AQA GCSE BIOLOGY (HIGHER) · 8461

BIOLOGY



MARK SCHEME

4.1.3 TRANSPORT IN CELLS

SCORE	PERCENTAGE
/133	%

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Q1.

(a) any **one** from:

- water on potato would increase mass

  allow so only the mass of the potato is measured

- to control amount of water on potato

  allow to remove water from outside of potato

  allow liquid / solution / sugar solution for water

  allow so you get the correct (starting) mass of the potato

  *do **not** accept so that all the pieces of potato weighed the same*

1

(b) increase in mass

1

increase in length

1

extra ticks negates marks

(c) osmosis

allow diffusion

1

into

allow inside
*do **not** accept through*

1

lower

allow low / more dilute / dilute

1

in this order only

(d) any **one** from:

- the concentration (of sugar solution) in the cells is 0.4 (mol/dm^3)
- the concentration (of sugar solution) in the cells is the same as the solution (in the tube)

1

allow reference to potato instead of cells

(e) any **two** from:

- has (root) hairs

  allow root hair cells

- large surface / area

  allow wide surface area

- (root) hairs extend into soil

  allow (root) hairs are long / widespread

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- (root) hairs have thin walls

2

ignore references to active transport and mineral uptake

[9]

Q2.

(a) to control for the starting mass (of the pieces of carrot)

allow because the pieces of carrot were not all the same mass at the start

*do **not** accept were not all the same size*
*do **not** accept as a control variable*

1

(b) suitable scale **and** label for y-axis

allow 5 or 6 per 2 cm

*do **not** accept 5 per 1 cm*

1

all points plotted correctly

allow ± ½ a square

*allow **1** mark for 4 correct points*

2

line of best fit

conc. …	***percentage (%) change…***
0.0	*+24*
0.2	*+12*
0.4	*+1*
0.6	*−8*
0.8	*−15*

1

(c) value from student's line of best fit

allow ± ½ a square

1

(d) mass decreased

1

(due to) **loss of water** by **osmosis**

ignore diffusion

1

through a partially / selectively / semi permeable membrane

1

a clear reference to concentration of water or concentration of sugar is required for the fourth mark

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(as) concentration of sugar solution is greater than concentration of sugar (solution) inside cells / carrot

allow (as) concentration of sugar solution inside cells / carrot is lower than the concentration of sugar solution (in the tube or around the carrot)

or

(as) the concentration of water is less outside the cells / carrot than the concentration inside the cells / carrot

allow answers in terms of dilute and concentrated solutions

1

(e) the (partially permeable / cell) membrane was damaged

allow idea that cell membrane is no longer intact
***or** is **more** permeable / leaky*

allow the membrane is denatured

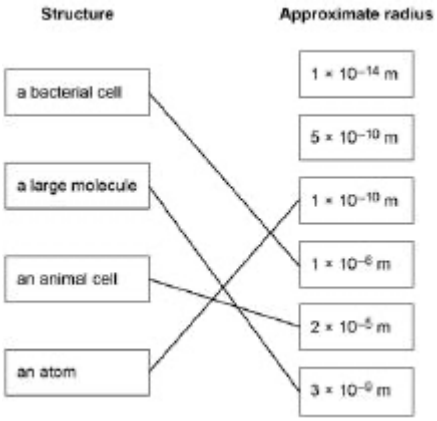
ignore cells are dead

1

[11]

Q3.

(a)



1
1
1
1

(b) 1.5:0.125 **and** 6:1

1

converted to same scale for example
12:1 and 6:1
or
6:0.5 and 6:1

allow 1.5:0.125 and 1.5:0.25
or
allow 1.5:0.125 and 0.75:0.125

1

as the length of the side of the cube increases the surface area to volume ratio decreases

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allow size for length of side
allow converse

1

(c) animal has a small(er) surface area to volume ratio (than a bacterium)

allow converse

1

(so) diffusion distance is larger in animals
or
volume to be supplied (with gas) by each unit of surface area is greater

allow converse

1

(therefore)
diffusion would not supply enough oxygen for the volume / size
or
diffusion would not remove enough carbon dioxide for the volume / size
or
diffusion rate per unit volume is slower

allow converse

1

(d) active transport requires <u>energy</u> because (sugar molecule) movement is from low concentration (outside cell) to high concentration (inside cell)

allow active transport requires <u>energy</u> because (sugar molecule) movement is against / up concentration gradient

1

(this) energy is transferred by <u>respiration</u> which requires oxygen

1

(and a) higher concentration of oxygen allows a faster (rate of) respiration (or energy transfer)

1

[13]

Q4.

