

2 Nutrition and respiration

Using and interpreting data

Question	Mark scheme	Marks
1 a)	<ul style="list-style-type: none"> rate at 20°C is higher / eq by 2.4 cm³ O₂ per min / is 4.8 cm³ O₂ per min (<i>or converse for 10°C</i>) rate at 20°C twice / double value at 10°C 	2
b)	<ul style="list-style-type: none"> carbon dioxide when percentage of carbon dioxide is increased, the rate increases 	2
c)	<ul style="list-style-type: none"> temperature (comparing the two graphs) at 0.15% CO₂ (point B) the rate increased when the temperature was increased from 10°C to 20°C 	2
Total		6

Question	Mark scheme	Marks
2 a) i)	<ul style="list-style-type: none"> butter 	1
ii)	<ul style="list-style-type: none"> accept value between 85 g and 90 g 	1
iii)	<ul style="list-style-type: none"> butter consumption high (in 1976) but fell steadily until 1996 / eq from 150 g to 40 g per week / eq 	2
b) i)	<ul style="list-style-type: none"> (total 1991) low fat spread + butter + margarine = 200 g (50 + 50 + 100) (total weekly fat consumption) 1991 less than in 1976 	3
ii)	(lower fat consumption so) less likely to suffer from: <ul style="list-style-type: none"> high blood pressure heart disease hardening of the arteries / atherosclerosis obesity eq <i>(accept any 2 from the list)</i>	2
Total		9

Question	Mark scheme	Marks
3 a) i)	<ul style="list-style-type: none"> 32 (the temperature change of the water, 52 – 20) × 20 × 4.2 = 2688 joules <i>(correct answer [2688] with no working = 3 marks)</i>	3
ii)	<ul style="list-style-type: none"> 3360 joules ([1 ÷ 0.8] × 2688) <i>(allow transfer error from part i)</i>	1
b) i)	<ul style="list-style-type: none"> 1600 – 1300 rice cakes release 300 joules more per gram than raisins <i>(correct answer with no working shown = 2 marks)</i> <i>(maximum 1 mark if units not stated)</i>	2
ii)	<ul style="list-style-type: none"> value on packaging is higher (<i>packaging = 15.8 kJ per g, student value = 1.6 kJ per g</i>) heat energy from burning food lost to air / eq / food not burnt completely 	2
Total		8

Question	Mark scheme	Marks
4 a)	<ul style="list-style-type: none"> • 40 g slice of bread provides $4 \times 4.8 \text{ g carbohydrate} = 19.2 \text{ g}$ • $116.0 \div 19.2$ • = 6 slices <p><i>(if error in first calculation is used correctly later, allow transfer error to max of 2 marks)</i> <i>(correct answer (6 slices) with no working shown = 3 marks)</i></p>	3
b) i)	<ul style="list-style-type: none"> • growth (of muscle) • repair (of muscle) 	2
ii)	<ul style="list-style-type: none"> • $(0.7 \div 10) \times 100$ • = 7% <p><i>(correct answer with no working shown = 2 marks)</i></p>	2
iii)	<ul style="list-style-type: none"> • would have to eat a very large amount of bread to obtain enough protein / eq • this large amount would contain too much carbohydrate / eq • other foods / eggs, have higher protein content / eq • a healthy diet contains vitamins / minerals / eq, not present in bread 	2
Total		9

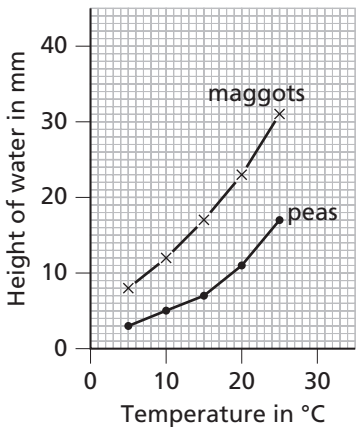
Practical activities

Question	Mark scheme	Marks
1 a) i)	<ul style="list-style-type: none"> • less glass, so less heat (energy) transferred to the test tube / so more heat (energy) transferred to the water / eq 	1
ii)	<ul style="list-style-type: none"> • warm air trapped (by can) / so less heat (energy) lost to surrounding air / so more heat (energy) transferred to the water / eq 	1
iii)	<ul style="list-style-type: none"> • warm air trapped (by cotton wool) / so less heat (energy) escapes from the top of the test tube / so more heat (energy) transferred to water / eq 	1
b)	<ul style="list-style-type: none"> • the crisp might not have burnt completely • heat (energy) loss to the air below the crisp • heat loss to the glass thermometer • heat loss through the metal sides of the tin • eq 	2
c)	repeat the experiment several times to obtain a mean value	1
Total		6

