



<b>2.40B understand the role of diffusion in gas exchange</b>			
(i)	correct reference to <u>oxygen</u> + <u>carbon dioxide</u> ;		1
<b>2.41B understand gas exchange (of carbon dioxide and oxygen) in relation to respiration and photosynthesis</b>			
<b>2.42B understand how the structure of the leaf is adapted for gas exchange</b>			
<b>2.43B describe the role of stomata in gas exchange</b>			
(c)(i)	20;		1
(ii)	fewer/no stomata / holes / pores / guard cells;		1
(ii)	1. oxygen <u>out</u> + carbon dioxide <u>in</u> ; 2. diffusion; 3. photosynthesis	ignore reference to respiration  CO <sub>2</sub> and O <sub>2</sub> to enter and leave = 1 O <sub>2</sub> and CO <sub>2</sub> to enter and leave = 0 CO <sub>2</sub> and O <sub>2</sub> to enter or leave = 0	Max 2
<b>2.44B understand how respiration continues during the day and night, but that the net exchange of carbon dioxide and oxygen depends on the intensity of light</b>			
4 (a)	1. <u>at low light</u> / up to A carbon dioxide released; 2. carbon dioxide absorbed; 3. levels off / flattens / plateaus / stays constant / <u>light</u> no longer limiting factor;		2 max
(b)	<u>respiration</u> = <u>photosynthesis</u> ;		1



<b>2.45B practical: investigate the effect of light on net gas exchange from a leaf, using hydrogen-carbonate indicator</b>			
3 (a)	light (intensity); affects/alters/increases/decreases/changes CO <sub>2</sub> level / gas exchange / photosynthesis;		2
(b)	size / species of leaves / eq; volume/amount/concentration of indicator; temperature;	ignore ref to tube size / time / cork seal / humidity	max 2
(c)	control / allow (valid) comparison / see if indicator changes (with no leaf) / colour change due to leaf / see if gas exchange happens without the leaf / eq;		1
(d) (i)	photosynthesis / allow photosynthesis more than respiration;  less CO <sub>2</sub> / CO <sub>2</sub> absorbed / eq;	ignore photosynthesis and respiration unqualified  ignore ref to pH	2
(ii)	respiration / <u>no</u> photosynthesis; CO <sub>2</sub> released / more CO <sub>2</sub> / no CO <sub>2</sub> absorbed / eq;	ignore ref pH	2
(e) (i)	respiration equals photosynthesis / CO <sub>2</sub> in equals CO <sub>2</sub> out / eq;	ignore gas exchange	1
(ii)	<u>no leaf</u> ;	ignor empty tube / nothing in tube	1
(f)	limewater only shows increase in CO <sub>2</sub> / cannot show decrease in CO <sub>2</sub> / cannot show amount of CO <sub>2</sub> / eq;		1
<b>2.46 describe the structure of the thorax, including the ribs, intercostal muscles, diaphragm, trachea, bronchi, bronchioles, alveoli and pleural membranes</b>			
2 (a) (i)	trachea / wind pipe / cartilage; alveoli / alveolus / air sacs;	reject air pockets	2
3(a)	A (right) lung(s) / <u>intercostal</u> muscle(s); B rib(s) / rib cage; C heart; D diaphragm;	Allow diaphragm	4
<b>2.47 understand the role of the intercostal muscles and the diaphragm in ventilation</b>			
(b)	1. diaphragm/D <u>contracts</u> ; 2. moves down / flattens / eq; 3. ribcage/B moves up/out / eq; 4. increase in (thorax) volume; 5. decrease in (thorax) pressure;	Mp3 Allow ribcage expand / ribs expand	5 max



(b)	<ol style="list-style-type: none"> <li>1. diaphragm;</li> <li>2. contracts (ONCE);</li> <li>3. flattens / moves down / lowers / eq;</li> <li>4. intercostal muscles;</li> <li>5. ribs move up / out / ribcage expands / eq;</li> <li>6. <u>volume</u> increases;</li> <li>7. <u>pressure</u> decreases;</li> </ol>		max 4
2.48 explain how alveoli are adapted for gas exchange by diffusion between air in the lungs and blood in capillaries			
(c)	<ol style="list-style-type: none"> <li>1. less surface area;</li> <li>2. slower diffusion / less diffusion / less gas exchange;</li> <li>3. less oxygen / less carbon dioxide;</li> </ol>	ignore less room allow converse for X	2
2.49 understand the biological consequences of smoking in relation to the lungs and the circulatory system, including coronary heart disease			
4(a)	<ol style="list-style-type: none"> <li>1. smoking;</li> <li>2. dust asbestos / working in mines;</li> <li>3.umes;</li> <li>4. enetic / lack of A1T;</li> <li>5. bronchitis;</li> </ol>	Ignore infection	2
(b)	<ol style="list-style-type: none"> <li>1. digest / breakdown / kill / destroy;</li> <li>2. acteria / pathogens / viruses/ microorganisms;</li> <li>3. prevent infection/disease/reproduction;</li> </ol>		2
(c)	2 268 000;;	1 mark for 0.80 / 80% / 80 ÷ 100 / divide by 10 multiply by 8	2
(d)	<ol style="list-style-type: none"> <li>(i) alveoli / alveolus;</li> <li>(ii) 1. <u>le</u> surface area;</li> <li>2. <u>diffusion</u> / gas <u>exchange</u>;</li> <li>3. (insufficie ) oxygen;</li> </ol>	Mark first answer in a list	1 2
(d)	<ol style="list-style-type: none"> <li>1. blocked / narrowed / clogged / eq;</li> <li>2. <u>coronary artery</u>;</li> <li>3. lot;</li> <li>4. at / cholesterol;</li> <li>5. less blood <u>to heart</u>;</li> <li>6. less oxygen / less oxygenated;</li> <li>7. <u>muscle</u> (cells);</li> <li>8. less respiration / anaerobic respiration;</li> <li>9. lactic acid / angina;</li> <li>10. heart attack / heart stops / cardiac arrest / eq;</li> </ol>		5



