produced in respiration may be used in photosynthesis; [1 mark]
- This will affect the measurement for the rate of production of carbon dioxide / the measured rate of carbon dioxide production may be lower than the actual rate / may not be accurate; [1 mark]

[Total: 3 marks]

During the daylight, photosynthesis will be taking place at the same time as respiration, so any carbon dioxide produced during respiration may be immediately used up in photosynthesis. This would mean that any recorded value for carbon dioxide production may not be accurate, as it may be less than the actual volume of carbon dioxide produced.

(3 marks)

(d) Suggest an explanation for the results shown in the table in part (b).

Answer

An explanation for the results shown in the table could be...

Any **two** of the following:

- Respiration occurs in both the leaves and the roots; [1 mark]
- Root cells are more active / have a higher metabolism than leaf cells **OR** root cells carry out more active transport than leaf cells / actively transport minerals from the soil (so they carry out more respiration); [1 mark]
- Cells in the root have more mitochondria (so they carry out more respiration); [1 mark]

[Total: 2 marks]

Note that this is an **explain** question so no marks will be available for just describing the results.

Both root cells and leaf cells produce carbon dioxide, and this can be explained by the fact that **both sets of cells are respiring** and producing carbon dioxide as a product.

The increased rate of respiration in root cells suggests that they are **more metabolically active**, e.g. due to the active transport of minerals into the root hair cells.

Remember that mitochondria are the site of respiration, so a cell that has **more mitochondria** will carry out more respiration.

(2 marks)

(e) In order to collect the data about carbon dioxide produced by the roots of the plant, scientists took samples of the air from the soil around the plant roots and adjusted it to account for atmospheric carbon dioxide levels.

Suggest why the readings they took may still be higher than the actual rate of carbon dioxide production in the plant roots.

Answer

The readings may still be higher because...

- Respiration of other organisms/microorganisms/decomposers in the soil (produces carbon dioxide); [1 mark]

[Total: 1 mark]

Soil is not devoid of life, but has a rich biodiversity of microorganisms within it, such as bacteria and fungi. All of these organisms respire, and so will be releasing carbon dioxide into their surroundings.

(1 mark)

9 (a) A teacher carries out a demonstration to show the effect of different concentrations of salt solution on red blood cells.

This is the teacher's method.

- Dilute a sample of blood using a salt solution that has the same concentration as blood plasma
- Place 1 cm^3 of the diluted blood into each of three test tubes labelled A, B and C
- Add 10 cm^3 of water to tube A
- Add 10 cm^3 of 1 % sodium chloride solution to tube B
- Add 10 cm^3 of 5 % sodium chloride solution to tube C
- Leave each tube for 5 minutes
- Compare the cloudiness of the solutions in the three test tubes
- Take a drop of liquid from each tube and put on separate microscope slides
- Observe each slide under a microscope

State the independent variable in this investigation.

Answer

The independent variable in this investigation is...

- Salt/sodium chloride concentration / concentration of salt/sodium chloride / percentage salt/sodium chloride solution / water potential of solution ; [1 mark]

[Total: 1 mark]

The independent variable is the variable **changed** by the investigator.

(1 mark)

(b) Give one variable that the teacher controls in this investigation.

Answer

A variable that the teacher controls in this investigation is...

Any **one** of the following:

- Concentration of (diluted) blood sample/plasma (i.e. how much the blood is diluted before starting the experiment); [1 mark]
- Volume of (diluted) blood/solution (this is always 1 cm^3); [1 mark]
- Time that solution is left for (this is always 5 mins); [1 mark]

Reject *volume of water for marking point 3; water on its own is only used as a variant of the independent variable (salt solution concentration).*

Ignore *amount used instead of volume.*

[Total: 1 mark]

(1 mark)

(c) After 5 minutes, these are the teacher's observations.

- Tube A – a clear red solution
- Tube B – a cloudy red suspension
- Tube C – a cloudy red suspension

(i) Explain the differences in the teacher's observations.

