HELICATE · AS AND A-LEVEL BIOLOGY · TOPIC BANK

3.1.7 Water

Mark scheme

Version 1 · 2 October 2026

TOTAL MARKS	QUESTIONS
42	7

How to use this mark scheme

;	Separates marking points. Each semicolon marks the end of one creditable point, and each point is worth one mark.
;;	Two marks for this answer (used for calculations).
/	Alternative words or phrases that are credited for the same point.
OR	An alternative answer for the same mark.
( )	Words in brackets are not needed to gain the mark.
max	More marking points are listed than marks available. Award up to the number of marks shown.
Accept	An alternative answer that gains credit.
Reject	A wrong answer. It does not gain credit and cancels a correct point it contradicts.
Ignore	Neither credited nor penalised. Mark the rest of the answer.
ECF	Error carried forward: credit correct working that uses an earlier wrong answer.
AO	Assessment objective: AO1 knowledge and understanding; AO2 applying knowledge; AO3 analysing, interpreting and evaluating.

Where an answer is correct but not listed, credit it if it is biologically accurate and answers the question at the depth the marks require. Right + wrong = wrong: a contradiction cancels a correct point.

Water as a metabolite and a solvent 3.1.7

Question	Marking guidance	Mark	Comments
01.1	A water molecule is used as each glycosidic bond is broken;	**1** (1 × AO1)	Water is a metabolite: it is a reactant in the hydrolysis of each glycosidic bond. Water itself is not hydrolysed

Question	Marking guidance	Mark	Comments
01.2	Correct answer for 2 marks: 227 (%);; Accept for 1 mark: an increase of 25 (mg per g) OR 25 ÷ 11	**2** (2 × AO2)	**Accept** 227.3 OR 227.27 (%) for 2 marks 327 (%) (36 ÷ 11 × 100) gains 0 marks unless the increase of 25 is shown

Question	Marking guidance	Mark	Comments
01.3	Fresh mass increases/changes as the grains take up water (from 12% to 45% water), so values per gram of fresh mass could not be compared (over time) OR so a change would reflect water uptake rather than a change in (the mass of) sugar;	**1** (1 × AO3)	**Accept** water content changes, so fresh mass would not give a valid comparison **Ignore** 'more accurate' unqualified

Question	Marking guidance	Mark	Comments
01.4	1. Water is a metabolite OR water is a reactant in hydrolysis OR water is used to break glycosidic bonds; 2. Water is a solvent (in which metabolic reactions occur) OR enzymes/amylase dissolve in water; 3. So enzymes can move to/collide with starch OR enzyme–substrate complexes (can) form; 4. Dry grains contain only 12% water, so there is too little water for (much) hydrolysis/for reactions to occur;	**3 max** (2 × AO1) (1 × AO2)	**Reject** 'water is hydrolysed' for point 1 1. **Accept** water is needed to split starch into maltose/sugars 2. **Accept** (dissolved) substances can move/diffuse in water 3. **Reject** starch dissolves (starch is insoluble) **Ignore** references to pH

Question	Marking guidance	Mark	Comments
01.5	1. (Supports:) reducing sugar content rises (from 4 to 41 mg per g) only after/as the water content rises; 2. Most of the water is taken up in the first 24 hours (12% to 42%), but most of the increase in reducing sugar is after 24 hours (11 to 41 mg per g) OR there is a delay (of 12–24 hours) before the reducing sugar rises; 3. Reducing sugar keeps rising between 36 and 60 hours (23 to 41 mg per g) when water content hardly changes (44% to 45%), so another factor must be involved (eg time for enzymes to be made); 4. A correlation does not show a causal relationship OR there is no control (eg grains kept dry for the same time); 5. No repeats OR sample size not known;	**3 max** (3 × AO3)	**Max 2** if only points supporting, or only points against, the conclusion are given 2 and 3. Must use data from the table; accept manipulated data, eg a rise of 30 (mg per g) after 24 hours compared with 7 before **Ignore** 'not enough data' unqualified

