

Question		Answer		Marks	Guidance
1	(a)		open circulatory system	1	ACCEPT cross / other mark DO NOT CREDIT if a tick is placed in more than one box
			closed circulatory system		
		single circulatory system			
		double circulatory system	✓ ;		
	(b)	(i)	systole / contraction, increases pressure ; diastole / relaxation/ blood flowing onwards, decreases pressure ; (contraction of) ventricle, muscle / wall ; left (ventricle) ;	2 max	IGNORE 'the heart' or 'the heart beating' or 'the heart pumping' without further qualification IGNORE ref to right (side) for mp 1 - 3 ACCEPT ref to peak on graph for increasing pressure ACCEPT ref to trough on graph for decrease in pressure ACCEPT ventricular systole 'contraction of left ventricle' = 1 mark 'contraction of muscle in left ventricle' = 2 marks 'ventricular systole increases pressure' = 2 marks
		(ii)	pulse / heart, <u>rate</u> ;	1	IGNORE heart beat / beats per minute

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(c)	<p><i>marks for pressure change:</i> pressure drops, as distance from heart increases ; greatest / rapid / significant, pressure drop while blood is in the arteries ; pressure, constant / does not drop, in veins ;</p> <p><i>marks for amplitude of fluctuations:</i> fluctuation / AW, decreases from aorta to arteries ; no fluctuation in, capillaries / veins ; use of comparative figures with unit ;</p>	3 max	<p>ACCEPT from aorta to arteries / correctly named blood vessels – look for decrease in pressure trend</p> <p>ACCEPT plateaus / level</p> <p>IGNORE ref to frequency of fluctuations ACCEPT ‘smaller fluctuations in artery’</p> <p>correct figures must be quoted from the graph to back up <u>one</u> point – correct unit used at least once. eg ‘peak to peak’, between aorta and arteries, falls 18.5 to 14 kPa pressure in aorta between 18.5 and 12.5 kPa pressure in arteries drops from 12.5 to 5 kPa pressure in capillary drops from 5 to 0.5 kPa overall drop from 18.5 to 0.5 kPa</p> <p><i>Any other figures must be checked against graph</i></p> <p>ACCEPT correct calculated figure eg pressure drops 6kPa in aorta</p>

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	(d)	(i)	<p>blood flows into <u>larger</u> number of vessels ;</p> <p>(total) cross-sectional area of the <u>arteries</u> is greater than the aorta ;</p> <p>(total) cross-sectional area of the <u>capillaries</u> is greater than the, aorta / <u>arteries</u> ;</p>		<p>IGNORE ref to pressure fluctuations and structure of vessel walls as not relevant to overall pressure change</p> <p>ACCEPT idea of vessels branching to many/more (smaller) vessels</p> <p>IGNORE ref to lumen size</p>
			<p>capillary (wall) is, thin / only one cell thick ;</p> <p>(high pressure would) burst / damage, capillary (wall) ;</p> <p>reduce chance of, tissue fluid build up / oedema ;</p>	2 max	<p>IGNORE ref to rate of flow</p> <p>IGNORE ref to capillary walls small / made of squamous cells</p> <p>ACCEPT cannot withstand (high) pressure</p>
			Total	11	

Question		Answer	Marks	Guidance																				
2	(a)	<table border="1"> <thead> <tr> <th>feature</th> <th>arterial blood</th> <th>tissue fluid</th> <th>lymph</th> </tr> </thead> <tbody> <tr> <td>hydrostatic pressure</td> <td>high</td> <td>low</td> <td>l</td> </tr> <tr> <td>presence of large proteins</td> <td>yes</td> <td colspan="2">no n OR yes y</td> </tr> <tr> <td>presence of neutrophils</td> <td>yes</td> <td>yes</td> <td>(yes / no)</td> </tr> <tr> <td>presence of erythrocytes</td> <td>yes</td> <td></td> <td>no</td> </tr> </tbody> </table>	feature	arterial blood	tissue fluid	lymph	hydrostatic pressure	high	low	l	presence of large proteins	yes	no n OR yes y		presence of neutrophils	yes	yes	(yes / no)	presence of erythrocytes	yes		no	4	<p>Mark the first answer for each box. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks</p> <p>Award 1 mark per correct row.</p> <p>IGNORE yes and no in first row</p> <p>ACCEPT some / few / low / usually, for yes in rows 2 and 3 DO NOT CREDIT not usually for yes</p> <p>In row two mark is awarded for idea that tissue fluid and lymph are the same (proteins in tissue fluid will enter lymph) - both responses must be the same to achieve a mark.</p> <p>Mark is awarded for tissue fluid response only.</p>
feature	arterial blood	tissue fluid	lymph																					
hydrostatic pressure	high	low	l																					
presence of large proteins	yes	no n OR yes y																						
presence of neutrophils	yes	yes	(yes / no)																					
presence of erythrocytes	yes		no																					

