

1 (a)	blood passes through <u>heart</u> twice, during one circulation of body / AW ; heart to lungs / pulmonary circulation AND heart to rest of body / systemic circulation ; <div style="text-align: right;">[1 max]</div>	R 'goes through heart twice' unqualified A 'one cycle' for one circulation of the body A a suitable diagram
(b)	<i>max 1 per blood vessel</i> <i>artery</i> 1 carries blood <u>from</u> the heart / delivers blood <u>to</u> tissues ; 2 withstands / maintains / transports blood at, high pressure ; 3 transports oxygenated blood except <u>pulmonary</u> (artery) ; <i>capillary</i> 4 exchange of substances to, tissues / cells ; 5 allows diffusion / described as movement of named gas ; 6 allows, filtration / white cells to escape / forms tissue fluid ; 7 allows (re)absorption ; 8 heat, exchange / loss / gain ; <i>vein</i> 9 transports blood, <u>to</u> the heart / <u>from</u> tissues ; 10 transports blood at low pressure ; 11 transports deoxygenated blood except <u>pulmonary</u> (vein) ; <div style="text-align: right;">[3]</div>	A blood, 'out of the heart' / 'to organs' / 'to body' A ...'except to the lungs' for except pulmonary (vein) R 'carries oxygenated blood to, organs / tissues (unqualified by ref to from the heart) A 'from blood' / allows gas exchange R plasma leaves capillaries R 'connects arteries to veins' R 'blood goes close to, tissues / cells' A ensures blood flows one way / stops backflow R carry blood (to heart) and lungs A 'except from the lungs' for except pulmonary (vein)

<p>1 (c)</p>	<p><i>allow up to 3 structural points, so must have a function for full marks. Functional point is most likely to be MP9</i></p> <p>1 small / narrow, lumen / space for blood / opening / hole ; 2 thick / big, wall ;</p> <p>3 elastic (tissue / fibres) ; 4 stretches / expands ; 5 recoils ;</p> <p>6 muscle ; 7 flexible to allow expansion / prevents rupture / prevents bursting ;</p> <p>8 fibrous, tissue / outer layer ; A collagen</p> <p>9 withstands / maintains, pressure ; [4 max]</p>	<p>R 'tube' R 'small / narrow' unqualified R 'cell wall'</p> <p>A ref. to pulsate R 'contracts to push blood' as implies peristaltic</p>
<p>(d)</p>	<p>1 blood fills valve / valve closes (in vein) ; 2 to prevent backflow ; 3 blood flows in one direction / towards heart / prevents flowing away from heart ; [2 max]</p>	<p>A correct description of valve action (in vein) R closing the vein / 'the vein closes'</p> <p>R if refer to valves in the heart</p>
<p>[Total: 10]</p>		

- 2 (a) (i) oxygen ;
glucose ; Ⓐ other valid substances [2]
- (ii) carbon dioxide ; [1]
- (b) muscle ; [1]
- (ii) ref. to contraction / shortening ; [1]
- (iii) ref. to increased pressure ;
so blood leaves heart + via aorta ;
ref. to volume decreases AW ; [max. 2]
- (c) (i) ref. to high + fat diet / cholesterol AW ;
ref. to smoking ;
ref. to stress ;
ref. to lack of exercise ;
ref. to genetic influence AW ;
Ⓡ refs to blood clots [max. 2]
- (ii) all parts of artery below point B shaded ; [1]
- (d) (structure) presence of valves ;
(explanation) prevents backflow of blood AW ;
(structure) ref. to wide lumen ;
(explanation) allows blood to flow with minimum resistance AW ;
(structure) ref. to tough wall / collagen present ;
(explanation) to prevent bursting AW ; [max. 4]
- [max. 14]

3 (a)	transports, oxygen/gases ;		[1]	
(b) (i)	1	controls activities in the cell/AW ;	max [1]	
	2	contains, chromosomes/genes/alleles/genetic information/DNA ;		
	3	controls how cells, develop/divide/reproduce/grow ;		
(ii)	more space for haemoglobin ; to enable greater oxygen carrying capacity/AW ; more flexible shape (to move through capillaries) ;		max [1]	

Question	Expected Answers		Marks	Additional Guidance
3 (c) (i)	<p>0.15 mol dm^{-3} (red blood cells) are normal shape/biconcave ;</p> <p>0.20 mol dm^{-3} (red blood cells) have shrunk/crenation/AW ;</p>		max [2]	
(ii)	<p>1</p> <p>2</p> <p>3</p> <p>4</p>	<p>osmosis ;</p> <p>(diffusion/osmosis) of water molecules into cells ;</p> <p>down a water <u>potential</u> gradient/ from high water <u>potential</u> (of solution) to low water potential (in cells) ;</p> <p>across partially permeable membrane ;</p>	max [3]	
(iii)	<p>cell wall (offers resistance) ;</p> <p>water potential (of plant cells) could be equal/higher/less negative (than 0.1 M solution) (so no net osmosis) ;</p>		max [1]	
(d) (i)	<p>0.15 mol dm^{-3} ;</p> <p>no net movement of water/ (red blood) cells will remain normal shape/AW ;</p>		[2]	<p>units must be included</p> <p>A (red blood) cells won't be damaged / isotonic (with solution)</p>
(ii)	<p>1</p> <p>2</p> <p>3</p> <p>4</p> <p>5</p> <p>6</p>	<p>ref to platelets ;</p> <p>fibrinogen converted to fibrin ;</p> <p>soluble to insoluble/fibrin is insoluble ;</p> <p>thrombin/enzyme in context ;</p> <p>mesh/network/web, to trap blood (cells) ;</p> <p>AVP ; e.g. reference to prothrombin or involvement of calcium ions</p>	max [3]	
			[Total: 14]	

