

1 Living organisms: variety and common features

Using and interpreting data

Question	Mark scheme	Marks																					
1 a)	<ul style="list-style-type: none"> • S = scale linear and uses at least half of the grid • L = lines neat, straight and through points • A1 = axes correct way round (Temperature along horizontal axis) • A2 = axes labelled (Temperature in °C, Rate of oxygen production in cm³ per minute) • P = points accurately plotted • K = key (or graphs labelled liver and potato) <table border="1"> <caption>Data points from the graph</caption> <thead> <tr> <th>Temperature (°C)</th> <th>Liver (cm³/min)</th> <th>Potato (cm³/min)</th> </tr> </thead> <tbody> <tr><td>5</td><td>4</td><td>0</td></tr> <tr><td>15</td><td>8</td><td>16</td></tr> <tr><td>25</td><td>21</td><td>17</td></tr> <tr><td>35</td><td>46</td><td>11</td></tr> <tr><td>45</td><td>44</td><td>2</td></tr> <tr><td>55</td><td>38</td><td>0</td></tr> </tbody> </table>	Temperature (°C)	Liver (cm³/min)	Potato (cm³/min)	5	4	0	15	8	16	25	21	17	35	46	11	45	44	2	55	38	0	6
Temperature (°C)	Liver (cm³/min)	Potato (cm³/min)																					
5	4	0																					
15	8	16																					
25	21	17																					
35	46	11																					
45	44	2																					
55	38	0																					
b)	<ul style="list-style-type: none"> • 35 °C (liver) and 25 °C (potato) (accept values from student's graph if drawn as a curve) • liver higher (or converse) 	2																					
c)	<ul style="list-style-type: none"> • enzymes are proteins • shape of molecule changes / shape of active site changes / eq • denatured at high temperatures • so cannot catalyse reaction / cannot bind to substrate / eq 	3																					
Total		11																					

Question	Mark scheme	Marks
2 a)	<ul style="list-style-type: none"> S = scale linear and uses at least half of the grid L = lines neat, straight and through points A1 + A2 = axes correct way round (x-axis for pH) and labelled (pH, Rate of protein breakdown in arbitrary units) P = points accurately plotted 	4
b)	<ul style="list-style-type: none"> pH 5.5 (accept value from student's graph) 	1
c) i)	<ul style="list-style-type: none"> pH3 	1
ii)	<ul style="list-style-type: none"> (an enzyme catalyses a reaction because) the active site has the right shape to bind substrates / eq (when substrates bind to the active site) they are in the correct orientation for reaction / the reaction is facilitated / eq changes in pH cause the active site to change shape / eq less able / unable to bind to substrate / eq 	3
d)	<ul style="list-style-type: none"> rate of protein breakdown would be lower / slower (than 96) / eq rates of enzyme-catalysed reactions vary with temperature / eq at 20°C molecules have lower kinetic energy / fewer collisions / eq 	3
Total		12

Question	Mark scheme	Marks
3 a) i)	<ul style="list-style-type: none"> (+)0.1 g -0.4 g (must show minus sign or say there is a loss in mass) 	2
ii)	<ul style="list-style-type: none"> $0.3 \div 1.9 \times 100$ 16% (allow 15.7 or 15.8%) (correct answer with no working = 2 marks) 	2
b) i)	<ul style="list-style-type: none"> -24% (must show minus sign) 	1
ii)	<ul style="list-style-type: none"> 0.24 M / 0.25 M 	1
c) i)	<ul style="list-style-type: none"> above 0.24 M / 0.25 M OR 0.24 / 0.25 M to 0.8 M 	1
ii)	<ul style="list-style-type: none"> water moved out / left the potato cylinders / eq (water moved) from a more dilute solution in cells / cytoplasm / cell vacuole to a more concentrated solution outside / eq through partially permeable / selectively permeable (cell) membrane / eq 	3
Total		10