Question	Mark scheme	Marks
2 a)	<ul style="list-style-type: none"> • the starch in the leaves is converted to sugar / sucrose in the dark 	1
b)	<ul style="list-style-type: none"> • sodium or potassium hydroxide / soda lime 	1
c) i)	<ul style="list-style-type: none"> • to kill the cells / make the cell membrane permeable to chlorophyll / stop further metabolism / eq 	1
ii) 1 2	<ul style="list-style-type: none"> • to remove chlorophyll from the leaf • the test tube with ethanol should be heated in a beaker of boiling water / eq • the ethanol must be kept away from a naked flame / eq • safety glasses should be worn 	1 2
iii)	<ul style="list-style-type: none"> • blue / black if starch present • brown / red-brown if starch absent 	2
d)	<ul style="list-style-type: none"> • light is necessary for photosynthesis / eq • carbon dioxide is necessary for photosynthesis / eq 	2
Total		10

Question	Mark scheme	Marks																					
3 a)	<ul style="list-style-type: none"> to increase the concentration of CO_2 (for photosynthesis) 	1																					
b) i)	<ul style="list-style-type: none"> S = scale linear and uses at least half the grid L = lines neat, straight and through points A1 = axes correct way round (temperature along horizontal axis) A2 = axes labelled (Temperature in $^{\circ}\text{C}$, Number of bubbles [of oxygen] per minute) P = points plotted accurately K = key (or graphs labelled experiment 1, experiment 2) <table border="1"> <caption>Data points from the graph</caption> <thead> <tr> <th>Temperature ($^{\circ}\text{C}$)</th> <th>Experiment 1 (bubbles/min)</th> <th>Experiment 2 (bubbles/min)</th> </tr> </thead> <tbody> <tr><td>5</td><td>15</td><td>15</td></tr> <tr><td>10</td><td>21</td><td>21</td></tr> <tr><td>15</td><td>27</td><td>27</td></tr> <tr><td>20</td><td>28</td><td>34</td></tr> <tr><td>25</td><td>28</td><td>38</td></tr> <tr><td>30</td><td>29</td><td>42</td></tr> </tbody> </table>	Temperature ($^{\circ}\text{C}$)	Experiment 1 (bubbles/min)	Experiment 2 (bubbles/min)	5	15	15	10	21	21	15	27	27	20	28	34	25	28	38	30	29	42	6
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30	29	42																					
ii)	<ul style="list-style-type: none"> Experiment 1: 28 (bubbles per minute) Experiment 2: 31 (bubbles per minute) (accept values from student's graph) 	2																					
c) i)	<ul style="list-style-type: none"> Experiment 1, rate of photosynthesis stays the same / unchanged / eq Experiment 2, rate (continues to) increase as temperature increases / eq suitable value quoted from graph (e.g. at 30°C, Experiment 1: 29 bubbles per minute, Experiment 2: 42 bubbles per minute) 	2																					
ii)	<ul style="list-style-type: none"> Experiment 1, rate of photosynthesis is limited / cannot increase / eq (limited) by light intensity / (cannot increase) because light intensity low / eq (or converse for Experiment 2) 	2																					
d)	<ul style="list-style-type: none"> allow suitable time / 15–20 minutes for the temperature in the test tube to equilibrate each time the temperature is changed / eq put the thermometer in the test tube (instead of the beaker) to ensure temperature recorded is that of the plant / eq monitor the temperature over each 5 minute period to ensure no increase in temperature due to heat from the lamp / eq eq 	1																					
Total		14																					

Question	Mark scheme	Marks
4 a) i)	<ul style="list-style-type: none"> (orange colour) carbon dioxide present in low concentration / carbon dioxide concentration similar to that of atmospheric air / eq 	1
ii)	<ul style="list-style-type: none"> purple colour in B because no CO_2 present in air in B / sodium hydroxide has absorbed all CO_2 from air yellow colour in D more CO_2 than at start CO_2 from germinating peas / flask C 	4
b)	<ul style="list-style-type: none"> put a thermometer in flask C insulate flask C / wrap in cotton wool / eq (if candidate describes a different apparatus that works, e.g. vacuum flask experiment, 1 mark max) 	2
Total		7

