Mark Scheme

Q1.

Question number	Answer	Notes	Marks
(a)	• plasma contains no cells (1) • plasma colourless/whole blood red (1)	Allow reverse for whole blood	2
(b)	any six from • blood of patient contains antibodies (1) • (antibodies) bind to Ebola/virus antigens/antibody-antigen complex formed/antibodies complementary to (virus) antigens (1) • phagocytes engulf (antibody-antigen complex) (1) • Ebola/virus destroyed (1) • testing of patient's blood ensures no disease present/prevents transfer of disease (1) • removal of red blood cells ensures no reaction when blood transfused/no agglutination (1) • anti-Ebola antibodies in transfused blood help person with disease to recover (1) • more effective than medicine (1) • quicker effect (1)	Ignore fight disease/virus Allow passive artificial immunity	6

Q2.

Question number	Answer	Notes	Marks
(a)(i)	• high (blood) pressure (in the glomerulus); • small molecules/named small molecule forced / filtered/pass through (into Bowmans capsule);	Do not allow protein	1 1
(ii)	Any four from: • lower concentration of glucose/oxygen in blood in renal vein; • used in respiration; • less/no urea in renal vein; • urea excreted in urine; • more carbon dioxide in renal vein; • carbon dioxide produced in respiration;	Allow reverse argument throughout	Max 4

(b) (i)	quantity of salt (in food);		1
(ii)	Any two from: • different foods used (which may affect the amount of urea produced/amount of water reabsorbed); • different people used who may be different genders/ages/ have a medical condition/different metabolism (that affects osmoregulation/water balance); • the food/drink consumed by the people prior to the investigation was not taken into account (which will influence the quantity of urea/water in urine produced);		Max 2
(iii)	use one person only (and vary salt intake)/monitor / control food/water consumption/give each person the same food (but vary salt content);	Allow valid alternatives	1
		Total question = 10 marks	

Q3.

Question number	Answer	Notes	Marks
(a) (i)	A (1) (aorta) B it is not the pulmonary artery C it is not the pulmonary vein D it is not the vena cava		1
(ii)	C (1) (right atrium) A it is not connected to the left atrium B it is not connected to the left ventricle D it is not connected to the right ventricle		1
(b) (i)	circle drawn beyond by-pass vessel and around end of coronary vessels (1)		1
(ii)	• no/less blood to heart <u>muscles</u> (1) • no/less oxygen/glucose transported (1) • no/less CO_2 removed (1)		3
(iii)	• takes blood beyond blockage (1) • to supply heart muscles (1)		2
		Total for question = 8 marks	

Q4.

Question number	Answer	Mark
(a)(i)	D	1

Question number	Answer	Mark
(a)(ii)	W = (inferior) vena cava (1) X = aorta (1)	2

Question number	Answer	Additional guidance	Mark
(a)(iii)	A description that makes reference to the following two points: • blood vessel W carries deoxygenated blood (1) • and contains more carbon dioxide (1)	or reverse argument blood vessel X	2

Question number	Answer	Additional guidance	Mark
(b)(i)	Thicker wall/narrower lumen/elastic muscle tissue	ignore reference to pressure	1

Question number	Answer	Mark
(b)(ii)	An explanation that makes reference to any two of the following points: • small lumen so high blood pressure maintained (1) • muscular wall that contracts forcing blood forward (1) • contains elastic tissue which recoils (1)	2

Question number	Answer	Additional guidance	Mark
(b)(iii)	Process: • (10 ÷ 50) = 0.2 mm (1) • (0.2 x 1000) = 200 µm (1)	allow 2 marks for correct final answer	2

Question number	Answer	Mark
(c)(i)	An explanation that makes reference any four of the following points: • ACE inhibitor blocks action of angiotensin converting enzyme/ACE (1) • prevents angiotensin I from binding to ACE (1) • angiotensin I not converted to angiotensin II (1) • blood vessels remain dilated/vasodilation/vasoconstriction prevented (1) • production of ADH reduced (1) • less water in blood (1) • lower blood pressure (1)	4

Question number	Answer	Mark
(c)(ii)	To reduce the risk of stroke/heart attack/heart disease/kidney failure	1

Q5.