(a) measure the mass / length of the chip at the start*

1

measure the mass / length of the chip at the end*

1

if neither mark awarded allow **1 mark for measure the increase in length / mass*

divide the change in mass / length by time taken

1

ignore references to blotting the potato chips

(b) use cork borer

allow a description
allow a potato chip cutter

1

(c) (rate) would be higher / faster

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ignore more diffusion / osmosis

1

(as) surface area (for diffusion / osmosis) is greater

1

(d) (as temperature increases the) rate (of osmosis) would increase
ignore more water taken in

1

as (water) molecules / particles have more energy to move (faster)
or
as (water) molecules / particles have more kinetic energy
allow (water) molecules / particles move faster

1

[8]

Q5.

(a) any **two** adaptations with linked descriptions from:

- many alveoli to provide a large surface area
- good blood supply to maintain steep diffusion / concentration gradient
- thin walls so gases do not have far to diffuse / travel
- well ventilated to maintain steep diffusion / concentration gradient

1 *mark for adaptation and* ***1*** *mark for linked description*
allow to collect oxygen ***or*** *to bring carbon dioxide to lungs*

4

(b) an allergy

1

(c) any **one** from:

- narrow(er) / small(er) (air) passages / bronchioles
- less air / oxygen can pass through

1

(d) 3.3 (dm^3)

1

(e) any **one** from:

- fake drug
- inactive form of drug

1

(f) neither the volunteers nor the scientists

1

(g) to avoid / reduce bias

1

(h) any **two** from:

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- drug only works for severe asthma attacks
  or
  drug only increased lung capacity in severe asthma attacks
- drug had little effect **or** slight reduction in healthy people
- drug had no effect in mild asthma attacks
- drug does not alleviate the problem entirely

2

[12]

Q6.

(a) 0.27 (g)

1

(b) potato lost mass

allow potato (cells) lost water

1

(c) all 3 points plotted correctly

allow ecf from art (a)

*allow **1** mark for 1 or 2 correct plots*

2

suitable line of best fit

allow ecf from their plots

1

(d) 2.6 (arbitrary units)

allow answer from their line

1

(e) same concentration as inside potato (cells)

1

(so) no (net) movement of water

allow description of this

1

by osmosis

1

[9]

Q7.

(a) any **two** from:

- synthesis of new molecules

  allow named molecule eg starch / glycogen / cellulose / lipids / fats / proteins / hormones / antibodies
- for active transport
- to keep warm (in mammals / birds)

  allow description

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allow to keep warm (in animals)
allow for movement (in animals)
allow for transmission of nerve impulses (in animals)

2

(b) mitochondria / mitochondrion

1

(c) both occur without oxygen

1

both release (a small amount of) energy

1

muscle cells produce lactic acid but plant cells produce ethanol

1

muscle cells do **not** produce carbon dioxide but plant cells do
marks can be awarded from correct word or balanced symbol equations

1

(d) the amount of oxygen needed to react with the lactic acid formed
allow the amount of oxygen needed to break down
or *oxidise the lactic acid*

1

[8]

Q8.

(a) transports water in the transpiration stream

1

(b) transports dissolved sugars using translocation

1

(c) 2/(0.1 × 0.1)
or
2/ 0.01

1

200
*an answer of 200 scores **2** marks*

1

(d) cooler around lower surface

1

more humid around lower surface
allow converse argument for upper surface of leaf if qualified

1

(so) less water evaporated
allow less breeze around lower surface

1

(e)

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Level 3: Relevant points (correct processes / explanations) are identified, given in detail and linked logically to form a clear account.	5-6
Level 2: Relevant points (correct processes / explanations) are identified and there are attempts at logical thinking. The resulting account is not fully clear.	3-4
Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical thinking.	1-2
No relevant content	0
Indicative content • water is absorbed by osmosis • osmosis is a passive process, or described • water in soil is at a higher concentration than inside cell • water moves down concentration gradient • through a partially permeable membrane • phosphate ions absorbed by diffusion • diffusion is a passive process, or described • phosphate ions are in a higher concentration in soil than inside cells • magnesium ions are absorbed by active transport • magnesium ions are in lower concentration in soil than inside cells • magnesium ions move from an area of lower concentration to an area of higher concentration inside the cells • magnesium ions move up the concentration gradient • process requires energy • energy from respiration	

6

[13]

Q9.