Question	Mark scheme	Marks																		
5 a) i)	<ul style="list-style-type: none"> sodium or potassium hydroxide / soda lime 	1																		
ii)	<ul style="list-style-type: none"> maggots respire and produce CO_2 CO_2 absorbed so volume of air decreases liquid moves up the tube to replace it 	2																		
b)	<ul style="list-style-type: none"> P = points plotted accurately L = points joined accurately with straight lines  <table border="1"> <caption>Data points estimated from the graph</caption> <thead> <tr> <th>Temperature (°C)</th> <th>Maggots Height (mm)</th> <th>Peas Height (mm)</th> </tr> </thead> <tbody> <tr> <td>5</td> <td>8</td> <td>3</td> </tr> <tr> <td>10</td> <td>12</td> <td>5</td> </tr> <tr> <td>15</td> <td>18</td> <td>7</td> </tr> <tr> <td>20</td> <td>23</td> <td>11</td> </tr> <tr> <td>25</td> <td>31</td> <td>17</td> </tr> </tbody> </table>	Temperature (°C)	Maggots Height (mm)	Peas Height (mm)	5	8	3	10	12	5	15	18	7	20	23	11	25	31	17	2
Temperature (°C)	Maggots Height (mm)	Peas Height (mm)																		
5	8	3																		
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c) i)	<ul style="list-style-type: none"> $23 \div 30$ $= 0.77 \text{ mm/min}$ (correct answer with no working shown = 2 marks) 	2																		
ii)	<ul style="list-style-type: none"> accept value between 37 mm and 40 mm 	1																		
d) i)	<ul style="list-style-type: none"> (height) at 8°C, 10 mm / eq (height) at 18°C, 20 mm / eq twice as fast / 100% faster / eq 	3																		
ii)	<ul style="list-style-type: none"> (respiration occurs because) enzymes are present, to break down sugars and release energy / catalyse the breakdown of sugars / eq at higher temperatures, molecules have more kinetic energy / move faster / eq more collisions / faster rate of reaction / eq rate of reaction doubles for 10 degree rise in temperature 	2																		
Total		13																		

Understanding structure, function and processes

Question	Mark scheme	Marks
1 a)	<ul style="list-style-type: none"> • 1 = C • 2 = A • 3 = B • 4 = D 	4
b)	• line drawn to touch part of the small intestine and no other structure, labelled X	1
c) i)	• oesophagus	1
ii)	<ul style="list-style-type: none"> • by peristalsis • by contraction of muscles (in wall of oesophagus) 	2
d) i)	<ul style="list-style-type: none"> • glucose • amino acids • fatty acids • glycerol • other named monosaccharide sugar • eq 	2
ii)	<ul style="list-style-type: none"> • projecting / finger-like shape / eq increases surface area (for absorption) • thin wall so short distance for molecules to travel / diffuse / eq • network of blood capillaries / lacteals to absorb molecules / eq 	2
Total		12

Question	Mark scheme	Marks
2 a) i)	• starch molecules are too large to pass through the pores in the tubing	1
ii)	<ul style="list-style-type: none"> • starch has broken down to maltose / sugar / eq • (by action of) amylase / enzyme • (amylase / enzyme) catalyses the reaction / eq 	2
iii)	<ul style="list-style-type: none"> • maltose / sugar molecules are small enough to pass through the pores in the tubing • move from high concentration (of maltose) inside the tubing to lower concentration (of maltose) in the water in the beaker / eq • by diffusion 	2
b)	<ul style="list-style-type: none"> • in both gut and tubing, large molecules broken down to small / eq • by enzymes / eq • in both gut and tubing, small molecules can pass through the wall / out / eq 	2
Total		7