Question number	Answer	Mark
(a)(i)	(red blood cells) are a similar size/diameter as the lumen of the capillary	1

Question number	Answer	Mark
(a)(ii)	An explanation that makes reference to any three of the following points: • more diffusion of oxygen (into cells) (1) • slower flow (of red blood cells) (1) • because more time for diffusion to take place (1) • greater surface area in contact with capillary walls/shorter diffusion distance (1)	3

Question number	Answer	Mark
(b)	An explanation that makes reference to any three of the following points: • less oxygen transported (to baby) (1) • (due to) presence of carbon monoxide(1) • has a higher affinity for red blood cells than oxygen or binds more strongly to red blood cells or binds irreversibly to red blood cells (1) • forms carboxyhaemoglobin (1) • less aerobic respiration/less energy released (in baby) (1) • less growth (1)	3

Q6.

Question number	Answer	Notes	Marks
(a) (i)	• transport oxygen; • from lungs; • to (body) tissues/cells;	Allow organs	3
(ii)	• haemoglobin to carry/combine with oxygen; • no nucleus, so more haemoglobin; • biconcave shape to increase surface area; • small/flexible (cell) membrane to pass through capillaries; • thin membrane to reduce diffusion distance;		4
(b) (i)	vein;		1
(ii)	• valve present/large lumen/thin (muscular) walls; • only found in veins/not found in arteries/other blood vessels;		2
(iii)	• distance 13-15 mm; • divide by 10 = 1.3-1.5;	Ecf: max 1 mark if mp1 incorrect but division by 10 of their value is correct	2
			Total 12

Q7.

Question number		Answer	Notes	Marks
(a)	(i)	• genetic material made of RNA (1) • no DNA (1)		2
	(ii)	<table><tr><th>Disease</th><th>Blood Tested (✓)</th></tr><tr><td>anaemia</td><td></td></tr><tr><td>cystic fibrosis</td><td></td></tr><tr><td>gonorrhoea</td><td>✓</td></tr><tr><td>HIV</td><td>✓</td></tr><tr><td>scurvy</td><td></td></tr></table>	-1 for each extra tick	2
	(iii)	• donor/blood transfused into person with Ebola (1) • needs to be compatible/matched/same group/not rejected (1) • otherwise agglutination/clumping occurs (1)	R clotting	3
	(iv)	• cause blood cells to burst/cells are damaged/destroyed/lose structure (1) • results in loss of function (1)		2
	(v)	• antibodies in donated blood (1) • can destroy virus in infected person (1)		2
(b)		• uracil present, not thymine (1) • guanine would pair with cytosine/adenine with uracil (1) • percentage of G and C/A and U would be the same (1)		3
			Total for question = 14 marks	

Q8.

Question number		Answer	Notes	Marks
(a)	(i)	• axes labelled (1) • suitable scale (1) • independent variable on X axis (1) • correct plots (2) • suitable curve (1)	-1 for each incorrect plot	6
	(ii)	• mean/average calculated (1) • reliable / reproducible / repeatable (1) • eliminate anomalies (1)		2
(b)	(i)	$\frac{70}{90}$ x 100 (1) 78%/77.78/77.8 (1)	correct answer = full marks	2
	(ii)	• travels in the blood (1) • time to reach/affect nerve (1)	R heart	2
(c)		• carries impulses to heart muscle (1) • reduces rate of contraction (1)		2
			Total for question = 14 marks	

Q9.