<p>(c) (i)</p>	<ol style="list-style-type: none"> <li>1. passive smoking / others inhale smoke / eq;</li> <li>2. causes cancer / contains carcinogens;</li> <li>3. asthma / emphysema / COPD / bronchitis / infection / eq;</li> <li>4. carbon monoxide reduces transport of oxygen / binding with haemoglobin / eq;</li> <li>5. causes CVD / heart disease / eq;</li> <li>6. discourage smoking / eq;</li> </ol>	<p>Ignore death</p>	<p>max 3</p>
<p>(ii)</p>	<ol style="list-style-type: none"> <li>1. slows growth / development / still growing / not fully developed / eq;</li> <li>2. children smaller / lungs are smaller;</li> </ol>		<p>max 1</p>

2.50 practical: investigate breathing in humans, including the release of carbon dioxide and the effect of exercise

<p>2 (a)</p>	<ol style="list-style-type: none"> <li>1. fore and after exercise;</li> <li>2. breaths per minute;</li> </ol>	<p>allow interchangeable rows / columns ignore breathing rate no credit for graph</p>	<p>2</p>
<p>(b)</p>	<ol style="list-style-type: none"> <li>1. muscle(s);</li> <li>2. expiration;</li> <li>3. oxygen required;</li> <li>4. remove lactic acid;</li> <li>5. oxygen debt;</li> <li>6. remove carbon dioxide;</li> </ol>		<p>4</p>
<p>(c)</p>	<ol style="list-style-type: none"> <li>1. repeat / use more people / eq;</li> <li>2. measure breathing rate during exercise;</li> <li>3. somebody else / machine / data logger / spirometer count breaths / eq;</li> <li>4. run at same speed / for same time same distance / run on treadmill / eq;</li> </ol>		<p>2</p>

2.51 understand why simple, unicellular organisms can rely on diffusion for movement of substances in and out of the cell

2.52 understand the need for a transport system in multicellular organisms



2.53 describe the role of phloem in transporting sucrose and amino acids between the leaves and other parts of the plant

<b>1(b)</b>	<ul style="list-style-type: none"> <li>in the phloem (1)</li> </ul>	Accept phonetic spelling e.g. phloem /flowem	<b>(1)</b>
<b>QWC</b>	<b>*5(b)</b>	<p>An explanation including some of the following points:</p> <p>water</p> <ul style="list-style-type: none"> <li>through the xylem</li> <li>capillary action</li> <li>osmosis into cells in the leaf</li> <li>evaporation from leaves</li> <li>transpiration stream</li> <li>diffusion into the atmosphere</li> <li>through stomata</li> </ul> <p>glucose</p> <ul style="list-style-type: none"> <li>converted to sucrose</li> <li>dissolved in water</li> <li>through the phloem</li> <li>bidirectional</li> </ul> <p>mineral salts</p> <ul style="list-style-type: none"> <li>dissolved in water</li> <li>through the xylem</li> <li>from root to tip</li> </ul>	<b>(6)</b>
<b>Level</b>	<b>0</b>	No rewardable content	
<b>1</b>	<b>1 - 2</b>	<ul style="list-style-type: none"> <li>a limited explanation of the transport of one molecule e.g. water moves from roots to leaves</li> <li>the answer communicates ideas using simple language and uses limited scientific terminology</li> <li>spelling, punctuation and grammar are used with limited accuracy</li> </ul>	
<b>2</b>	<b>3 - 4</b>	<ul style="list-style-type: none"> <li>a simple explanation of the transport of two molecules including correct reference to at least one of the vessels phloem or xylem.</li> <li>the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately</li> <li>spelling, punctuation and grammar are used with some accuracy</li> </ul>	
<b>3</b>	<b>5 - 6</b>	<ul style="list-style-type: none"> <li>a detailed explanation of the transport of all three molecules with correct reference to movement through phloem and xylem</li> <li>the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately</li> <li>spelling, punctuation and grammar are used with few errors</li> </ul>	
2.54 describe the role of xylem in transporting water and mineral ions from the roots to other parts of the plant			
3(a)	1. water; 2. minerals / ions / salts / named mineral ion / eq;	Ignore nutrients  Allow 2 marks for 2 named minerals;	2
<b>3(a)(iii)</b>	xylem	xylem vessel / tube(s)	<b>(1)</b>