4	(a)	hepatic portal vein ;	[1]	
	(b)	(semi lunar) valves ; prevent backflow ; large, lumen ; low, pressure/resistance to blood flow ; thin/less elastic/less muscular, walls (than arteries) ; low blood pressure ; allows vein to be squeezed by (surrounding skeletal) muscles ;	2 + 2 max [4]	in each case the explanation must be linked to a correct feature
	(c)	= $(181 - 135) \div 135 \times 100$; = 34 (%) ;;	max [2]	
	(d) (i)	(liver) responds to insulin (from pancreas) ; increased, uptake/respiration, of glucose ; glucose converted to glycogen ; by enzymes ; glycogen is, insoluble/stored ; negative feedback ;	max [2]	A glycogenesis R hormones carrying out conversions directly ignore homeostasis
	(ii)	temperature ; water ; AVP ; e.g. pH/ions/urea/carbon dioxide	max [1]	

4 (e)	deamination ; (part of excess) amino acids converted to urea ; (part of) amino acid converted to ammonia ; ammonia converted to urea ; ammonia is harmful ; (rest of) amino acid molecule, releases energy/ converted to glucose / glycogen / respired ; (some amino acids) used to make proteins e.g. fibrinogen ; AVP ; e.g. transamination	max [3]	A description of amino group removal ignore protein converted to urea
(f)	bile production / AW ; breakdown / remove, hormones / red blood cells / toxins / alcohol / drugs ; storage of, iron / vitamin A / vitamin D ; AVP ; e.g. cholesterol, synthesis / AW	m [1]	R homeostasis, deamination, protein synthesis, transamination
		[Total: 14]	

Question			Answers	Marks	Additional Guidance
5	(a)	(i)	lymphocyte ;	[1]	ignore leucocyte A phonetic spellings
		(ii)	1 attach to, bacteria / viruses / pathogens ; 2 cause them to, aggregate / stick together / AW ; 3 stop them spreading ; 4 help phagocytes engulf them ; 5 cause <u>bacteria</u> to burst / kill <u>bacteria</u> / destroy bacteria ; 6 stop <u>bacteria</u> moving / immobilise <u>bacteria</u> ; 7 neutralise, toxins / poisons / harmful substances ; 8 stop, viruses / bacteria, entering cells ;	[max 2]	A antigens R 'fight' against <i>anywhere in the answer</i> A opsonisation / described A 'makes bacteria more detectable by phagocytes' ignore 'dissolve bacteria' A 'detoxify'
	(b)	(i)	1 when blood clots / following a cut / when wounded / AW ; 2 when blood vessels are damaged ; 3 on exposure of, blood / fibrinogen, to air ; 4 flows over rough surfaces / AW ;	[max 1]	A injury
		(ii)	1 (fibrinogen is converted into) <u>insoluble</u> (fibrin) ; 2 forms, mesh / net / network / strands ; 3 traps, (red) blood cells / platelets ; 4 (dries) to form a scab ; 5 prevents, loss of blood / more bleeding ; 6 prevents infection / AW ;	[max 3]	<i>assume answer is about fibrin</i> A 'gauze' / threads / fibres / web A prevents entry of (named) pathogens R foreign bodies

Question		Answers	Marks	Additional Guidance
5	(c) (i)	5°C – low (kinetic) energy / slow movement of molecules ; low frequency of / few, collisions ; 70°C – enzyme <u>denatured</u> ; ref. to active site / shape of enzyme ;	[max 3]	<i>accept that 'it' refers to the enzyme</i> denatures active site = 2 marks, A thrombin for enzyme R if 'die' / 'die and denature' A 'deformed' / AW, active site / enzyme
	(ii)	time taken for fibrin to form / liquid to become sticky / AW ; time taken for fibrinogen / substrate to disappear ; how much fibrin produced in, unit time / stated time ; how much fibrinogen converted, in unit time / stated time ;	[max 1]	A rate of fibrin production / how long it takes blood to clot / form a mesh / to reach same viscosity R 'how long it took a scab to form' A product for fibrin A substrate for fibrinogen
	(iii)	pH ; volume of, enzyme / thrombin (solution) ; concentration of, enzyme / thrombin (solution) ; volume of, substrate / fibrinogen (solution) / blood ; concentration of, substrate / fibrinogen (solution) ; calcium ions ; AVP ; e.g. equilibration time	[max 2]	R temperature A 'amount' for concentration A 'amount' for concentration R blood R size of fibrinogen / substrate
			[Total: 13]	