Question number	Answer	Additional guidance	Mark
(a)	Reponses in the following order: pressure (1) volume (1) diaphragm (1) down (1) inflating (1)	reject along	5

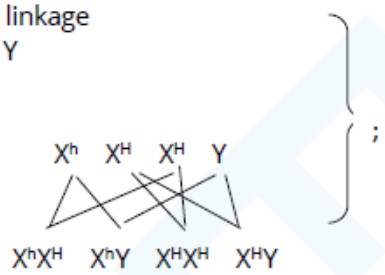
Question number	Answer	Mark
(b)(i)	Arrow shows blood is flowing away from lung/alveolus	1

Question number	Answer	Mark
(b)(ii)	Process: • width of wall (measured with ruler) is 1 mm (1) • scale 18 mm = 0.1 mm (1) • actual width = 0.1 ÷ 18 (1) • 0.0055/0.006 mm (1)	4

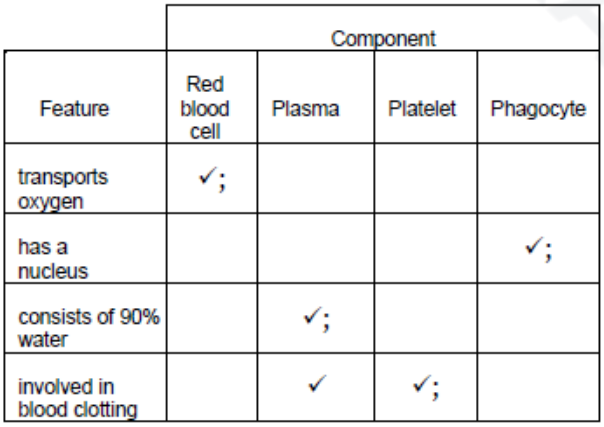
Question number	Answer	Mark
(b)(iii)	An explanation that makes reference to the following points: • thin wall (1) • therefore short diffusion pathway (1) • oxygen/carbon dioxide will pass across in shorter time (1)	3

Q10.

Question number		Answer	Notes	Marks
(a)	(i)	A (the inheritance of two different alleles, both of which are expressed) B is incorrect as one allele is not expressed in codominant inheritance C is incorrect as the ABO inheritance does not involve the inheritance of multiple alleles D is incorrect as ABO inheritances does not involve the inheritance of multiple alleles		1
	(ii)	I^AI^A and I^Ai		1

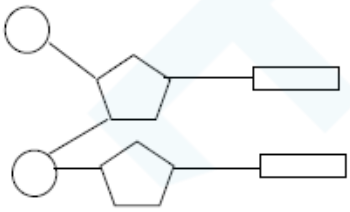
(b)	(i)	• blood group O contains no antigens; • antigens removed/digested (by enzyme); • carbohydrase digest carbohydrates; • protease digest proteins;		Max 3
	(ii)	reduces need to find donor/cheaper/blood readily available/less chance of transfusing incorrect blood group/less risk of disease/infection;		1
(c)	(i)	parent genotypes X^hX^H and X^HY;	One mark for parent genotypes and one mark for gametes **and** linkage	1
		gametes and linkage X^h X^H X^H Y  		1
	(ii)	1 in 4/25%/quarter/1/4 /1:3/0.25;		1
			Total question = 9 mark	

Q11.

Question number	Answer	Notes	Marks
		Mark by row	4
		Total 4 marks	

Q12.

Question number	Answer	Mark
(a)	A description that makes reference to the following points: • DNA double versus RNA single-stranded (1) • DNA contains thymine while RNA contains uracil (1) • DNA contains deoxyribose while RNA contains ribose (1)	3

Question number	Answer	Mark
(b)	A drawing that includes: • organic bases attached to correct position on ribose (1) • phosphate attached at C3 and C5 (1) 	3

Question number	Answer	Additional guidance	Mark
(c)(i)	Process: • 37% must be thymine (1) • 100 – (2 × 37) = 26% must be guanine (G) and cytosine (C) (1) • so guanine = 26 ÷ 2 = 13% of nucleotides (1)	allow 3 marks for correct final answer	3

Question number	Answer	Mark
(c)(ii)	An explanation that makes reference to the following points: *muscle cell* adenine 37%/same amount as cheek cell (1) because genetically identical to cheek cell (1) *red blood cell* adenine 0% (1) no nucleus (1) DNA in nucleus/no DNA (1)	5

Question number	Answer	Mark
(d)	D	1

Q13.