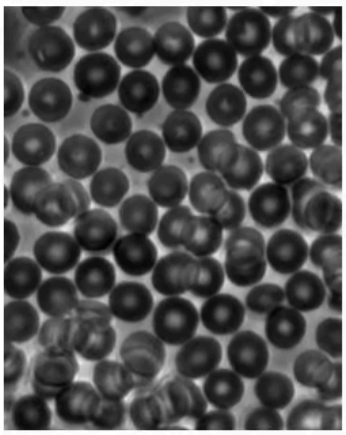
(2)

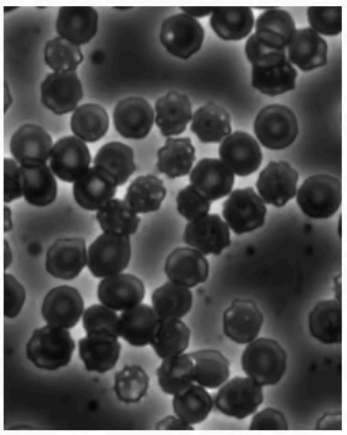
(ii) When the teacher looks down a microscope for cells on each slide, these are the teacher's observations.

- Slide from tube A – no cells are seen
- Slide from tube B – normal biconcave red cells are seen

- Slide from tube C – red cells are seen but the cells have shrunken edges

The photographs show the teacher's observations.





Tube A	Tube B	Tube C

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Explain the differences between the teacher's observations of the slides from each tube.

(2)

Answer

(i) The differences in the teacher's observations are due to...

Any **two** of the following:

- There are no cells / the cells have burst/exploded in (distilled) water/A; [1 mark]
- Haemoglobin dissolves (producing a clear red colour in A); [1 mark]
- Cells are present / remain unchanged / do not burst in tubes B and C / the 1 % and 5 % tubes (giving a cloudy red appearance); [1 mark]

(ii) The differences between the teacher's observations of the slides from each tube are due to...

Any **two** of the following:

- Water enters red cells in A/(distilled) water; [1 mark]
- Water both enters and leaves / there is no (overall) movement of water in B/1 % solution; [1 mark]
- Water leaves red cells in C/5 % solution; [1 mark]
- (Movement of water is due to) osmosis; [1 mark]

[Total: 4 marks]

The cells in tube A have been placed into a solution with a higher water potential than the cell contents, so water moves down a water potential gradient **into** the red blood cells by osmosis, causing them to swell and eventually burst, releasing their haemoglobin contents into the surrounding water. This means that there are no cells present and causes the water to have a clear, red colour.

Tube B has been placed into a solution with a water potential that is the same as the cell contents, so there is no overall movement of water (the same amount moves into and out of the cells) and the red blood cells do not change their appearance.

Tube C has been placed into a solution with a lower water potential than the cell contents, so water moves down its concentration gradient **out of** the red blood cells by osmosis, causing them to shrink and have wrinkled edges.

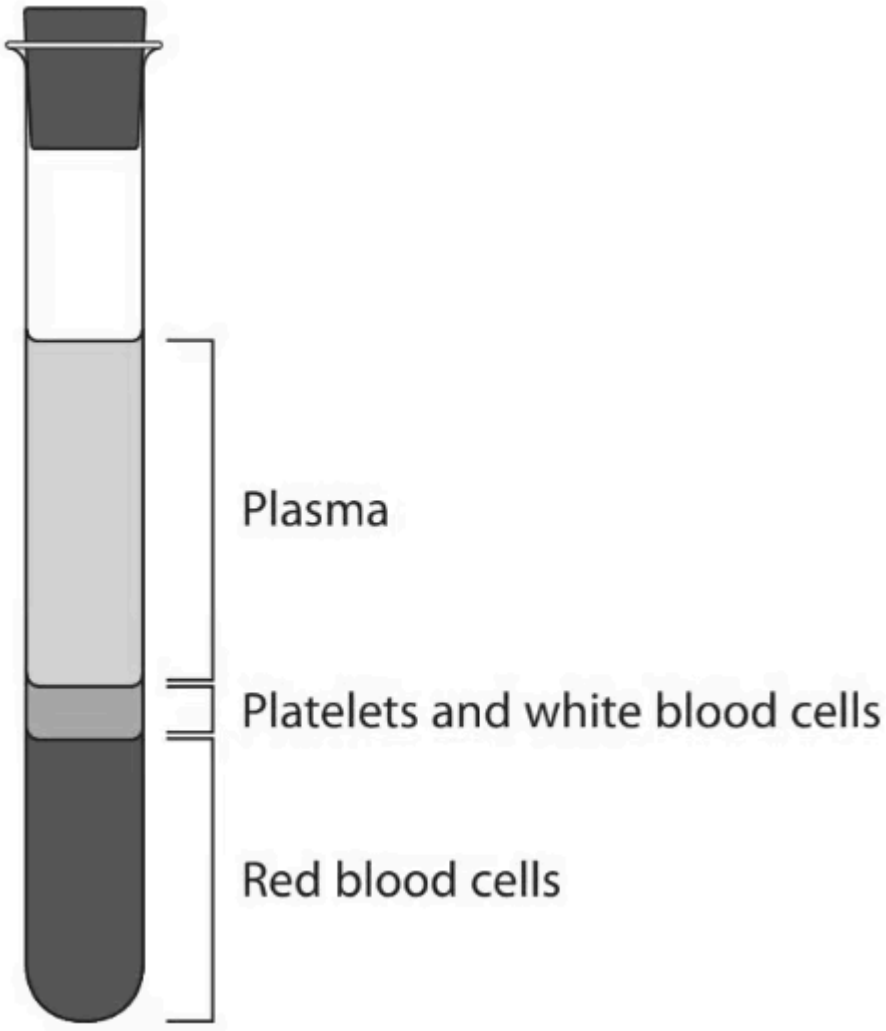
The presence of red blood cells in tubes B and C gives the tubes a cloudy, red appearance.