2.55B understand how water is absorbed by root hair cells			
(b)	1. shape;  Then max 4 from: 2. cell wall; 3. cell membrane; 4. cytoplasm; 5. nucleus; 6. vacuole;	Palisade cell labelled = max 4	5
<b>2(d)</b>	A description including <b>two</b> from the following: <ul style="list-style-type: none"> <li>• osmosis (1)</li> <li>• from high concentration to low concentration / down a concentration gradient (1)</li> <li>• through a partially permeable membrane (1)</li> </ul>	not active transport, but ignore diffusion correct references to water potential and solute potential not from where there are more water molecules semi permeable and selectively permeable	<b>(2)</b>
2.56B understand that transpiration is the evaporation of water from the surface of a plant			
<b>2(c)(i)</b>	An explanation that makes reference to: identification – knowledge (1 mark) and reasoning /justification – knowledge (1 mark): <ul style="list-style-type: none"> <li>• it surrounds the pine leaf (1)</li> <li>• so prevents water loss from the pine leaf/prevents dehydration (1)</li> </ul>		<b>(2)</b>
6 (a)(i)	1. allows diffusion / evaporation / transpiration / loss of water; 2. creates transpiration pull / transpiration stream / water pulled up / water drawn up; 3. osmosis; 4. water absorbed by root;		Max 2
2.57B understand how the rate of transpiration is affected by changes in humidity, wind speed, temperature and light intensity			
2	1. high <b>humidity decreases rate</b> ; 2. reduced concentration gradient / eq; 3. high <b>wind increases rate</b> ; 4. increased concentration gradient / eq; 5. high <b>temperature increases rate</b> ; 6. more (kinetic) energy / more evaporation / eq; 7. high <b>light increases rate</b> ; 8. stomata open / eq;	One mark for condition and change in transpiration second mark for explanation of change  Allow converse throughout	5



**2.58B practical: investigate the role of environmental factors in determining the rate of transpiration from a leafy shoot**

1 (a) (i)	1. measure mass / measure weight / measure water loss; 2. in one minute / in an hour / per minute / per hour / per day / after a period of time / eq;	2. gnore before and after / at the end of the experiment	2															
(ii)	1. no plant; 2. oil layer and water present; 3. balance present;	ignore twig with no leaves  ignore number on balance  labels not needed	3															
(b)	<table border="1"> <thead> <tr> <th>change of condition</th> <th>Change in transpiration rate</th> <th>Explanation</th> </tr> </thead> <tbody> <tr> <td>warmer air</td> <td>increase;</td> <td>more (kinetic) energy / more evaporation / molecules move faster / eq;</td> </tr> <tr> <td>put in the dark decrease</td> <td>put in the dark decrease</td> <td>stomata close;</td> </tr> <tr> <td>increased wind increase</td> <td>increased wind</td> <td>increased concentration gradient / moves molecules away / blows water away / eq;</td> </tr> <tr> <td>increased humidity</td> <td>decrease;</td> <td>decreased concentration gradient</td> </tr> </tbody> </table>	change of condition	Change in transpiration rate	Explanation	warmer air	increase;	more (kinetic) energy / more evaporation / molecules move faster / eq;	put in the dark decrease	put in the dark decrease	stomata close;	increased wind increase	increased wind	increased concentration gradient / moves molecules away / blows water away / eq;	increased humidity	decrease;	decreased concentration gradient		5
change of condition	Change in transpiration rate	Explanation																
warmer air	increase;	more (kinetic) energy / more evaporation / molecules move faster / eq;																
put in the dark decrease	put in the dark decrease	stomata close;																
increased wind increase	increased wind	increased concentration gradient / moves molecules away / blows water away / eq;																
increased humidity	decrease;	decreased concentration gradient																
(c)	1. supply mineral ions / supply named mineral ion; 2. support / turgidity / prevent wilting / eq; 3. cooling / prevent overheating; 4. water for photosynthesis;	1. gnore nutrients  3. ignore homeostasis idea  ignore growth	2															
<b>2(a)</b>	D - transpiration		<b>(1)</b>															
<b>2(b)(i)</b>	B - 32 g		<b>(1)</b>															



<p><b>2(b)(ii)</b></p>	<p>A description including two of the following</p> <ul style="list-style-type: none"> <li>• it rises between the temperatures of 15(°C) and 35(°C) (1)</li> <li>• water loss decreases after 35(°C) (1)</li> <li>• credit correct reference to figures from the table, if related to temperature (1)</li> </ul>	<p>ignore any explanation given, including ref to transpiration</p> <p>award one mark for : water loss went up and then went down</p> <p>eg. greatest water loss at 35(°C) there is less water loss at 45(°C) than at 35(°C)</p>	<p><b>(2)</b></p>
<p><b>2(b)(iii)</b></p>	<p>A suggestion including any two from the following:</p> <ul style="list-style-type: none"> <li>• prevent evaporation/loss of water from the soil (1)</li> <li>• to ensure that mass of the calcium chloride only changed (due to water loss from plant) (1)</li> <li>• to ensure that method is valid / it is a fair test (1)</li> <li>• to stop the uptake of water by the soil (1)</li> </ul>	<p>ignore ref to water loss from pot or roots</p> <p>ignore accurate and reliable</p>	
<p>(b)(i)</p>	<p>S scale linear and at least half of both axes;            L lines straight, neat and through points;            A axes correct way round;            P points plotted accurately;            U units stomatal pore <math>\mu\text{m}</math> and rate of transpiration <math>\text{mg} / \text{m}^2 / \text{s}</math>;            K key still air and moving air;</p>	<p>bar chart no L and no P            non-linear scale no P            if no plot for 0,0 no P            but allow L</p> <p>P allow within one square</p>	<p>6</p>
<p>(ii)</p>	<p>1. transpiration increases in both / eq;            2. levels off in still air / continues to increase in moving air / more increase in moving air / eq;</p>		<p>2</p>
<p>(iii)</p>	<p>1. takes water away / blows water away / less water outside / eq;            2. increases / maintains gradient;            3. (increases) diffusion;</p>	<p>maintains diffusion gradient = 2 marks</p>	<p>3</p>