(a) (LHS)
glucose

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1

(RHS)
carbon dioxide

1

(RHS)
water

either order on RHS

1

(b) any **one** from:

- ache
- bum
- hurt
- fatigue(d)
- tired
- cramp
- painful

1

(c) any **three** from:

- temperature (of room)
- time running / 10 minutes running
- recovery before increasing speed
- same person
- incline of treadmill

allow normal lactic acid concentration at start

3

(d) (as speed increases) blood lactic acid concentration increases

ignore (directly) proportional

1

increase is greater at higher speeds

allow converse

allow linear relationship at higher speeds

1

(e) 7.5 – 1.2

1

6.3 (arbitrary units)

*an answer of 6.3 scores **2** marks*

1

(f) increased blood flow

1

delivers more oxygen

1

therefore less anaerobic respiration
or
therefore more respiration is aerobic

1

(g) after anaerobic respiration, oxygen debt must be repaid.

1

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oxygen is needed to remove lactic acid from muscles.

1

[16]

Q10.

(a) evaporation

1

(b) water is condensing

1

(c) safe

1

(d) uses a lot of electricity / energy

ignore cost unqualified

allow the volume of water is too small

or *you only get a small volume produced*

1

(e) guard cells

1

(f) chloroplasts

1

permanent vacuole

1

(g) $\frac{12}{0.03}$

1

400

1

(h) **C**

1

highest number of stomata

1

[11]

Q11.

(a) cell membrane

extra boxes ticked negates mark

1

(b) nucleus

extra boxes ticked negates mark

1

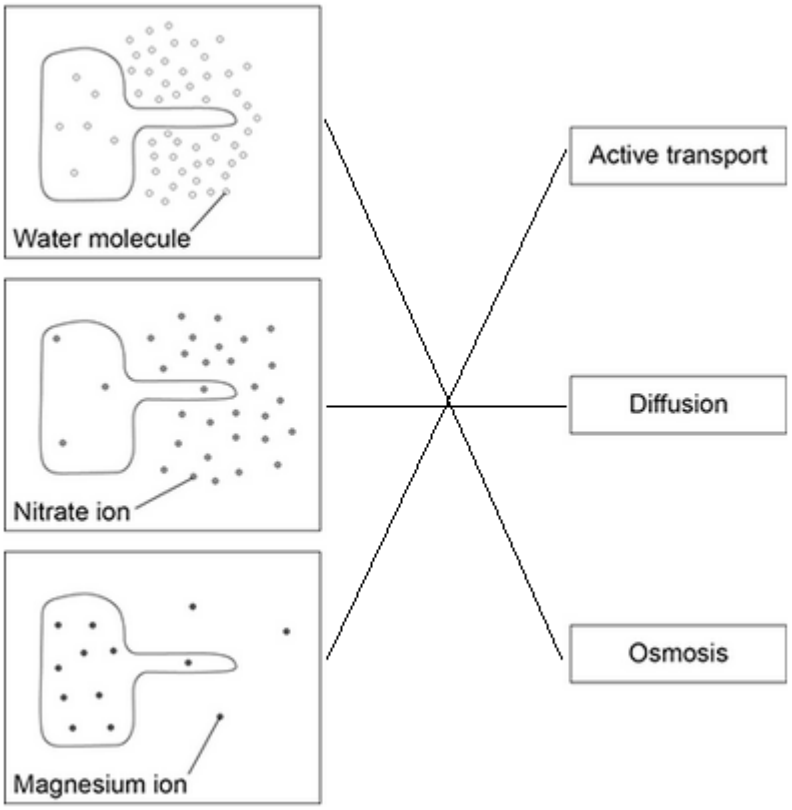
(c) has a tail so it can swim (to an egg)

accept has many mitochondria to release energy to swim

1

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(d)



*all three correct for **2** marks*
*one or two correct for **1** mark*

2

[5]

Q12.

(nitrate) ions are absorbed by active transport

1

(active transport) is the movement of ions against the concentration gradient

allow (active transport) is the movement of ions from a dilute to a more concentrated solution

1

(active transport) requires energy from respiration

1

(respiration) requires oxygen

1

no / little oxygen / air in water-logged soil

1

[5]

Q13.