(4 marks)

(d) Blood samples can be separated into different layers using a centrifuge.

This is a machine that spins blood at a high speed.

A new sample of blood is shown after it has been spun in a centrifuge.



Describe how the blood in tubes A, B and C from the teacher's demonstration would look after they had been spun in a centrifuge.

Answer

The blood in tubes A, B and C from the teacher's demonstration would have the following appearance after they had been spun in a centrifuge...

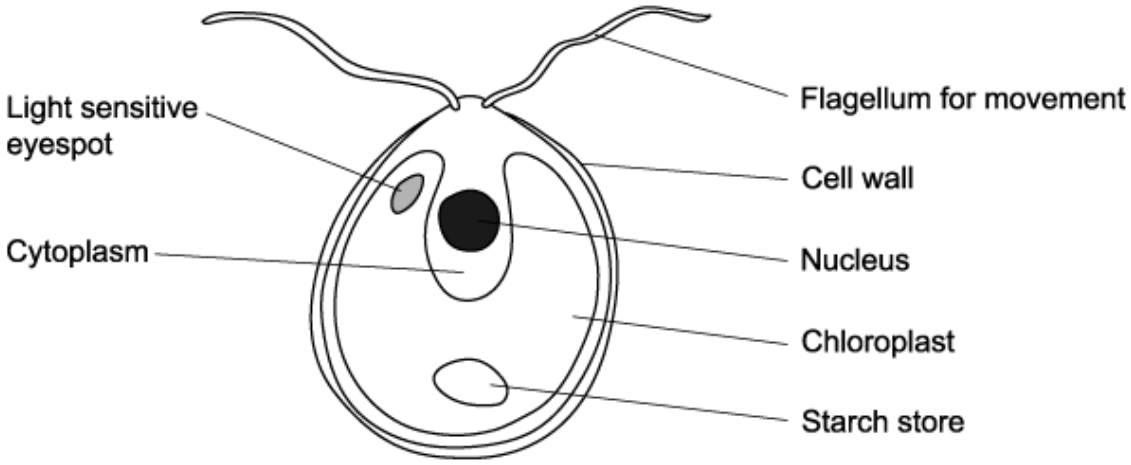
- Tube A would have no red cell (layer) / bottom layer / no (separation into) layers / would be red throughout **OR** would have more plasma / no platelets; [1 mark]
- Tube B/C would have normal cell layers / a normal (layer) of red cells **OR** would (only) have slightly fewer red cells / a slightly smaller red cell layer than normal; [1 mark]

[Total: 2 marks]

Make sure that you describe the appearance of tube A as well as tubes B and C for both marks here.

(2 marks)

10 (a) The image below shows a single-celled organism known as *Chlamydomonas*.



(i) Suggest the group of organisms to which *Chlamydomonas* belongs.

(1)

(ii) Explain your answer to part (i).

(2)

Answer

(i) Chlamydomonas belongs to the following group of organisms...

- Protoctists; [1 mark]

(ii) Chlamydomonas is classified this way because...

- It is unicellular / single celled / a single celled organism; [1 mark]
- It has internal membranes / a nucleus / a chloroplast; [1 mark]

Protoctists are single-celled organisms that do not fit clearly into any other group of organisms.

The fact that Chlamydomonas is **single-celled** tells us that it is not a plant (plants are multicellular organisms) and the fact that it has **internal cell membranes** tells us that it is not a bacterium.

