AQA GCSE BIOLOGY (HIGHER) · 8461

BIOLOGY



MARK SCHEME

4.2.3 PLANT TISSUES, ORGANS AND SYSTEMS (PACK 3)

SCORE	PERCENTAGE
/123	%

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Q1.

(a) any **one** from:

- meristem(s)
- **tip** of shoot
  ignore stem and embryo
- **tip** of root

1

(b) to produce large numbers of identical plants

1

(c) 6×10^{-12} (grams)

1

(d) $\frac{28}{360} \times 15$

or

1.166666666(r)

allow $\frac{7}{90} \times 15$

allow correct rounding
allow 1.16

1

1.17 (hours)

*allow **1** mark for 1 hour 10 minutes **or** 1 and 1/6 hours **or** 70 minutes **only** if units given*

1

*an answer of 1.17 (hours) scores **2** marks*

(e) **stage 1**
cell growth
or
increase in number of organelles

allow increase in named organelle e.g. ribosomes / mitochondria

1

DNA replicates*
or
two copies of each chromosome form*

**allow DNA duplicates / doubles*
**ignore genetic information replicates*
if this statement given as part of stage 2 allow **max 4 marks*

1

stage 2 / mitosis
one set of chromosomes moves to each end of cell

allow chromosomes separate or are pulled apart

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1

nucleus divides

allow nucleus splits into two

1

stage 3

cytoplasm / cell membrane divides to form two (genetically) identical cells

allow cytokinesis

1

***max 4** if correct sequence but no reference to stage numbers*

***max 4** marks if no stage numbers given*
ignore names of phases

marks can be awarded for labelled diagrams

(f) any **two** from:

advantages:

- may be used to cure / treat (current / future) diseases
  or
  cure medical conditions
  or
  produce replacement cells / tissues / organs

  allow example e.g. diabetes / paralysis
  ignore used for medical treatments

- cells / tissues of any type could be produced

  allow cells differentiate into many types

- cells / tissues of any type could be produced

  ignore identical cells are produced unqualified

- many cells produced
- cells produced could be used for research
- would reduce waiting time for organ transplants

2

any **two** from:

ignore references to cost
ignore unethical unqualified
ignore references to religion / beliefs

disadvantages:

- potential life is killed / destroyed

  allow embryo is destroyed
  ignore cells destroyed or wasted

- shortage of donors / eggs
- egg donation / collection has risks
- do not yet know risks /side effects of the procedure on the patient

  allow may cause tumours / cancer

- may transfer (viral) infection

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- poor success rate to produce viable eggs / embryo

2

ignore references to cost

[14]

Q2.

(a) stoma / stomata

ignore pore

1

(b) guard (cell)

1

(c) osmosis

in this order only

1

transpiration

1

(d) increasing temperature

1

increasing wind speed

1

(e) any **one** from:

- for photosynthesis
- to bring mineral (ions) into / up the plant

allow correctly named ions e.g. nitrates

- translocation

allow to cool the plant

1

(f) any **one** from:

- decreased transpiration

allow no transpiration

- less water lost

allow no water lost

1

(g) $\frac{12}{800}$

1

0.015 (millimetres)

1

15 (micrometres)

*allow **1** mark for incorrect width × 1000*

1

*an answer of 15 (micrometres) scores **3** marks*

[11]

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Q3.

(a) (dead hollow) tubes
or
(dead) hollow cells

1

(strengthened by) lignin (and cellulose)

1

(b) $\text{size of real object} = \frac{\text{size of image}}{\text{magnification}}$

allow $\frac{26}{800}$ *for* ***1*** *mark*

1

= 0.0325 (millimetres)

allow 0.0325 (millimetres) for ***2*** *marks*

1

= 32.5 (micrometres)

allow ***1*** *mark for incorrect length × 1000*

1

an answer of 32.5 ***or*** *33 (micrometres) scores* ***3*** *marks*

(c) water enters (the guard cells)

1

(by) osmosis

allow diffusion (of water) through a partially permeable membrane

1

(d) water is lost through leaves by transpiration / evaporation

1

(no leaves is a benefit) when low / no rainfall so less / no water lost

1

(because) temperatures are high therefore transpiration would be rapid

1

or

water is used in the leaves for photosynthesis (1)

(if there are no leaves) there is no photosynthesis then no water is needed (which is a benefit) when there is low / no rainfall (1)

(because) temperatures are high therefore photosynthesis would be rapid (1)

[10]

Q4.