(a) (placed) randomly

allow description of placement

1

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sufficient number (of quadrats) used

1

count (dandelions) in each quadrat

1

use mean number of dandelions, area of quadrat and area of field to estimate population

accept (area of field / area quadrat) × mean number of dandelions per quadrat

1

(b) (40 × 145) / 0.25 = 23 200

1

(0.42 × 23 200 =) 9744

*allow 9744 with no working shown for **2** marks*

*allow ecf from correct attempt at the previous step) × 0.42 for **1** mark*

1

(c) **Level 2 (3–4 marks):**
A detailed and coherent explanation is given. Logical links between clearly identified relevant points are made to explain why dandelion growth may be limited.

Level 1 (1–2 marks):
Discrete relevant points are made. The logic may be unclear.

0 marks:
No relevant content

Indicative content

factors that may be considered:
competition for resources including:
- light
- water
- space
- mineral ions (allow nutrients / salts / ions from the soil)

reference to why growth may be limited:
- (light) energy for photosynthesis
- water as a raw material for photosynthesis / support
- surface area exposed to light
- sugar / glucose produced in photosynthesis
- (space) to grow bigger
- (space) for growth of root system
- (mineral ions) for growth
- (mineral ions / sugar) for production of larger molecules **or** named example

4

[10]

Q77.

(a) X – relay (neurone)
Y – motor (neurone)

both required for mark

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must be in correct order

1

(b) chemical (released from **X**)

*do **not** accept electrical impulse*

accept chemical messenger / transmitter
accept neurotransmitter

accept named transmitter substance eg acetylcholine

1

(crosses) synapse

*allow for **2** marks diffusion of the chemical across the synapse*

1

[3]

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Q1.

(a) 48% of students achieved this mark. Many said that drying the potato would remove the water from the outside. Better responses referred to the water affecting the mass of the potato.

Some students thought drying the potato would remove water that the potato had absorbed. This implied the water was inside the potato so did not gain credit.

(b) 73% of students achieved at least one mark. This was usually for saying that the potato in water would increase in mass. Fewer said that it would also increase in length. A decrease in hardness was a common incorrect response.

(c) 56% of students achieved two or more marks. Marks were more commonly awarded for knowing water moves by osmosis, and for saying the water would move into the cells. As this was a low demand question diffusion was allowed for osmosis. At a higher demand students would be expected to know that water moves by osmosis. Some students talked about water moving through the cells which was ignored. The direction of water movement into the cells was needed.

Most errors were seen in relation to the concentration of the solution outside the potato. Many said it was at a higher concentration than inside the cells, which was incorrect. Others said that it was at zero concentration, which was given on the diagram, so was ignored.

(d) This question was set at standard demand. 9% of students said the concentration in the cells was 0.4 mol/dm^3, or the same as the solution in tube B. Many rephrased the stem of the question and said water did not enter or leave the potato, or that osmosis did not take place. Others said the concertation of the solution was higher or lower than that inside the potato.

(e) Many students did not know the term root hair. 51% of students achieved one or more marks.

Q2.

(a) 9% of students understood why the percentage change in mass was calculated. A clear reference to the starting mass of the carrots being controlled, or that the carrots were not all the same mass at the start, was needed.

Quite a lot of students referred to being able to compare the carrots, which was insufficient. Some restated the title of the investigation, and said so that the effect of different concentrations of sugar solution on the carrot could be seen.

(b) When plotting graphs, it is advisable to use a pencil so errors can be erased.

93% of students achieved a minimum of two marks, with 22% achieving full marks. Common mistakes included:

- forgetting to label the *x*-axis
- using an inappropriate scale, which made plotting very difficult
- plotting dots instead of crosses; dots cannot always be seen

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- drawing a line of best fit which did not average out the data.

Most students chose a scale of 2 cm to 5% which was the most sensible option. Those choosing 1 cm to 5% did not gain the scale mark as less than half of the available space was used. Some students used a scale of 1 cm to 3 % which was acceptable.

Students should be aware that a line of best fit can be a curve or a straight, ruled line. The data provided formed a gentle curve. Approximately 10% of students drew a curve through all the points, which was correct. Those who drew a straight line could still be awarded the mark, as long as it averaged out the data. Very thick lines or sketchy, double or broken lines were insufficient.