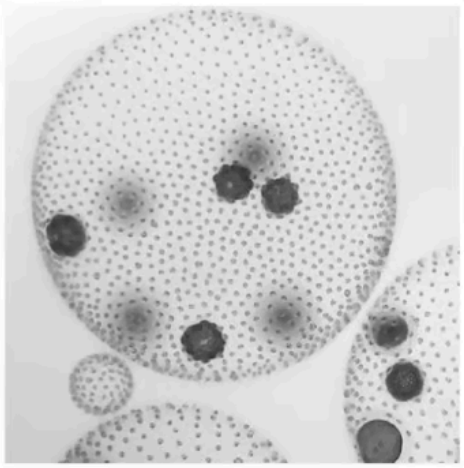
(3 marks)

(b) A group of organisms closely related to *Chlamydomonas*, known as *Volvox*, forms multicellular structures. *Volvox* consists of a hollow ball surrounded by an outer layer of cells.

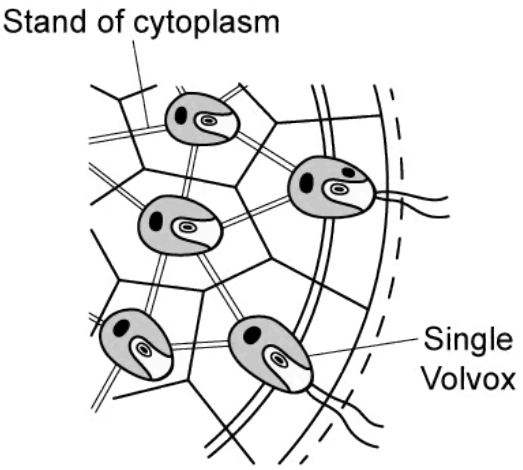
Volvox contains two types of cell:

- Somatic cells which surround the hollow ball to form an outer layer. These cells are unable to divide to produce more cells, but they have flagella which they can use for movement. Somatic cells are similar in structure to *Chlamydomonas* in part (a).
- Gonidia cells are large cells which are visible as denser regions within the hollow ball. These cells can divide and give rise to new *Volvox*.

The structure of *Volvox* is shown in the images below.



Adult *Volvox*.



The cellular structure of *Volvox*.

Frank Fox, via Wikimedia Commons (left)

(i) Use the information provided to suggest why *Volvox* is not considered to have tissues or organs.

(2)

(ii) *Volvox* is thought to be a useful model for studying the evolutionary transition between single-celled and multi-cellular organisms.

Suggest why this is the case.

(2)

Answer

(i) *Volvox* is not considered to have tissues or organs because...

Any **two** of the following:

- The somatic cells form a hollow ball (so do not have the structure of a tissue); [1 mark]
- The somatic cells are spaced out / connected to each other only by strands of cytoplasm (so do not have the structure of a tissue); [1 mark]
- Gonidia cells are not found in groups (so they do not count as a tissue); [1 mark]
- The two cell types do not work together to carry out a common function (so they do not form an organ); [1 mark]
- Two different cell types are not enough to form an organ; [1 mark]

This is a tricky question that requires you to **consider the features of tissues and organs** carefully before thinking about why it is that *Volvox* does not meet the criteria for tissues or organs.

A tissue is a group of similar cells carrying out a single function. While it could be argued that the somatic cells and gonidial cells work with other cells of their type to carry out a specific function (somatic cells = motion and gonidial cells = reproduction), the structural arrangement of these cells do not match what we would expect from a tissue.

Organs consist of several tissues working together to carry out a single function. The two groups of cells do not work together, and it could be argued that two cell types are not enough to form an organ.

(ii) *Volvox* is thought to be a useful model for studying the evolutionary transition between single-celled and multi-cellular organisms because...