Heat capacity and latent heat of vaporisation 3.1.7

Question	Marking guidance	Mark	Comments
02.1	Correct answer for 2 marks: 6.4;; Accept for 1 mark: ranges of 16 (°C) **and** 2.5 (°C) **OR** 16 ÷ 2.5	**2** (2 × AO2)	Plotted values: air 10 to 26 °C; pond water 16.5 to 19.0 °C **Accept** readings giving an air range of 15.5–16.5 and a pond water range of 2.4–2.6, giving answers from 6.0 to 6.9, for 2 marks **Accept** 6.4 : 1

Question	Marking guidance	Mark	Comments
02.2	1. Water has a high (specific) heat capacity; 2. So a lot of (heat) energy is needed to change the temperature of the pond water OR water buffers changes in temperature, so the pond water warms and cools less than the air;	**2** (1 × AO1) (1 × AO2)	2. **Accept** water resists changes in temperature Latent heat of vaporisation alone does not gain point 1 **Ignore** references to evaporation/latent heat of vaporisation **Ignore** definitions of heat capacity

Question	Marking guidance	Mark	Comments
02.3	Their body temperature stays (fairly) constant, so the rate of (enzyme-controlled/metabolic) reactions stays (fairly) constant OR is not slowed (much) at night;	**1** (1 × AO2)	**Accept** enzyme activity stays (fairly) constant **Ignore** references to denaturing (the air temperature does not reach denaturing temperatures)

Question	Marking guidance	Mark	Comments
03.1	1. Water evaporates from W OR heat (energy) from the lamp is used to evaporate water from W; 2. Water has a large latent heat of vaporisation, so evaporation absorbs a lot of heat (energy) OR so evaporation has a (large) cooling effect; 3. Energy is used to break hydrogen bonds between water molecules OR to change water from liquid to vapour/gas, rather than to raise the temperature (of W); 4. The water in W has a high (specific) heat capacity, so more (heat) energy is needed to raise the temperature of W (than of D); 5. D has no water to evaporate, so (all) the heat (energy) it absorbs raises its temperature; 6. After 12 minutes, all the water (in W) has evaporated OR W has dried out; 7. So there is no (longer a) cooling effect, and W heats up to the same temperature as D (31.5 °C);	**5 max** (1 × AO1) (2 × AO2) (2 × AO3)	**Max 4** if point 2 is not given Descriptions of the data, eg in the first 12 minutes D rose by 11.5 °C and W by only 2.0 °C, gain credit only as part of point 5 or point 7; a description alone gains no marks 2. **Reject** latent heat of evaporation 6. **Accept** no water is left to evaporate **Ignore** explanations of why the temperatures level off, eg heat gained equals heat lost

Question	Marking guidance	Mark	Comments
03.2	A leaf is continuously supplied with water (from the xylem/stem), so it does not dry out OR a leaf can control/limit evaporation (eg by closing stomata or with a waxy cuticle) OR a leaf is living, so it respires, releasing heat (which raises its temperature);	**1** (1 × AO3)	**Accept** any other valid difference that would affect the evaporation of water or the temperature of the leaf **Ignore** differences in shape or colour unless linked to evaporation or temperature

Question	Marking guidance	Mark	Comments
04.1	Correct answer for 2 marks: 79 (%);; Accept for 1 mark: 2304 (kJ) removed by evaporation **OR** one error, eg: 99 (%) (80% not applied) 0.079 (%) (mass not converted from kg to g)	**2** (2 × AO2)	**Accept** 79.4 (%) for 2 marks Working: 1200 g × 0.80 = 960 g; 960 × 2.4 = 2304 kJ; 2304 ÷ 2900 × 100 = 79.4%

Question	Marking guidance	Mark	Comments
04.2	1. Evaporation of sweat/water provides a (large) cooling effect OR removes a lot of heat (energy) per gram; 2. With little loss of water from the body OR under 1 kg (960 g) of evaporated water removed most (79%) of the heat produced; 3. So body temperature does not rise (much) OR enzymes are not denatured;	**2 max** (1 × AO1) (1 × AO2)	**Reject** latent heat of evaporation Do not award point 1 for (high) heat capacity **Accept** less risk of dehydration for point 2

