Question			Answer	Marks	Guidance
1	(a)		<table><tr><th></th><th>open circulatory system</th><th>closed circulatory system</th></tr><tr><td>single circulatory system</td><td></td><td></td></tr><tr><td>double circulatory system</td><td></td><td>✓ ;</td></tr></table>	1	**ACCEPT** cross / other mark **DO NOT CREDIT** if a tick is placed in more than one box
	(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

Question			Answer	Marks	Guidance
	(c)		*marks for pressure change:* 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 **;** *marks for amplitude of fluctuations:* fluctuation / AW, decreases from aorta to arteries **;** no fluctuation in, capillaries / veins **;** use of comparative figures with unit **;**	3 max	**ACCEPT** from aorta to arteries / correctly named blood vessels – look for decrease in pressure trend **ACCEPT** plateaus / level **IGNORE** ref to frequency of fluctuations **ACCEPT** 'smaller fluctuations in artery' 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 *Any other figures must be checked against graph* **ACCEPT** correct calculated figure eg pressure drops 6kPa in aorta

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

Question	Answer	Marks	Guidance
2 (a)		4	**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** **Award 1 mark per correct row.**

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	;

IGNORE yes and no in first row

ACCEPT some / few / low / usually, for yes in rows 2 and 3
DO NOT CREDIT not usually for yes

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.

Mark is awarded for tissue fluid response only.

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

Question			Answer	Marks	Guidance
		(ii)			**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**
			to withstand pressure		
			D1 wall is thick **;**		**ACCEPT** tunica media, tunica adventitia, tunica externa for wall
			D2 (thick layer of) **collagen ;**		
			E3 (wall / collagen) provides strength **;**		**ACCEPT** (wall / collagen) is strong
			D4 **endothelium,** corrugated / folded **;**		**ACCEPT** tunica intima for endothelium **IGNORE** lining
			E5 *idea of:* no damage to, endothelium / artery (wall) (as it stretches) **;**		**IGNORE** prevents artery bursting / breaking **ACCEPT** wall will not tear
			max 3		
			to maintain pressure		
			D6 (thick layer of) **elastic** tissue / elastic fibres / **elastin ;**		**IGNORE** elastic unqualified
			E7 to cause **recoil** / return to original size **;**		
			D8 (thick layer of) **<u>smooth</u> muscle ;**		
			E9 narrows / constricts, **lumen** / artery **;**		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
			E10 AVP **;**		*eg:* *idea of:* blood is forced (through narrow, channel / lumen) *idea of:* restriction of blood flow to one area allows pressure to be maintained elsewhere
			max 3		
				4 max	**QWC rubric continued on next page……**

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: *withstanding pressure:* **collagen** **endothelium / endothelial** *maintaining pressure:* **elastic / elastin** **recoil** **smooth muscle** **lumen** **constrict(ion)**
	Total	**11**	

Question			Expected Answer	Mark	Additional Guidance
3	(a)	(i)	**X** = right atrium **;** **Y** = aorta **;** **Z** = (left) pulmonary artery **;**	3	**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** **ACCEPT** right atria **IGNORE** RA **IGNORE** PA
3	(a)	(ii)	*left ventricle* **1** (more muscle to create) more force **;** **2** (needs to create) higher pressure **;** **3** push blood against greater **,** resistance / friction **;** **4** (left ventricle) pumps blood further / pumps blood to all parts of body / supplies systemic circulation **;**	**3 max**	Assume answer refers to left ventricle unless otherwise stated. **ACCEPT ORA** for left atrium throughout **1** **IGNORE** more powerful contraction **ACCEPT** stronger contraction **2** **IGNORE** withstanding or maintaining pressure **4** **ACCEPT** pumps blood **,** all round body / greater distance **IGNORE** pumps blood to the body **DO NOT CREDIT** references to **,** right ventricle / lungs