1 (b) (iii)	<p>A description including two of the following:</p> <ul style="list-style-type: none"> <li>• transport (1)</li> <li>• named substance / <b>blood cell</b> (1)</li> <li>• (which is transported) to or from named cell / tissue /organ (1)</li> </ul>	<p>accept: carries accept: heat</p> <p>MP2 is dependent on MP1</p>	(2)
2.61 understand how adaptations of red blood cells make them suitable for the transport of oxygen, including shape, the absence of a nucleus and the presence of haemoglobin			
3 (b) (iv)	<p>An explanation linking two points from the following</p> <ul style="list-style-type: none"> <li>• contain haemoglobin(1)</li> <li>• which combines with oxygen(1)</li> </ul> <p>OR</p> <ul style="list-style-type: none"> <li>• no nucleus (1)</li> <li>• so (more) haemoglobin can be carried(1)</li> </ul> <p>OR</p> <ul style="list-style-type: none"> <li>• biconcave (shape)(1)</li> <li>• large surface area(1)</li> </ul>	<p>Accept forms oxyhaemoglobin for 2 marks</p> <p>Allow more room to carry oxygen</p>	(2)
2.62 understand how the immune system responds to disease using white blood cells, illustrated by phagocytes ingesting pathogens and lymphocytes releasing antibodies specific to the pathogen			
1 (a) (i)	cell <u>membrane</u> ; nucleus (must be lobed); cytoplasm;	ignore shape of cell must be labelled if cell wall no credit for membrane	3
	(ii) nucleus / bigger / irregular / not (bi)concave / eq / no haemoglobin;	allow converse	1
(b)	1 ingest / engulf / surround / phagocytosis / eq; 2 enzymes; 3 digest / breakdown / eq; 4 lymphocytes; 5 antibodies / antitoxins; 6 specific / eq; 7 antigen; 8 memory / memory cell / eq;		Max 5



(c)	1. kill/destroy bacteria / eq; 2. white blood cells; 3. phagocytes / macrophage; 4. engulf / surround / ingest / digest / eat / eq; 5. lymphocytes; 6. antibodies / antigens; 7. bind to antigens; 8. memory cells;	phagocytosis = 2  lymphocytes engulf = allow lymphocyte mark only  phagocytes produce antibodies all phagocyte mark only  white blood cells engulf = 2  white blood cells produce antibodies = 2	5
-----	------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	---



<b>2.63B understand how vaccination results in the manufacture of memory cells, which enable future antibody production to the pathogen to occur sooner, faster and in greater quantity</b>															
(e)	1. <u>memory</u> cells; 2. an bodies; 3. (production and response) sooner / quickly / faster / more / last longer / eq;	2. Allow if production by incorrect cell 3. Ignore more robust / more powerful	2												
(d)	1. ead / attenuated / harmless / inactive / weakened / modified / pathogen / bacteria / microbe / microorganism / virus / eq; 2. an gens; 3. memory cells; 4. secondary immune response / <u>faster immune</u> response / antibody produced <u>faster / sooner / quicker / more</u> ;	Dead form of the disease = 0 Dead strain = 0 Ignore dead virus  Ignore antibody production in primary immune response	4												
<b>2.64B understand how platelets are involved in blood clotting, which prevents blood loss and the entry of micro-organisms</b>															
(d)	(i)	platelets;	1												
	(ii)	1. less ood loss / eq; 2. less entr of microbes / less entry of pathogens / less infection / less disease / eq;	2												
<b>2.65 describe the structure of the heart and how it functions</b>															
(b)	<table border="1"> <thead> <tr> <th>Sentence</th> <th>letter</th> </tr> </thead> <tbody> <tr> <td>the right atrium is</td> <td>(B)</td> </tr> <tr> <td>the chamber that pumps blood into the lungs is</td> <td>A;</td> </tr> <tr> <td>the chamber with the thickest muscle wall is</td> <td>H;</td> </tr> <tr> <td>the blood vessel containing blood at the highest pressure is</td> <td>E;</td> </tr> <tr> <td>the blood vessel carrying blood with the least oxygen into the heart</td> <td>C;</td> </tr> </tbody> </table>	Sentence	letter	the right atrium is	(B)	the chamber that pumps blood into the lungs is	A;	the chamber with the thickest muscle wall is	H;	the blood vessel containing blood at the highest pressure is	E;	the blood vessel carrying blood with the least oxygen into the heart	C;		4
Sentence	letter														
the right atrium is	(B)														
the chamber that pumps blood into the lungs is	A;														
the chamber with the thickest muscle wall is	H;														
the blood vessel containing blood at the highest pressure is	E;														
the blood vessel carrying blood with the least oxygen into the heart	C;														