Question	Mark scheme	Marks
4 a)	<ul style="list-style-type: none"> substrate / lipid / fat / eq (+ water) attaches to enzyme / eq at active site reaction facilitated / correct orientation of substrate (and water) / products leave enzyme / products leave active site / eq 	2
b) i)	<ul style="list-style-type: none"> 40 °C (<i>allow</i> ± 2 °C) 	1
ii)	<ul style="list-style-type: none"> (20 °C) 5 (mg / hour) (<i>allow</i> ± 1.0 °C) (30 °C) rate is 5 (mg / hour) higher / eq <i>OR</i> rate is double / eq (<i>or converse</i>) 	2
iii)	<ul style="list-style-type: none"> (at 30 °C) molecules have more kinetic energy / move more quickly / eq (<i>or converse for 20 °C</i>) (at 30 °C) more collisions (between enzyme / active site and substrate) / eq (<i>or converse for 20 °C</i>) 	2
iv)	<ul style="list-style-type: none"> (enzyme) denatured at high temperatures shape of molecule changes / shape of active site changes / eq so cannot catalyse reaction / cannot bind to substrate / eq 	2
c)	<ul style="list-style-type: none"> emulsify lipid / fat <i>OR</i> disperse lipid / fat into small droplets / eq provides a larger surface area for lipase to act on / eq 	2
Total		11

Practical activities

Question	Mark scheme	Marks
1 a)	<ul style="list-style-type: none"> measure, height of liquid above initial marked level / distance moved by meniscus / eq in mm / cm / using a ruler / eq 	2
b) i)	<ul style="list-style-type: none"> level has risen / eq 	1
ii)	<ul style="list-style-type: none"> water enters / moves into, the bag down the water concentration gradient / from the water to the solution / eq (water enters) by osmosis through the partially permeable / selectively permeable Visking tubing / sucrose molecules too large to pass through Visking tubing / eq 	3
c)	(experiment 2) <ul style="list-style-type: none"> because the water level rose higher / eq (due to) greater concentration gradient (between water and concentrated solution) / eq so (water) moves more rapidly 	2
d)	<ul style="list-style-type: none"> leakage from the knot in the Visking tubing / from its attachment to the bung / eq tighten knot firmly / tightly tied / use twisted wire around bung / eq <i>OR</i> <ul style="list-style-type: none"> sucrose solution spilled on the outside of the Visking tubing / eq wash outside of tubing carefully after filling / use a syringe for filling / eq <i>OR</i> <ul style="list-style-type: none"> bags of different sizes / eq measure the length from knot to rubber bung to ensure both the same / eq <i>OR</i> <ul style="list-style-type: none"> error in, reading the water level (related to meniscus) / marking water level (thickness of marker line) keep eye level with meniscus when reading level / use a fine point marker / use graduated glass tubing / eq (<i>credit other valid error and precaution</i>)	2
e)	<ul style="list-style-type: none"> temperature of the water / temperature of the air / height of water in the beakers / eq (<i>can credit this answer if given for d), but once only</i>)	1
Total		11

Question	Mark scheme	Marks
2 a) i)	<ul style="list-style-type: none"> the contents of each tube have time to equilibrate / reach the temperature of the water bath (before mixing) / eq 	1
ii)	<ul style="list-style-type: none"> to prevent transfer of contents from one tube to another / eq 	1
b) i)	<ul style="list-style-type: none"> the value 6 minutes (at 20°C) / eq sensible example of human error, e.g. enzyme volume slightly larger than 1 cm³ / starch volume measured out incorrectly / slightly less than 5 cm³ starch / using a dropper from another tube / eq 	2
ii)	<ul style="list-style-type: none"> 13 + 14 + 15 = 42, 42 ÷ 3 14 minutes <p>(correct answer [14 minutes] with no working shown = 2 marks)</p>	2
iii)	<ul style="list-style-type: none"> time until starch completely digested / eq 	1
c) i)	<ul style="list-style-type: none"> 40°C 	1
ii)	<ul style="list-style-type: none"> carry out the experiment at several temperatures, just above and below 40°C OR appropriate temperatures quoted within the range 34°C to 44°C / eq 	1
d)	<ul style="list-style-type: none"> add Benedict's solution (to liquid in a test tube) heat test tube in a beaker of boiling water for 5 minutes / eq green / yellow / orange / brick-red colour indicates glucose present 	3
Total		12