Question	Marking guidance	Mark	Comments
04.3	1. Some mass was lost as water vapour in exhaled air/by breathing; 2. Some mass was lost as carbon dioxide (from respiration) OR mass of respiratory substrate used/respired; 3. Some sweat was absorbed by clothing (and did not evaporate or drip off); 4. The 80% (that evaporated) is an estimate OR it is difficult to measure how much sweat dripped off;	**2 max** (2 × AO3)	**Accept** urination or loss of faeces during the hour **Ignore** ‘human error’ or ‘inaccurate scales’ unqualified

Cohesion 3.1.7

Question	Marking guidance	Mark	Comments
05.1	1. (Strong) cohesion between water molecules OR water molecules are attracted to each other; 2. (Cohesion) produces surface tension (at the water surface); 3. Surface tension supports the (small/light) pond skaters, so all stay on the surface with no detergent; 4. Detergent reduces cohesion, so it reduces surface tension; 5. So as the concentration of detergent increases, the surface supports fewer pond skaters OR more pond skaters sink, with none supported at 0.020%;	**4 max** (2 × AO1) (2 × AO2)	1. **Accept** hydrogen bonds between water molecules 1. **Reject** adhesion used for attraction between water molecules; otherwise ignore adhesion Descriptions of the data gain credit only as part of point 3 or point 5

Question	Marking guidance	Mark	Comments
05.2	1. Heavier pond skaters are more likely to break through the surface/sink (whatever the detergent concentration); 2. So differences are due (only) to the concentration of detergent OR mass is a control variable, so the results are valid/can be compared;	**2** (2 × AO3)	**Accept** converse for 1, eg lighter pond skaters are more likely to stay on the surface **Ignore** 'fair test' unqualified

Question	Marking guidance	Mark	Comments
05.3	Population decreases because pond skaters sink/drown OR cannot stand/move/feed on the surface;	**1** (1 × AO2)	**Accept** pond skaters move to/survive only in ponds without detergent **Reject** detergent poisons/kills pond skaters without reference to the surface

Question	Marking guidance	Mark	Comments
06.1	It has strong cohesion between its molecules;	**1** (1 × AO1)	

Question	Marking guidance	Mark	Comments
06.2	The air bubble breaks the (continuous) column of water, so water molecules below the bubble are no longer held/pulled up by cohesion to the water above;	**1** (1 × AO2)	**Accept** hydrogen bonds for cohesion **Ignore** adhesion **Ignore** 'chain of water molecules' unless a continuous column/stream is described

Water in living organisms 3.1.7

Question	Marking guidance	Mark	Comments
07	1. Water is a metabolite: a reactant in photosynthesis OR in hydrolysis (reactions), eg of starch/sucrose OR a product of condensation (reactions), eg forming starch/cellulose; 2. Water is a solvent, so metabolic reactions (in cells) can occur OR so enzymes and substrates are dissolved; 3. Water is a solvent, so (dissolved) substances, eg mineral ions/sucrose, can be transported (in the xylem/phloem); 4. Cohesion (between water molecules) supports (continuous) columns of water in the xylem; 5. So water can be pulled up to the leaves (at the top of the tree); 6. Large latent heat of vaporisation, so evaporation of water from the leaves has a cooling effect; 7. With little loss of water; 8. High (specific) heat capacity, so (water in cells) buffers changes in temperature OR leaves heat up slowly in the sun; 9. So enzymes (in the leaves) are not denatured OR (cell) temperature stays close to the optimum for enzymes;	**6 max** (4 × AO1) (2 × AO2)	A property gains credit only when it is linked to its importance; naming a property alone gains no marks **Max 4** if fewer than three different properties are explained 1. **Reject** 'water is hydrolysed' (eg in photosynthesis) 4. **Accept** hydrogen bonds between water molecules for cohesion; reject adhesion used for attraction between water molecules 5. **Accept** 'transpiration stream' or a description of a stream of water; 'transpiration' alone is not enough 6. **Reject** latent heat of evaporation 7. Point 7 must follow point 6 9. Point 9 must be linked to point 6 or point 8 **Ignore** references to pH **Accept** any other valid property of water if its importance to the tree is validly explained, as an alternative to any one point

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