4 (a) (i)	lung / lungs;		1
(ii)	1. gas oxygen / oxygenated / eq; 2. loss of carbon dioxide / eq;	Ignore refs to pressure / velocity  Ignore colour change	2
(b)	prevent backflow / eq;		1



2.66 explain how the heart rate changes during exercise and under the influence of adrenaline				
4	(a)	(i) (student) 8 / eight;	any other student = 0 eg student 5 and student 8 = 0	1
		(ii) (rate) faster <u>when frightened</u> ; adrenalin(e);	allow epinephrine / noradrenaline	2
		(iii) yes: repeated/10/lots of people / similar pattern / eq;	ignore answers that link to validity such as expecting to be frightened / age of students	1
		OR		
		no: not enough people / one student not frightened / eq;	reject not repeated	
2.67 understand how factors may increase the risk of developing coronary heart disease				
(d)		1. ss oxygen; 2. ss (aerobic) respiration; 3. <u>anaerob</u> respiration; 4. ctic acid / low pH; 5. enzy s denatured;	Ignore glucose	max 3
2.68 understand how the structure of arteries, veins and capillaries relate to their function				
2	(a)	1. narrower lumen / eq; 2. thicker wall; 3. more muscle / stronger muscle / eq; 4. more elastic; 5. no valves;	Ignore blood flow  Allow converse	2
(d)		1. vein;  Two from: 2. wide lumen / eq; 3. easy to see / near to surface (of skin); 4. low blood pressure; 5. thin wall / less muscular wall;	use vein because arteries have a thick wall = 1 for mp5  capillaries = 0  5. Ignore less muscle	3 max
<b>4(b)</b>		An explanation that combines identification – application of knowledge (1 mark) and reasoning/justification – application of understanding (1 mark): • the blood vessel has thick walls/small lumen (1)  • to carry oxygenated blood/to carry blood under higher pressure (1)		<b>(2)</b>



2.69 understand the general structure of the circulation system, including the blood vessels to and from the heart and lungs, liver and kidneys

<b>2(b)</b>	<b>D</b> pulmonary vein → atrium → ventricle → aorta		<b>(1)</b>												
(b)(i)	<table border="1"> <thead> <tr> <th>Name of blood vessel</th> <th>Letter</th> </tr> </thead> <tbody> <tr> <td>vena cava</td> <td>L or N</td> </tr> <tr> <td>aorta</td> <td>C;</td> </tr> <tr> <td>pulmonary vein</td> <td>B;</td> </tr> <tr> <td>hepatic artery</td> <td>D;</td> </tr> <tr> <td>renal vein</td> <td>I;</td> </tr> </tbody> </table>	Name of blood vessel	Letter	vena cava	L or N	aorta	C;	pulmonary vein	B;	hepatic artery	D;	renal vein	I;	Reject B and D and B or D	4
Name of blood vessel	Letter														
vena cava	L or N														
aorta	C;														
pulmonary vein	B;														
hepatic artery	D;														
renal vein	I;														
(b)(ii)	<table border="1"> <thead> <tr> <th>Contents of blood vessel</th> <th>Letter of blood vessel</th> </tr> </thead> <tbody> <tr> <td>contains the most glucose after a meal</td> <td>J;</td> </tr> <tr> <td>contains the least urea</td> <td>I;</td> </tr> <tr> <td>contains the least oxygen</td> <td>M;</td> </tr> </tbody> </table>	Contents of blood vessel	Letter of blood vessel	contains the most glucose after a meal	J;	contains the least urea	I;	contains the least oxygen	M;		3				
Contents of blood vessel	Letter of blood vessel														
contains the most glucose after a meal	J;														
contains the least urea	I;														
contains the least oxygen	M;														
1 (a)	(i) artery / arteries / aorta;		1												
	(ii) atrium / left or right atrium / left or right atria / left or right auricle;		1												
	(iii) 1. fewer chambers / two chambers / one atrium / one ventricle / eq; 2. fewer valves / eq; 3. no separation of left and right sides / no septum / no left and right atria / no left and right ventricles; 4. chamber walls have similar size / eq; 5. fewer blood vessels / only two blood vessels / eq;	allow converse for <u>human</u> heart  3. ignore ref to circulation / blood flow													



(b)	1. ss oxygen/deoxygenated in fish heart; 2. re carbon dioxide in fish heart; 3. oxygen used in respiration; 4. carbon dioxide produced by respiration;; 5. b od oxygenated in human lungs; 6. carbon dioxide removed in human lungs;	allow converse for blood in human heart	4
(c)	1. single circulatio / no separate lung circulation / blood passes through heart once / blood in fish has to pass through two sets of capillaries / eq;  2. fish are smaller / fish have smaller heart / fish heart has thinner walls;	allow converse for human	2