Question	Mark scheme	Marks
3 a)	<ul style="list-style-type: none"> the movement of molecules down a concentration gradient from regions of higher concentration to regions of lower concentration 	2
b) i)	<ul style="list-style-type: none"> cube B surface area = 54 cm² (6 × (3 × 3)) volume = 27 cm³ (3 × 3 × 3) 	2
ii)	<ul style="list-style-type: none"> rate of diffusion (into each cube) depends on surface area to volume ratio higher surface area to volume ratio in cube A (or converse), OR surface area to volume ratio for cube A = 6:1 OR $\frac{6}{1}$ and for cube B = 54:27 OR 2:1 OR $\frac{54}{27}$ OR $\frac{2}{1}$ the dye penetrates cube A more quickly / dye has reached the centre of cube A, but only the outer edge of cube B / eq 	2
c)	<ul style="list-style-type: none"> shading shown further in, towards the centre at higher temperature dye molecules have more kinetic energy / molecules move / diffuse more quickly 	2
d)	<ul style="list-style-type: none"> small organism has a large surface area to volume ratio (therefore) oxygen diffuses rapidly into the centre / to all parts / eq larger organism has a smaller surface area to volume ratio, so diffusion alone too slow to supply cells in the centre / eq 	2
Total		10

Understanding structure, function and processes

Question	Mark scheme	Marks
1 a) i)	<ul style="list-style-type: none"> • hyphae / mycelium • walls (of hyphae) made of chitin • many nuclei (in hyphae) / eq <i>(credit any other correct structural feature)</i>	3
ii)	<ul style="list-style-type: none"> • (mucor) feeds by saprotrophic nutrition • digestive enzymes secreted onto the food / extracellular digestion / digestion outside the hyphae • digested / small molecules absorbed 	2
iii)	<ul style="list-style-type: none"> • it respire / eq • excrete / eq • reproduce / eq • move / eq • responds to its surroundings / eq • controls its internal conditions / eq 	3
b)	<i>bacteria have:</i> <ul style="list-style-type: none"> • a cellular structure • cell membrane • plasmids • cytoplasm • cell wall • chromosomes • in bacteria, genetic material is DNA; in viruses it may be DNA or RNA • bacteria are larger than viruses <i>(give appropriate credit for virus structural differences from bacteria)</i>	3
Total		11

Question	Mark scheme	Marks
2 a)	<ul style="list-style-type: none"> • A cytoplasm • B cell membrane • C nucleus 	3
b)	<ul style="list-style-type: none"> • 2. tissue + <i>example from:</i> epithelium / muscle / connective tissue / nervous tissue / epidermis / xylem / phloem / mesophyll / eq • 3. organ + <i>example from:</i> eye / heart / kidney / liver / lung / large or small intestine / ovary / testis / flower / stem / leaf / root / eq • 4. system + <i>example from:</i> digestive / endocrine / excretory / nervous / reproductive / skeletal / transport / circulatory / eq 	3
c)	<i>Similarities (both have)</i> <ul style="list-style-type: none"> • nucleus • cell membrane • cytoplasm <i>Differences</i> <ul style="list-style-type: none"> • yeast cell has a cell wall • yeast cell has a large central vacuole • yeast cell may have buds <i>(give appropriate credit for cheek cell differences from yeast cell)</i>	2 1
Total		9

Question	Mark scheme	Marks
3 a)	<ul style="list-style-type: none"> A: cytoplasm; activities / metabolism of cell take place here / contains enzymes / contains organelles / eq B: cell wall; provides strength / protection / rigidity / eq C: chloroplast; contains chlorophyll / carries out photosynthesis / makes sugar / starch / eq D: vacuole; contains cell sap / contributes to turgidity / support / eq E: nucleus; contains genetic information / DNA / chromosomes / controls activities of the cell / eq 	5
b)	<p><i>Similarities (both have)</i></p> <ul style="list-style-type: none"> nucleus cell membrane cytoplasm <p><i>Differences</i></p> <ul style="list-style-type: none"> leaf cell contains chloroplasts leaf cell has a cell wall leaf cell has a large vacuole leaf cell contains cell sap <p><i>(give appropriate credit for animal cell differences from leaf cell)</i></p>	2 2
Total		9