Any **two** of the following:

- The cells of *Chlamydomonas* and *Volvox* are very similar; [1 mark]
- *Chlamydomonas* cells could have started working together to form a multicellular organism/*Volvox*; [1 mark]

- *Volvox* is a very simple multicellular organism / only has two cell types **SO** is easy to study (compared to, e.g. a mammal); [1 mark]

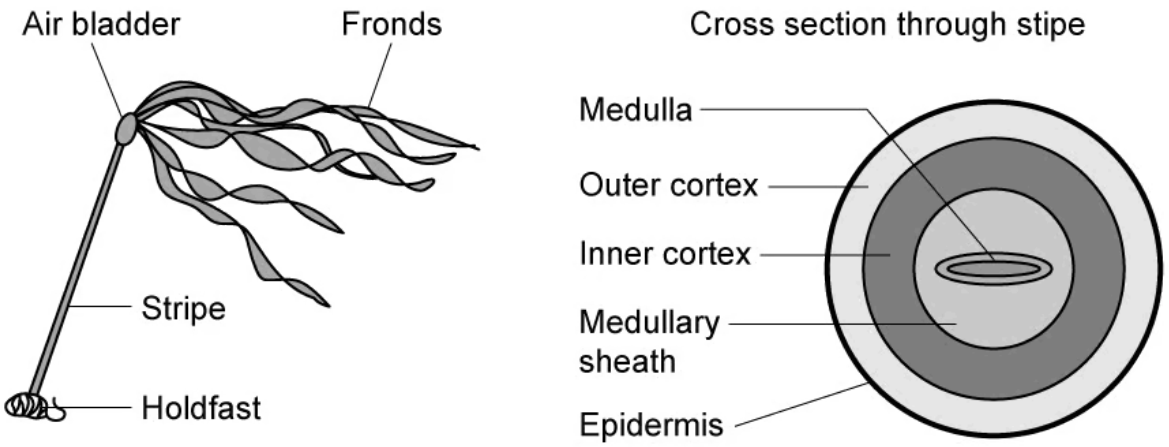
This is another tricky question, and you are not required to know anything about evolution at this stage in your studies. Provided that you understand the concept of uni- vs multicelled organisms, you should be able to grasp the idea that at some stage in the history of life **single-celled organisms came together to form multicellular organisms**. *Volvox* is considered to be a useful organism in the study of how this might have happened due to its similarity to existing single-celled organisms and its simple structure.

[Total: 4 marks]

(4 marks)

(c) The group of organisms to which *Chlamydomonas* and *Volvox* belong also includes seaweeds such as kelp.

Some of the structures in kelp can be seen in the diagram below.



Describe the differences in structural organisation of kelp with that of Volvox in part (b).

Answer

The structural organisation of kelp can be contrasted with that of *Volvox* as follows...

- Kelp has organs (e.g. holdfast / stipe etc.) **WHILE** *Volvox* does not; [1 mark]

- Kelp has several layers of cells **WHILE** *Volvox* is a hollow ball / has only one (outer) layer of cells; [1 mark]

- Kelp has several tissue types (e.g. epidermis / medulla) **WHILE** *Volvox* does not have tissues; [1 mark]

[Total: 3 marks]

When a question asks you to give contrasting features of two items, you should be sure that each statement contains a **direct comparison**. For example, here you would not get credit for simply stating that 'kelp has organs'; you need to say **how this is different** to *Volvox*.

(3 marks)

(d) Kelp is a type of seaweed, a plant-like organism that gains its food by photosynthesising. Kelp grows by attaching itself to the sea bed with a structure known as a holdfast, allowing the fronds to extend towards the water's surface.

The medulla within the stipe of kelp, shown in part (c), contains cells known as hyphae which transport substances from one part of the kelp to another.

(i) Suggest why the hyphae in the medulla are crucial to the growth of the kelp.

(4)

(ii) Name one other group of organisms in which hyphae can be found.

(1)

Answer

(i) The hyphae in the medulla are crucial to the growth of the kelp because...

Any **four** of the following:

- The frond/leaf is the only part of the kelp located near to the water's surface (due to flotation provided by the air bladder); [1 mark]
- The leaf/frond absorbs light energy from the sun **SO** can carry out photosynthesis; [1 mark]
- Photosynthesis produces glucose; [1 mark]
- Glucose must be transported **SO** that the cells (in other parts of the kelp) can carry out respiration; [1 mark]
- Respiration releases energy that allows the kelp to grow; [1 mark]

This question requires you to use your knowledge of the role of photosynthesis in photosynthesising organisms, together with information about kelp nutrition and structure provided in the question.

The key with extended questions like this is to ensure that you **continue your line of reasoning to its conclusion**. You have been asked to **link** the ideas of transport and growth, so you should consider what will need to be transported (glucose), why transport is necessary (photosynthesis only occurs in the light), and why the transported substance is needed for growth (respiration releases energy).

(ii) Hyphae can also be found in...

- Fungi; [1 mark]

[Total: 5 marks]

(5 marks)