2.70 understand the origin of carbon dioxide and oxygen as waste products of metabolism and their loss from the stomata of a leaf									
(iv)	diffusion / diffuses; stomata / pores / holes; concentration gradient / eq;	2							
2.71 know the excretory products of the lungs, kidneys and skin (organs of excretion)									
1 (a)	removal / eq;  waste products of cells / metabolism / respiration / chemical reactions;	getting rid of toxic waste = 1 ignore toxic ignore examples such as CO <sub>2</sub> / urea MP2 reject if ref to egestion/faeces	2						
(c)	named organ and substance:  lungs + carbon dioxide / water kidney + urea / urine / water / salts / eq  skin + sweat / water / salts / urea / eq liver + bile;;	2							
2.72B understand how the kidney carries out its roles of excretion and osmoregulation									
(d)	1. osmo)receptors; 2. ypothalamus; 3. pituitary glan 4. DH; 5. ADH) <u>increases</u> / <u>more</u> (ADH); 6. kidney / nephron; 7. collecting duct; 8. <u>ore</u> permeable; 9. <u>e</u> absorption (of water) / water into blood;	Ignore less urine / less water in urine	6 max						
2.73B describe the structure of the urinary system, including the kidneys, ureters, bladder and urethra									
4 (a)	C;	Ignore ureter	1						
2.74B describe the structure of a nephron, including the Bowman's capsule and glomerulus, convoluted tubules, loop of Henle and collecting duct									
3 (a)	<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Event</th> <th>L tter</th> </tr> </thead> <tbody> <tr> <td>ultrafiltration</td> <td></td> </tr> <tr> <td>glucose reabsorption</td> <td>B;</td> </tr> </tbody> </table>	Event	L tter	ultrafiltration		glucose reabsorption	B;	2	
Event	L tter								
ultrafiltration									
glucose reabsorption	B;								
(b)	capillary / capillaries;		1						
2.75B describe ultrafiltration in the Bowman's capsule and the composition of the glomerular filtrate									
(b) )	1. (protein molecules are) large / too big / eq;  2. leave glomerulus / leave capillaries / enter Bowman's / enter renal capsule / eq;	Accept converse linked to small molecules  Ignore if into glomerulus	2						
5 (a)	vessel entering is wider / eq; (increased) <u>pressure</u> ; <u>ultrafiltration</u> ;	ignore thicker ignore references to capillary structure	2						



<b>2.76B understand how water is reabsorbed into the blood from the collecting duct</b>			
(d)	1. (more) ADH; 2. increased permeability; 3. collecting duct; 4. (re)absorption of water;		3 max
<b>2.77B understand why selective reabsorption of glucose occurs at the proximal convoluted tubule</b>			
(ii)	1. <u>reabsorbed</u> / (absorbed) back into blood; 2. <u>proximal</u> / <u>first</u> (convoluted) tubule / eq; 3. active transport / active uptake / against concentration gradient / eq;	Ignore other named parts of nephron	2 max
(c) (i)	active transport / active uptake; low to high concentration / against conc. gradient / eq; energy / ATP;	reject if in list	2
(ii)	respiration; energy / ATP; osmotic effect;		Max 2
<b>2.78B describe the role of ADH in regulating the water content of the blood</b>			
(b)	1. iuretic) enters blood / travels in blood; 2. tuitary / hypothalamus; 3. <u>les</u> ADH; 4. collecting <u>duct</u> ; 5. less permeable; 6. les water (re)absorbed / less water into blood;	ignore references to urine	Max 5
<b>2.79B understand that urine contains water, urea and ions</b>			
(iii)	1. urea; 2. minerals / ions / salts / named mineral ion / hormones / vitamins;		2
2.80 understand how organisms are able to respond to changes in their environment			
2.81 understand that homeostasis is the maintenance of a constant internal environment, and that body water content and body temperature are both examples of homeostasis			



<p>1 (c)</p>	<p>A description linking two of the following:</p> <p>(brain contains the) <u>hypothalamus</u> (1)</p> <p>(brain/hypothalamus) detects changes in temperature (1)</p> <p>by {receiving/sending} information via {nerve endings / sense organs / skin receptors / effectors} (1)</p>		<p>(2)</p>
<p>2.82 understand that a co-ordinated response requires a stimulus, a receptor and an effector</p>			
<p>(c)(i)</p>	<p>muscle(s) / leg muscle / named muscle;</p>	<p>Ignore leg alone</p>	<p>1</p>
<p>2.83 understand that plants respond to stimuli</p>			
<p>2.84 describe the geotropic and phototropic responses of roots and stems</p>			
<p>1(a)(i)</p>	<p>C - positive gravitropism</p>		<p>(1)</p>
<p>2.85 understand the role of auxin in the phototropic response of stems</p>			
<p>1(b)(i)</p>	<p>A suggestion to include the following</p> <p>to see what the shoot should do under normal conditions /to compare the control results with the experimental results (1)</p>		<p>(1)</p>
<p>1(b)(ii)</p>	<p>A explanation to include three of the following:</p> <p>Rebecca's shoot did not curve and Andrew's shoot did curve (1 )</p> <p>Rebecca's experiment (black cap will) does not allow light to shine on the tip (1)</p> <p>auxin / plant growth substance will not move (to shaded side of shoot) / is evenly distributed (1)</p> <p>Andrew's experiment</p> <p>jelly will allow auxin / plant growth substance to diffuse /move (through to shaded side) (1)</p> <p>causing cell elongation (1)</p>	<p>auxin is made/found in the tip</p>	<p>(3)</p>



<b>3(a)(ii)</b>	An explanation to include the following linked points  (auxins) move to the shaded side of a shoot (1)  causing cells on the shaded side to <u>elongate</u> (1)	accept move to the side opposite the light  accept get longer for elongate Ignore references to cell division	<b>(2)</b>
-----------------	-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------	------------------------------------------------------------------------------------------------------------------------	------------