Question			Expected Answer	Mark	Additional Guidance
3	(a)	(iii)			**DO NOT CREDIT** statements that refer to right atrium or right ventricle
			1 ventricular systole **or** ventricle , wall / muscle , contracts ;		**1** **IGNORE** ref to atrial contraction
			2 (ventricular contraction) raises ventricular pressure ;		
			3 (ventricular pressure) higher than atrial pressure ;		
			4 *idea of* (pressure / movement of blood, generated by ventricular contraction) pushes valve shut ;		**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
			5 chordae tendinae prevent inversion ;	**max 2**	**5** **ACCEPT** valve tendons / tendinous cords
	(b)		aorta / (named) artery / arteries / arteriole(s) ;		**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** **ACCEPT** smooth muscle / elastic tissue / collagen / narrow lumen **DO NOT CREDIT** valves
			blood / plasma ;		
			capillary / capillaries / capillary wall / (capillary) endothelium ;	**3**	
			Total	**[11]**	

Question			Expected Answers	Marks	Additional Guidance
4			surface area to volume ratio ;		**ACCEPT** SA / VOL **or** SA:Vol
			<u>erythrocytes</u> ;		**ACCEPT** minor spelling errors if phonetically correct e.g. erythocyte **DO NOT CREDIT** erthocytes, erephosite, erthrocyte **IGNORE** red blood cells
			affinity ;		**ACCEPT** attraction
			oxyhaemoglobin ;		**ACCEPT** HbO / HbO_8 **DO NOT CREDIT** HbO_2 etc
			carbon dioxide / CO_2 / hydrogen ions / H^+ ;		**ACCEPT** carbonic acid **DO NOT CREDIT** CO^2 **DO NOT CREDIT** hydrogen, H, H_2
			Bohr / bohr (shift) ;	6	**ACCEPT** phonetic spellings e.g. borr, bore, borh
			Total	6	

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

Question			Expected Answers	Marks	Additional Guidance
5	(c)		*This is a QWC question* **1** fetal <u>haemoglobin</u> has a high<u>er</u> **<u>affinity</u>** (for oxygen) (than adult haemoglobin) **;** **2** (fetal Hb) takes up oxygen in low(er) **partial pressure** of oxygen **;** **3 placenta** has low partial pressure of oxygen **;** **4** at low partial pressure of oxygen / in placenta**,** adult (oxy)haemoglobin will **dissociate** / AW **;**	max 3	**IGNORE** oxyhaemoglobin for haemoglobin **ACCEPT** Hb for <u>haemoglobin</u> (but not HbO) **ACCEPT** fetal Hb becomes *more* saturated at a *low(er)* partial pressure of oxygen **ACCEPT** ppO_2 / pO_2 / oxygen tension / O_2 concentration, for partial pressure of oxygen **ACCEPT** in placenta mother's haemoglobin, releases its oxygen / saturation drops
			QWC (two terms used in correct context and spelt correctly)**;**	max 1	Any **two** terms from the following**:** affinity, dissociate / dissociation, placenta, partial pressure / oxygen tension, saturation / saturated

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)	**1** (actively respiring tissue) needs / requires, *more* oxygen ; **2** for aerobic respiration / to release *more* energy ; **3** (actively respiring tissue produces) *more* CO_2 ; **4** haemoglobin involved in transport of CO_2 ; **5** less haemoglobin available to combine with O_2 ; **6** (Bohr shift) causes *more* oxygen to be released ;	max 2	*idea* of '*more*' should be clear as shown (MP 1,2,3,6) **ACCEPT** make *more* ATP **ACCEPT** produces *a lot* of CO_2 / as CO_2 levels rise **CREDIT** detail to include carbonic acid dissociation / formation of haemoglobinic acid / HHb etc **DO NOT CREDIT** oxygen released *more* quickly / quicker **ACCEPT** oxygen released *more*, readily / easily 'More CO_2 produced so more O_2 released' = 2 marks
			Total	**12**	