(a) nucleus

1

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cell wall

1

(b) any **one** from:

- contain (many) chloroplasts
- positioned near the top surface of the leaf
- packed closely together

1

(c)

Structure	Tissue	Organ	Organ system
Leaf		✓	
Xylem	✓		
Roots, stem and leaves			✓

additional tick in a row negates the credit for that row

allow **1** mark for two correct rows

2

(d) ×4

1

reason: any **one** from:

- gives the largest field of view
- easier to focus

1

(e) eyepiece lens: ×10
and
objective lens: ×40

or

eyepiece lens: ×5
and
objective lens: ×80

allow sensible suggestions that give a magnification of ×400

1

(f) 12.4 (mm)

allow 12 (mm)

1

(e) real width = $\frac{12.4}{400}$

1

0.031 (mm)

*an answer of 0.031 (mm) scores **2** marks*
allow ecf from part (f)

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1

[11]

Q5.

(a) carbon dioxide + water → (glucose) + oxygen

allow reactants in either order

allow correct formulae, balancing not required

1

(b) chlorophyll

1

(c) glucose (produced in photosynthesis) is converted into starch

1

(d) starch could be broken down (into sugar)

1

(e) so the colour of the iodine solution / result can be seen

1

(f) any **one** from:

- turn off Bunsen / flame before collecting ethanol
- use a water bath to heat the ethanol

allow idea that there are no naked flames near the ethanol

1

(g) **A** orange / brown

1

B black / blue-black

1

[8]

Q6.

(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

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allow converse argument for upper surface of leaf if qualified

1

(so) less water evaporated

allow less breeze around lower surface

1

(e)

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	

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• energy from respiration	

6

[13]

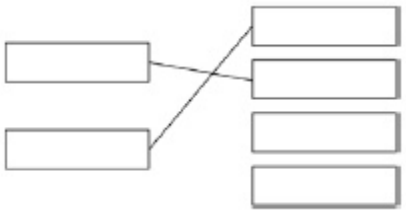
Q7.

(a) chlorophyll

ignore chloroplast

1

(b)



*do **not** accept more than one line from each method*

1

1

(c) black spot / fungus has evolved / mutated to be resistant (to the fungicide)

1

(d) (6200 – (3300 + 1750) =) 1150 (Mg)

1

(e) 1150 × 1000 = 1150000 (kg)

1

(f) power stations use less coal

1

(g) less sulfur dioxide from all sources / total

1

(h) any **one** from:

- data only shown from 1970
- fewer power stations (therefore fewer emissions)

1

(i) less sulfur dioxide

or

less acid rain

1

(that) destroyed fungus / spores

1

[11]

Q8.

(a) xylem / phloem

allow translocation / transpiration

1

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(b) any **one** from:
- through tools or hands (after touching infected plants)
- in the soil
- infected plants in contact with healthy plants

1

(c) GM is faster

1

GM is less dependent on chance at fertilisation

1

(d) any **four** from:
- gene for resistance is cut out with enzymes
- placed into a vector (virus or plasmid)
- inserted into early stage of young plants
- that grow by mitosis
- plants grow with gene in most cells

points must be in correct order to gain credit

4

(e) any **two** from:
- a species is less likely to survive in changing conditions

allow named change such as new disease
- less links in food webs **or** populations become smaller and have less variation
- less likely have suitably adapted individuals

2

(f) any **one** from:
- habitat for predators of pests
- natural barrier against disease transmission / herbivores
- reduce wind damage

ignore references to cost

1

[11]

Q9.

(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

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permanent vacuole

1

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

1

400

1

(h) **C**

1

highest number of stomata

1

[11]

Q10.