2.86 describe how nervous and hormonal communication control responses and understand the differences between the two systems

(b)	(i)	1. chemicals involved / eq; 2. receptors involved / eq; 3. effectors involved / eq;	eg 1. accept neurotransmitters/adrenaline/auxin	2 max
	(ii)	1. (animal) electrical/impulses / (plant) chemical/hormone; 2. (animal) fast / (plant) slow; 3. (animal) stimulus and response distant / (plant) stimulus and response close; 4. (animal) muscle contraction / (plant) growth response;	2. Ignore short and long term effect	2 max

(c)	1. electrical; 2. uses cells / uses neurones / uses nerves / uses CNS / eq; 3. faster; 4. specific target / location / eq; 5. all or nothing / no dose effect / eq; 6. short-lasting / eq;	Allow following compares 1. chemical 2. blood 3. slower 4. widespread 5. dose effect 6. long-lasting; hormonal is via blood but nervous is electrical = 2	max 3
-----	-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	-------

2.87 understand that the central nervous system consists of the brain and spinal cord and is linked to sense organs by nerves

2.88 understand that stimulation of receptors in the sense organs sends electrical impulses along nerves into and out of the central nervous system, resulting in rapid responses

(b)			2 max
	Sense organ	Stimulus	
	eye	sight (of food / sight of lab attendant / eq);	
	ear	sound (of food arriving / sound of lab attendant / tuning fork / eq);	
	nose	smell (of food / eq);	

(c)	1. fast(er) / quick / rapid / immediate / eq; 2. involuntary / unconscious / without thinking / automatic / does not involve brain/ eq; 3. instinctive / inherited / inborn / innate / not learnt; 4. protects the body from damage / eq;	2 max
-----	----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	-------

<b>3(a)(i)</b>	A	<b>(1)</b>
----------------	---	------------



3(a)(ii)	A		<b>(1)</b>
3(b)	<p>an explanation linking the following</p> <ul style="list-style-type: none"> <li>• from receptor (cells) / sense organ (1)</li> <li>• to the {brain / spinal cord / CNS / synapse / other neurone}(1)</li> <li>• as an <u>electrical</u> impulse (1)</li> </ul>	<p>Accept named sense organ</p> <p><u>electrical</u> message/signal Ignore references to current</p>	<b>(2)</b>
3(c)	<p>a description including <b>two</b> of the following</p> <ul style="list-style-type: none"> <li>• insulates (electrical signal) (1)</li> <li>• the axon (1)</li> <li>• speeds up the impulse (1)</li> </ul>	<p>ignore protects / protection</p> <p>accept message / signal for impulse</p>	<b>(2)</b>
3(d)	<p>a description including <b>three</b> of the following</p> <ul style="list-style-type: none"> <li>• receptor cells (pick up a stimulus) (1)</li> <li>• sensory neurone sends a message to the spinal cord / relay neurone / CNS (1)</li> <li>• the message travels from the relay neurone / CNS / spinal cord to the motor neurone (1)</li> <li>• (this initiates a response) in the effector / muscle / gland (1)</li> <li>• message travels across synapse (by neurotransmitters) (1)</li> </ul>	<p>accept the correct nerve pathway diagram for 3 marks</p> <p>accept nerve for neurone</p>	<b>(3)</b>
2.89 understand the role of neurotransmitters at synapses			
Q02aiv	synapse(s) / synaptic cleft / synaptic gap		<b>(1)</b>



6 (c)	A description including two of the following: <ul style="list-style-type: none"><li>• gap between two neurones (1)</li><li>• neurotransmitters / chemical transmitters are released (1)</li><li>• (neurotransmitters) travel from one neurone to another (1)</li><li>• and stimulate electrical impulse in that neurone(1)</li></ul>	(2)
-------	--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	-----



2.90 describe the structure and functioning of a simple reflex arc illustrated by the withdrawal of a finger from a hot object			
	receptor / nerve ending; sensory neurone / sensory nerve; impulse / message / signal; CNS / spinal cord / grey matter; synapse; relay neurone / relay nerve; motor neurone ; muscle / effector; contract;	sensory or motor not in correct order = 0  ignore brain  allow intermediate / association;	5
(f)	1. receptors; 2. impulse / signal; 3. sensory neurone; 4. to spinal cord / grey matter / CNS; 5. synapse; 6. relay neurone / intermediate neurone / interneurone ; 7. motor neurone; 8. muscle / effector;	Mp 2 ignore message	5 max
2.91 describe the structure and function of the eye as a receptor			
5 (a)	A lens; B cornea; C retina;	A. Ilow lense C. ignore rods/cones/receptors/fovea	3
2.92 understand the function of the eye in focusing on near and distant objects, and in responding to changes in light intensity			
(ii)	<u>ciliary</u> muscle / <u>ciliary</u> body; contracts / eq; ignore constrict <u>suspensory</u> ligaments; slacken / relax / eq; lens; fat(ter) / thick(er) / wider / rounder / eq;	assume near but allow converse if ref to hawk far away  only accept words linked to width  ignore pupil / iris / radial circular muscles  eg do not award contract mark if ref to radial / circular	max 4
3 (a)	6 to 7;	Allow 0.6 to 0.7 <u>cm</u>	1
(b)	retina / fovea / yellow spot / macula;		1
(c)	1. <u>radial</u> muscles contract; 2. <u>circular</u> muscles relax; 3. pupil gets bigger / wider / dilates / expands / eq; 4. more light enters eye;	Ignore references to iris size  Reject ciliary muscles	Max 3