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	(b)	(<p>maintain / high(er), (blood) pressure ;</p> <p>increase rate of, flow / delivery ;</p> <p>flow can be, diverted / directed / AW ;</p>	2 max	<p>Mark the first suggestion on each prompt line.</p> <p>IGNORE separates oxygenated from deoxygenated blood</p> <p>IGNORE generate / create, pressure</p> <p>IGNORE ref to pressure gradient</p> <p>ACCEPT blood moves faster / quicker</p> <p>IGNORE ref to going to, all cells / where needed</p>

Question	Answer	Marks	Guidance
(ii)	<p><i>to withstand pressure</i></p> <p>D1 wall is thick ; D2 (thick layer of) collagen ; E3 (wall / collagen) provides strength ;</p> <p>D4 endothelium, corrugated / folded ;</p> <p>E5 <i>idea of:</i> no damage to, endothelium / artery (wall) (as it stretches) ;</p> <hr/> <p style="text-align: right;">max 3</p> <p><i>to maintain pressure</i></p> <p>D6 (thick layer of) elastic tissue / elastic fibres / elastin ; E7 to cause recoil / return to original size ;</p> <p>D8 (thick layer of) smooth muscle ; E9 narrows / constricts, lumen / artery ;</p> <p>E10 AVP ;</p> <p style="text-align: right;">max 3</p>	4 max	<p>Ensure that there is at least one D mark and one E mark for four marks AND Ensure that there is at least one withstand mark and one maintain mark for four marks</p> <p>ACCEPT tunica media, tunica adventitia, tunica externa for wall</p> <p>ACCEPT (wall / collagen) is strong</p> <p>ACCEPT tunica intima for endothelium IGNORE lining IGNORE prevents artery bursting / breaking ACCEPT wall will not tear</p> <p>IGNORE elastic unqualified</p> <p>Ref to lumen must be in context of explaining how pressure is maintained eg makes lumen small(er) = 1 mark DO NOT CREDIT in context of constriction to push or pump the blood along the artery IGNORE 'lumen is narrow' or 'has small lumen' as these are a description of the lumen not referring to the wall <i>eg:</i> <i>idea of:</i> blood is forced (through narrow, channel / lumen) <i>idea of:</i> restriction of blood flow to one area allows pressure to be maintained elsewhere</p> <p style="text-align: right;">QWC rubric continued on next page.....</p>

Question	Answer	Marks	Guidance
2 (b)(ii)	Q QWC - two technical terms used and spelt correctly ;	1	Words must be used in correct context and section. any 2 from: <i>withstanding pressure:</i> collagen endothelium / endothelial <i>maintaining pressure:</i> elastic / elastin recoil smooth muscle lumen constrict(ion)
	Total	11	

Question			Expected Answer	Mark	Additional Guidance
3	(a)	(i)	<p>X = <u>right</u> atrium ;</p> <p>Y = aorta ;</p> <p>Z = (left) pulmonary artery ;</p>	3	<p>Mark the first answer for each letter. If the first answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks</p> <p>ACCEPT <u>right</u> atria IGNORE RA</p> <p>IGNORE PA</p>
3	(a)	(ii)	<p><i>left ventricle</i></p> <p>1 (more muscle to create) more force ;</p> <p>2 (needs to create) <u>higher</u> pressure ;</p> <p>3 push blood against greater , resistance / friction ;</p> <p>4 (left ventricle) pumps blood further / pumps blood to all parts of body / supplies systemic circulation ;</p>	3 max	<p>Assume answer refers to left ventricle unless otherwise stated. ACCEPT ORA for left atrium throughout</p> <p>1 IGNORE more powerful contraction ACCEPT stronger contraction</p> <p>2 IGNORE withstanding or maintaining pressure</p> <p>4 ACCEPT pumps blood , all round body / greater distance IGNORE pumps blood to the body DO NOT CREDIT references to , right ventricle / lungs</p>

Question			Expected Answer	Mark	Additional Guidance
3	(a)	(iii)	<p>1 ventricular systole or ventricle , wall / muscle , contracts ;</p> <p>2 (ventricular contraction) raises ventricular pressure ;</p> <p>3 (ventricular pressure) higher than atrial pressure ;</p> <p>4 <i>idea of</i> (pressure / movement of blood, generated by ventricular contraction) pushes valve shut ;</p> <p>5 chordae tendinae prevent inversion ;</p>	max 2	<p>DO NOT CREDIT statements that refer to right atrium or right ventricle</p> <p>1 IGNORE ref to atrial contraction</p> <p>4 DO NOT CREDIT 'valve shuts' alone DO NOT CREDIT in context of blood flowing from atrium to ventricle resulting in pressure increase to close valve</p> <p>5 ACCEPT valve tendons / tendinous cords</p>
	(b)		<p>aorta / (named) artery / arteries / arteriole(s) ;</p> <p>blood / plasma ;</p> <p>capillary / capillaries / capillary wall / (capillary) endothelium ;</p>	3	<p>Mark the first answer for each role. If the first answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks</p> <p>ACCEPT smooth muscle / elastic tissue / collagen / narrow lumen</p> <p>DO NOT CREDIT valves</p>
Total				[11]	