Question	Mark scheme	Marks																				
4 a)	<table><tr><th>Feature</th><th>Viruses</th><th>Bacteria</th><th>Protoctists</th></tr><tr><td>1</td><td>x</td><td>✓</td><td>✓</td></tr><tr><td>2</td><td>✓</td><td>x</td><td>x</td></tr><tr><td>3</td><td>x</td><td>✓</td><td>✓</td></tr><tr><td>4</td><td>x</td><td>✓</td><td>x</td></tr></table>	Feature	Viruses	Bacteria	Protoctists	1	x	✓	✓	2	✓	x	x	3	x	✓	✓	4	x	✓	x	4
	Feature	Viruses	Bacteria	Protoctists																		
	1	x	✓	✓																		
	2	✓	x	x																		
	3	x	✓	✓																		
	4	x	✓	x																		
(1 mark for each correct row)																						
b)	<ul style="list-style-type: none">• an organism that causes disease• virus example: tobacco mosaic virus / influenza virus / HIV virus / eq• bacteria example: pneumococcus / eq• protocist example: plasmodium / eq	4																				
Total		8																				

Applying principles

Question	Mark scheme	Marks
1 a) i)	<ul style="list-style-type: none"> in X, no starch under / around the beans, starch present in rest of the dish / eq in Y, starch present throughout dish / eq in Z, starch present throughout dish / eq <p><i>(all correct, 2 marks, one error, 1 mark, two errors, 0 marks)</i></p>	2
ii)	<p><i>(in X)</i></p> <ul style="list-style-type: none"> enzyme / amylase produced (by beans) (enzyme) diffuses (into agar) digests / breaks down starch / eq <p><i>(in Y)</i></p> <ul style="list-style-type: none"> starch not broken down / eq enzyme / amylase not active / eq boiling denatures / destroys enzyme <p><i>(if X or Y missing from answer, max marks = 2)</i></p>	3
iii)	<ul style="list-style-type: none"> (blue-black colour means) no starch broken down / eq enzyme / amylase not present / inactive in dry bean / eq 	2
b)	<ul style="list-style-type: none"> oxygen warm temperature / warmth / eq 	1
Total		8

Question	Mark scheme	Marks
2 a)	<ul style="list-style-type: none"> • A cell wall • B cytoplasm • C cell vacuole 	3
b) i)	<i>(unboiled potato)</i> <ul style="list-style-type: none"> • liquid level inside well has risen / eq • water level in dish has fallen / eq 	2
ii)	<ul style="list-style-type: none"> • water has moved into the well (from the potato) / eq • water moves down concentration gradient from potato cells / vacuoles / eq <i>OR</i> water moves from dilute solution in cells / vacuoles / eq to more concentrated solution in well / eq • (cell) membranes of potato cells are partially permeable / selectively permeable / eq • water moves down concentration gradient from dish into potato cells / eq 	3
iii)	<ul style="list-style-type: none"> • boiling damages the cell membrane / eq • (cell membrane) no longer partially permeable / becomes permeable / eq 	2
Total		10

Question	Mark scheme	Marks
3 a) i)	<ul style="list-style-type: none"> • the cell on slide A is the same size / looks the same, as at the start / appears biconcave / unchanged / eq • the cell on slide B is smaller / not biconcave / wrinkled / eq 	2
ii)	<ul style="list-style-type: none"> • water moves out of the cell • from more dilute solution inside cell to 3.0% salt solution / to more concentrated solution outside cell / eq • (through) partially permeable / selectively permeable cell membrane / eq 	3
iii)	<ul style="list-style-type: none"> • the concentration of the blood plasma stays the same / constant / eq • the same as the concentration inside the red blood cells / eq • reference to osmoregulation / homeostasis 	2
b)	<ul style="list-style-type: none"> • in active transport (molecules / substances) are moved against the concentration gradient / in osmosis (molecules / substances) move down the concentration gradient / eq • active transport requires energy / osmosis does not require energy / osmosis is passive / eq • a range of different substances are moved by active transport / osmosis applies only to water / eq 	2
Total		9

Question	Mark scheme	Marks
4 a)	<ul style="list-style-type: none"> • no starch in small cube / eq • in large cube, no starch near the edges of the cube, but starch present in the centre / eq 	2
b)	<ul style="list-style-type: none"> • (starch in small cube) broken down (to sugar / maltose) / eq • by amylase / enzyme / eq 	2
c)	<ul style="list-style-type: none"> • (in both) amylase diffuses into the cube / eq • from high to low concentration (of amylase) / eq • small cube has larger surface area to volume ratio / eq <i>(or converse for large cube)</i> • in large cube, amylase does not reach the centre, but in small cube it does / eq 	3
Total		7