(c) Students had to read the value from their line where the percentage change in mass was 0. A tolerance of ± ½ a square was allowed.

33% of students correctly estimated the sugar concentration from their graph. A number of students gave an answer of 0.4 mol/dm^3 despite their line passing through a concentration greater than this. Other common incorrect answers included 0.2 and 0.8 mol/dm^3. Some students incorrectly read the scale, reading 0.46 as 0.43 or 0.42 as 4.2

(d) 55% of students achieved at least one mark, but only 27% achieved two or more marks. There were a few very good responses which demonstrated that the definition for osmosis had been learnt. Quite a lot of good answers only scored three marks because they did not mention that the mass decreased. Others did not mention the partially permeable membrane.

For the second marking point diffusion was ignored, as at high demand students are expected to know that water moves by osmosis. A few thought that water moves by active transport. Some thought that it was sugar that moved by osmosis.

Some responses included confused references to concentration. It was not clear whether students were talking about water or sugar concentration. Some switched between water concentration and sugar concentration. Those who expressed concentration in terms of dilute and concentrated solutions generally gave clearer responses.

Incorrect ideas that were seen included:

- the carrot filling up with sugar and bursting
- gas being given off
- bits falling off the carrot as it dissolved
- enzymes breaking down the starch.

(e) 3% of students achieved this mark for this question targeted at grades 8−9. Many students appreciated that the high temperature would damage something in the cell. In order to gain the mark they had to refer to the membrane.

Damage to the cell or to enzymes was often stated. Saying osmosis could not happen or the cells were dead were both insufficient. Some thought that water would not be able to enter or leave the cell, which was incorrect.

Q3.

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(a) This high demand question required students to use a combination of recall from the specification and relative size, and negative standard form. As anticipated, any students found this challenging with 7% of students achieving three or four marks.

(b) This high demand question discriminated well with only the highest-attaining students achieving any marks (15%). Students were expected to calculate the surface area to volume ratio for both cubes, make them comparable, and then describe the change in ratio as the size / length of the cube changed. Some students calculated the surface area and volume, but could not express this as a ratio, or appreciate that they need to be comparable.

Some students chose to calculate ratios of model cells of different size to those in the question. This approach could lead to marking point three, but not correct calculations for marking points one and two in this instance.

(c) This proved to be the most difficult question on the paper with 5% of students achieving any marks. Students occasionally took their lead from the prior question about surface area to volume ratio, but this was rare. Many answers described diffusion in detail, without answering the question. Comparisons of cell structure between bacteria and animal cells were frequent, but did not answer the question.

(d) As expected, students found this question very difficult with 3% of students achieving full marks. They were unable to make the link between active transport and respiration. Many students confused the concentrations of glucose and oxygen when trying to describe the active transport of glucose. Incorrect answers referring to respiration making / creating / producing energy were seen.

Q4.

(a) Students struggled with this question based on a Required Practical Activity. 69% of students did not gain any marks. Most students who gained credit weighed the chips before and after placing in water, and many found the difference in mass. However, very few realised that to convert this difference to a rate they would need to divide by the time taken.

Many students suggested measuring the amount of water at the beginning and at the end, and some simply said ‘measure the chip’ without specifying what was being measured.

(b) It appears that the term ‘cork-borer’ is unfamiliar to many students with 8% achieving the mark. A description of the equipment was enough to gain the point for some students. Lots of different answers were given such as ‘grater’, ‘potato slicer’, ‘ruler’ or ‘scissors’.

(c) This question was challenging to most students with 155 able to achieve any credit. Most did not identify that there was a larger surface area in the potato chip, and those that did rarely linked this to a greater rate of diffusion / osmosis.

(d) Very few marks were gained in this question. The first marking point was given mainly in terms of ‘more water taken in’ or simply, ‘it would increase’, whereas an answer was required in terms of an increase in rate. 3% of students linked this to kinetic energy or movement of particles to achieve full marks.

Q77.

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(a) There was the usual confusion between the two types of neurone; these types should be familiar to students hoping to gain grades A and B.

(b) Knowledge and understanding of the word ‘synapse’ was seen far more frequently than the idea of a chemical being released from X. Many students stated that the impulse had to ‘jump the gap’. A surprisingly large number of students described a reflex arc in detail rather than answering the question.

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