(ii)	<p>1. radial muscles contract / circular muscles relax;</p> <p>2. <u>pupil</u> dilates / widens / gets bigger / <u>iris</u> gets smaller / eq;</p> <p>3. more light can enter;</p>		3
2.93 describe the role of the skin in temperature regulation, with reference to sweating, vasoconstriction and vasodilation			
6 (a)	<p>1. (ears) large surface area / increases SA:VOL;</p> <p>2. heat loss / cools / eq;</p> <p>3. have a blood supply / capillaries;</p> <p>4. <u>vasodilation</u>; not if linked to capillaries/veins</p> <p>5. flapping / fanning / eq;</p>	<p>ignore shade / thin</p> <p>2. allow sweating / evaporation</p>	3
(d) (i)	<p>more sweat / more perspiration / more evaporation ;</p> <p>need to cool / maintain body temperature / thermoregulation / thermoregulatory centre / hypothalamus eq;</p>	<p>must give idea of more</p>	<p>2</p> <p>max 2</p>
(ii)	<p>less evaporation / sweat can not disperse / eq;</p> <p>cannot cool / overheating / eq;</p> <p>more sweat;</p>		
(b) (i)	<p>r <u>sweat</u> / <u>sweating</u> / eq;</p> <p>evaporation / eq;</p> <p>cooling / heat loss / eq;</p>		3
(ii)	<p>vasodilation / dilate / widen / expand / eq;</p> <p>(more) <u>blood</u> to skin/surface / <u>blood</u> near to skin/surface;</p> <p>cooling / heat loss / eq;</p>	<p>ignore names of blood vessels</p> <p>ignore vasoconstriction</p> <p>reject blood vessels moving</p>	3



2.94 understand the sources, roles and effects of the following hormones: adrenaline, insulin, testosterone, progesterone and oestrogen

2 (a)	<table border="1"> <thead> <tr> <th>Effect</th> <th>Name of hormone</th> <th>Source</th> </tr> </thead> <tbody> <tr> <td>converts glucose to glycogen</td> <td>(insulin)</td> <td>(pancreas)</td> </tr> <tr> <td>stimulates male secondary sexual characteristics</td> <td>testosterone;</td> <td>(testis)</td> </tr> <tr> <td>increases permeability of the collecting duct</td> <td>ADH;</td> <td>hypothalamus / pituitary;</td> </tr> <tr> <td>repairs uterus lining</td> <td>oestrogen;</td> <td>ovary;</td> </tr> </tbody> </table>	Effect	Name of hormone	Source	converts glucose to glycogen	(insulin)	(pancreas)	stimulates male secondary sexual characteristics	testosterone;	(testis)	increases permeability of the collecting duct	ADH;	hypothalamus / pituitary;	repairs uterus lining	oestrogen;	ovary;	Allow reasonable spellings	5
Effect	Name of hormone	Source																
converts glucose to glycogen	(insulin)	(pancreas)																
stimulates male secondary sexual characteristics	testosterone;	(testis)																
increases permeability of the collecting duct	ADH;	hypothalamus / pituitary;																
repairs uterus lining	oestrogen;	ovary;																
1 (a) (i)	pancreas;	allow pancreas	1															
(b)	1. lower / reduce / regulate / maintain / control / eq; 2. <u>blood sugar</u> / <u>blood glucose</u> ; 3. <u>lycogen</u> ;	blood glucose to glycogen = 2 excess glucose to glycogen = 1 released when glucose levels are high = 1	2															
(ii)	1. adrenaline; 2. increased <u>heart</u> rate / <u>heart</u> pumps more blood / <u>heart</u> pumps faster / eq; 3. increased breathing rate/depth / opens air passages / eq; 4. increase blood flow to muscles / vasodilation in muscles / vasoconstriction in gut / eq; 5. glycogen to glucose; 6. respiration / energy / ATP;		3 max															



2.95B understand the sources, roles and effects of the following hormones: ADH, FSH and LH			
(ii)	<ol style="list-style-type: none"><li>1 control water level / water regulation / osmoregulation / eq;</li><li>2 permeability / eq;</li><li>3 <u>collec ing duct</u>;</li><li>4 water reabsorption / water into blood / water into body / less waterloss from body / more concentrated urine / less urine / eq;</li></ol>		max 3
<b>3(a)</b>	<p>An explanation linking <b>four</b> of the following points:</p> <ul style="list-style-type: none"><li>• (dehydration detected by) osmoreceptors/hypothalamus (1)</li><li>• pituitary gland (1)</li><li>• (releases more) ADH (1)</li><li>• ADH acts on the nephron/collecting duct/tubules (1)</li><li>• making the {collecting duct/tubules/nephron} more permeable (1)</li><li>• so <b>more</b> water is reabsorbed (by the body/blood) (1)</li></ul>	<p>ignore brain</p> <p>accept {small amount/concentrated} urine produced</p>	<b>(4)</b>