Question	Mark scheme	Marks
3 a)	<ul style="list-style-type: none"> • A: cuticle – reduces water loss from surface • B: epidermis – allows light to pass through / eq • C: palisade mesophyll – most photosynthesis takes place here • D: xylem / phloem / vein / vascular bundle – (xylem) carries water / mineral salts to leaf OR (phloem) carries sugars away from leaf <p>(all correct = 4, 6 or 7 correct = 3, 4 or 5 correct = 2, 3 or 2 correct = 1)</p>	4
b) i)	• lower epidermis	1
ii)	<ul style="list-style-type: none"> • arrow(s) shown going through stomatal pore, upwards • arrow(s) shown pointing upwards, through air spaces (<i>no mark if through cells</i>) • arrow(s) ending at chloroplast in palisade cell <p>(all correct = 2, one error = 1)</p>	2
iii)	<ul style="list-style-type: none"> • no photosynthesis at night, only respiration • carbon dioxide moves in the opposite direction / from the palisade cells / eq • stomata / guard cells closed / eq 	2
Total		9

Question	Mark scheme	Marks
4 a) i)	<ul style="list-style-type: none"> • <i>on left of arrow:</i> glucose • <i>on right of arrow:</i> carbon dioxide and water (<i>any order</i>) • aerobic respiration 	3
ii)	<ul style="list-style-type: none"> • <i>on left of arrow:</i> glucose • <i>on right of arrow:</i> ethanol and carbon dioxide (<i>any order</i>) • anaerobic respiration 	3
b)	<ul style="list-style-type: none"> • more energy per minute after 1 hour than after 2 hours 	1
Total		7

Extended writing

Question	Mark scheme	Marks
1	<ul style="list-style-type: none"> • digestion involves the breakdown of large food molecules to smaller ones • (digestion / breakdown) by enzymes • lipase • (lipase) from pancreas / pancreatic juice / pancreatic duct • (breaks down) lipid to fatty acid + glycerol • bile • from gall bladder / liver • (bile) alkaline / neutralises acid from stomach / provides correct pH for lipase action • (bile) emulsifies lipids / converts lipids to small droplets / eq • so large surface area for lipase to act 	6
Total		6

Question	Mark scheme	Marks
2	<ul style="list-style-type: none"> • <i>up to 2 marks for naming final products of digestion from the list:</i> glucose / amino acids / fatty acids / glycerol • small intestine long, so large surface area for rapid diffusion / absorption • villi are finger-like projections • (villi) provide large surface area, for rapid diffusion / absorption • (villi) have thin walls, for rapid diffusion / absorption • capillaries are close to surface of villi, for rapid diffusion / absorption • large number of capillaries, allows rapid diffusion / absorption • amino acids / glucose, into capillaries / blood vessels in villi • (fatty acids / glycerol / fat droplets) into lacteals 	6
Total		6

Question	Mark scheme	Marks
3	<p><i>(whole leaf)</i></p> <ul style="list-style-type: none"> • large surface area OR flat surface, captures light (for photosynthesis) / eq • veins support leaf, in suitable position to receive light / eq • leaf is thin, so short diffusion paths inside OR light can reach cells on lower side of leaf / eq <p><i>(internal structure)</i></p> <ul style="list-style-type: none"> • upper epidermis OR cuticle, is transparent / allows light to pass through • palisade mesophyll cells, are near upper surface of leaf OR packed closely together, to receive light / eq • palisade mesophyll cells have many chloroplasts, to absorb light / for photosynthesis • spongy mesophyll has air spaces, to allow carbon dioxide to reach cells / to allow circulation of gases / eq • guard cells / stomata, allow exchange of gases with air / allow diffusion of carbon dioxide into leaf / eq • veins / xylem, bring water to cells • phloem (in veins), carries away products of photosynthesis / sucrose / eq <p><i>(marks can be awarded on a diagram provided there are suitable annotations, or explanations in text)</i></p>	6
Total		6

Question	Mark scheme	Marks
4	<ul style="list-style-type: none"> • (in mouth) amylase, starch to maltose (<i>if mark not awarded here, may be given for the action of pancreatic amylase in the small intestine</i>) • (mouth to) oesophagus / stomach / small intestine • (in small intestine) maltase, maltose to glucose • reference to digestion / action enzymes / smaller molecules (for absorption) / eq • absorption in small intestine • reference to villi • (in villi) into blood capillaries • (capillaries to) hepatic portal vein • (transport) to liver • (in liver) conversion of glucose to glycogen <p>(1 mark for starch to maltose and maltose to glucose if no reference to named enzymes)</p>	6
Total		6