Question	Expected Answers	Marks	Additional Guidance
4	surface area to volume ratio ; <u>erythrocytes</u> ; affinity ; oxyhaemoglobin ; carbon dioxide / CO ₂ / hydrogen ions / H ⁺ ; Bohr / bohr (shift) ;	6	ACCEPT SA / VOL or SA:Vol ACCEPT minor spelling errors if phonetically correct e.g. erythrocyte DO NOT CREDIT erthrocytes, erephosite, erthrocyte IGNORE red blood cells ACCEPT attraction ACCEPT HbO / HbO ₈ DO NOT CREDIT HbO ₂ etc ACCEPT carbonic acid DO NOT CREDIT CO ² DO NOT CREDIT hydrogen, H, H ₂ ACCEPT phonetic spellings e.g. borrh, bore, borh
	Total	6	

Question			Expected Answers	Marks	Additional Guidance
5	(a)		<p>visible / can be seen / increase contrast ;</p> <p>named example of what is now visible (after staining) ;</p>	2	<p><i>First mark is for 'seeing' and the second mark is for 'recognising' what can now be seen.</i></p> <p>ACCEPT see detail IGNORE ref to resolution</p> <p>ACCEPT recognise different <i>types</i> of white blood cell ACCEPT can (now) see, nucleus / organelles / named organelles IGNORE recognise parts inside red blood cell IGNORE can now see red blood cells (already visible)</p> <p>'can now see red and white blood cells' = 2 marks</p>
5	(b)	(i)	<p>3D shape can be seen / greater depth of field ;</p> <p>can see, surface features / detail ;</p>	max 1	<p>DO NOT CREDIT shape alone</p> <p>ACCEPT 'you can see what is on the surface' IGNORE 'you see the surface better' because this needs further clarification i.e. features, shape, named structure</p>
		(ii)	<p>smaller / named, organelle (becomes visible) ;</p> <p>shapes / details of organelles ;</p>	max 1	<p>ACCEPT named structure(s) such as lysosome, RER, mitochondrion, ribosome, Golgi , vesicle, nucleolus DO NOT CREDIT nucleus or chloroplast (already visible)</p>

Question		Expected Answers	Marks	Additional Guidance
5	(c)	<p><i>This is a QWC question</i></p> <p>1 fetal <u>haemoglobin</u> has a higher <u>affinity</u> (for oxygen) (than adult haemoglobin) ;</p> <p>2 (fetal Hb) takes up oxygen in low(er) partial pressure of oxygen ;</p> <p>3 placenta has low partial pressure of oxygen ;</p> <p>4 at low partial pressure of oxygen / in placenta, adult (oxy)haemoglobin will dissociate / AW ;</p>	max 3	<p>IGNORE oxyhaemoglobin for haemoglobin ACCEPT Hb for <u>haemoglobin</u> (but not HbO)</p> <p>ACCEPT fetal Hb becomes <i>more</i> saturated at a <i>low(er)</i> partial pressure of oxygen ACCEPT ppO₂ / pO₂ / oxygen tension / O₂ concentration, for partial pressure of oxygen</p> <p>ACCEPT in placenta mother's haemoglobin, releases its oxygen / saturation drops</p>
		<p>QWC (two terms used in correct context and spelt correctly);</p>	max 1	<p>Any two terms from the following: affinity, dissociate / dissociation, placenta, partial pressure / oxygen tension, saturation / saturated</p>

Question			Expected Answers	Marks	Additional Guidance
5	(d)	(i)	curve to right of curve A ; appropriate sigmoid shape ;	2	Curve should start at 0% on y axis and reach at least 80% on y axis
5	(d)	(ii)	<p>1 (actively respiring tissue) needs / requires, <i>more oxygen</i> ;</p> <p>2 for aerobic respiration / to release <i>more</i> energy ;</p> <p>3 (actively respiring tissue produces) <i>more CO₂</i> ;</p> <p>4 haemoglobin involved in transport of CO₂ ;</p> <p>5 less haemoglobin available to combine with O₂ ;</p> <p>6 (Bohr shift) causes <i>more oxygen</i> to be released ;</p>	max 2	<p><i>idea of 'more'</i> should be clear as shown (MP 1,2,3,6)</p> <p>ACCEPT make <i>more</i> ATP</p> <p>ACCEPT produces a <i>lot</i> of CO₂ / as CO₂ levels rise</p> <p>CREDIT detail to include carbonic acid dissociation / formation of haemoglobinic acid / HHb etc</p> <p>DO NOT CREDIT oxygen released <i>more</i> quickly / quicker</p> <p>ACCEPT oxygen released <i>more</i>, readily / easily</p> <p>'More CO₂ produced so more O₂ released' = 2 marks</p>
Total				12	