(a) temperature

1

carbon dioxide concentration

allow type of pondweed

allow mass of pondweed

1

(b) $\frac{(34+31+31=)96}{3}$

*allow **1** mark for*

$\frac{22+34+31+31=)118}{4}=29.5$

2

$\frac{32}{2(\text{min})}$

= 16(.0) (bubbles per minute)

allow ecf from incorrect mean

1

(c) 2.3(333)

1

(d) place different coloured filters over the lamp bulb

or

use different coloured light bulbs

1

keep the lamp the same distance from the pondweed each time

1

[8]

Q11.

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(a) cell membrane

extra boxes ticked negates mark

1

(b) nucleus

extra boxes ticked negates mark

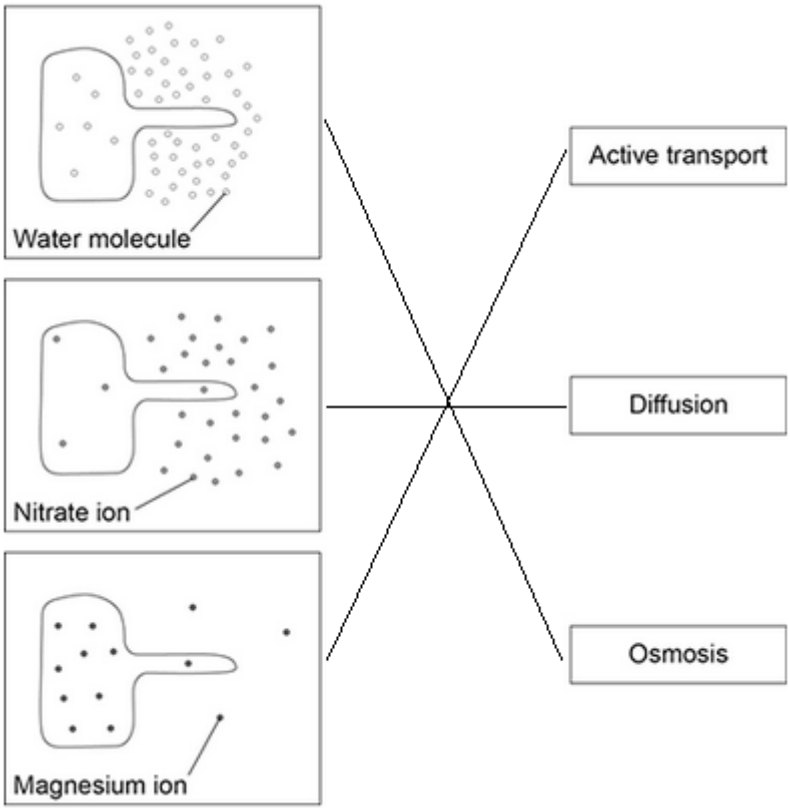
1

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

accept has many mitochondria to release energy to swim

1

(d)



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

2

[5]

Q12.

(a) xylem

1

(b) **A** is phloem, **B** is xylem

1

any **three** from:

- phloem transports sugars
- there are more sugars in fluid A
- xylem transports mineral ions / potassium ions / nitrate ions
- there are more mineral ions in fluid B.

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3

(c) correct conversion of 1.18 µg to mg / cm^3

1

$$\frac{118}{0.00118} = 100\ 000$$

*allow **1** mark for 100 (ie no conversion to mg)*
*allow 100 000 with no working shown for **2** marks*

1

(d) potassium ions are transported into the root

1

against a concentration gradient

1

by active transport

1

[10]

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Q1.

(a) 26% of students achieved the mark for saying stem cells are found in meristems or the tips of roots or shoots. A variety of incorrect organs or tissues were named, the most common being root, stem, xylem and embryo. Some students named parts of a cell, such as chloroplast or cytoplasm.

(b) 49% of students correctly identified producing a large number of identical plants as one economic use of plant stem cells. There was some confusion of genetic engineering and stem cell technology, as most other students selected to create genetically modified crops as their answer.

(c) This question was targeted at grades 8−9. 4% of students correctly converted 6 picograms into grams and wrote the answer in standard form.

Some students did not understand the term standard form and gave a number written in decimal form. This value was usually an incorrect conversion of picograms to grams. Common incorrect attempts at writing the value in standard form included 6×10^{-6} or 6×10^{-9}

(d) 15% of students achieved both marks for calculating the number of hours the cell spent in mitosis and giving the answer to three significant figures. 20% of students achieved one mark because they rounded the number incorrectly or gave their answer in hours and minutes. Many students referred to both 28 and 15 but used an incorrect calculation or did not realise there are 360° in a circle.

(e) 14% of students achieved more than two marks. The majority of students gained a mark for stating that the cell would grow during stage 1, or two copies of each chromosome form. The latter of these events was often included in stage 2, rather than stage 1. This error, or if stage numbers were omitted, limited the response to a maximum of four marks.

Some very good descriptions of mitosis, including spindle formation, were seen. However, a lot of students did not mention the nucleus dividing. A few students gained the final mark for saying cytokinesis occurred in stage 3. Few gave the full description of the cytoplasm or membrane dividing to form two identical cells.

42% of students did not achieve any marks. This was usually because they described the process of IVF. Some confused the cell cycle with meiosis and fertilisation.

(f) 31% of students achieved two or more marks.

Marks were generally awarded for advantages, rather than disadvantages. Common correct advantages given included:

- how stem cells can be used in patients
- diseases stem cells can be used to treat, for example paralysis
- that the cells would not be rejected by patients.

The most common disadvantage mentioned was that an embryo or potential life was destroyed. Saying the cells were wasted was insufficient.

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A lot of students confused the process with that of IVF.

Q2.

(a) 17% of students could name the hole in the leaf a stoma or stomata.

(b) 10% of students could name a guard cell. Many students incorrectly named cell components.

(c) 49% of students could correctly use the term osmosis or transpiration, with few being able to achieve both marks.

(d) Students were asked to tick two boxes but nearly 20% of students only ticked one box. 19% of students got both answers correct, and 65% of students achieved one mark. More students were aware that increasing temperature increases water loss from stomata, rather than increasing wind speed.

(e) 23% of students could give a reason why the movement of water in plants is important. 'For photosynthesis' was the most common correct answer. Those who did not gain the mark often gave vague answers, such as 'to keep the plant alive'.

(f) Students found this question difficult with 9% of students answering correctly. Many referred to leaves taking in water or blocking water from reaching the roots. Few referred to less water loss or decreased transpiration.

(g) 69% of students could calculate the real width of the cell, given the equation in the question. Fewer could convert from millimetres to micrometres, with many dividing by 1000.

Q3.

(a) The majority of students could describe xylem as hollow cells, or tubes. The second marking point, for the presence of lignin (to strengthen the cell) was rarely seen. Some students referred only to cells having a semi-permeable membrane, or other cell parts, that did not answer the question. 27% of students achieved one or two marks for this question.

(b) 38% of students could correctly calculate the real length of the cell by recalling and using the correct equation. Many did not convert units from millimetres to micrometres, or did so incorrectly, by dividing by 1000, or multiplying by 100. Marks were awarded if an incorrect calculation of length was then correctly converted; illustrating that students should always show their working.

(c) 77% of students could not explain how guard cells increase in volume. Many referred to water vapour or carbon dioxide entering or leaving via the stomata, which did not answer the question. Marking point one, for the idea of water entering the cell was often confused. References to osmosis or a description of osmosis for the second marking point were rare, with 55 of students achieving full marks.

(d) Some students were able to analyse the graph and deduce that rainfall is low from March to November, and link this to less water loss as an advantage to the tree. Few students correctly referred to the idea of temperature being high and therefore the rate of transpiration being rapid. 7% of students achieved two or three marks.

Many misconceptions were seen regarding water uptake in plants. Many answers referred to water entering the leaves through stomata. Some students believe leaves prevent the tree from taking up water.

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