Question number	Answer	Notes	Marks
(a)	transport oxygen to body cells		1
(b)	• (X) plasma (1) • (Y) platelets (1)		2
(i)	Evidence of division by 5(1) 3:1	full marks for correct final answer	2
(ii)	• white blood cells/lymphocytes increase in number (1) • (white blood cells)used in defence against disease(1) • produce antibodies/phagocytosis(1)	Ignore fight disease/pathogen Allow kill/destroy pathogen/bacteria	2
Total for Question 1 = 7 marks			

Q14.

Question number	Answer	Notes	Marks
(a)	<table><tr><th>Component</th><th>Name</th><th>Function</th></tr><tr><td>A</td><td>*red blood cell/erythrocyte*</td><td>*carry/transport oxygen*</td></tr><tr><td>B</td><td>white blood cell/phagocyte;</td><td>engulf bacteria;</td></tr><tr><td>C</td><td>platelets;</td><td>clotting;</td></tr></table>		4 marks
(b) (i)	any five of • enzyme/thromboplastin/thrombokinase; • released from (damaged) platelets; • prothombin to thrombin; • fibrinogen to fibrin; • meshwork formed; • trapped rbc form clot; • ref. to Ca^{2+};	reject secrete	5 marks
(ii)	• prevents loss of too much blood; • prevents entry of pathogens/bacteria; • which would cause infection/prevents infection;		3 marks
Total 12 marks			

Q15.

Question number	Answer	Notes	Marks
(a)(i)	A aorta;		1
(ii)	D vena cava;		1
(iii)	• wider lumen; • thinner walls; • valves; 	Ignore arrows Accept valves drawn either way round	1 1 1

(iv)	Any three from: (Blood vessel X) • thicker walls/more muscle/elastic fibres in walls to maintain blood flow to maintain/withstand high (blood) pressure; • thinner lumen to maintain high blood pressure; OR (Blood vessel Y) - • less muscle/elastic tissue in walls so slower blood flow; • wider lumen so carries blood at lower pressure; • contains valves to prevent backflow;		Max 3
(b)	Any four from: • thin wall/wall one cell thick; • contains pores; • shorter diffusion pathway; • narrow lumen; • only one (blood) cell/few (blood) cells at a time can pass through;		Max 4

Total question = 12 marks

Q16.

Question number	Answer	Notes	Marks
(a) (i)	• reference to platelets; • fibrinogen converted to fibrin; • (fibrin) mesh/crosslinks/fibres formed;		3
(ii)	• reduced blood flow to heart/cardiac muscle / tissue/cells; • less oxygen/glucose delivered; • less (aerobic) respiration/energy released (by cardiac tissue);		3
(b)(i)	size of blood clot/volume of water /aspirin solution used/temperature/shape of blood clot/width of straw;	Allow valid alternatives	1
(ii)	use water without aspirin dissolved;		1
(iii)	• the more tablets dissolved the more solution collected; • the more tablets dissolved the quicker the solution is collected; • aspirin dissolves/acts on blood clot; • size of blood clot reduced more quickly with more tablets/blood clot dissolves/breaks down faster with more tablets;		Max 3
(c)	Any four from: • aspirin binds to enzyme/aspirin competes (with substrate) for active site; • active site of enzyme changed/blocked; • less/no substrate binds (to enzyme); • reaction involving release of chemicals reduced/stopped; • platelets do not stick together;		Max 4
		Total question = 15 marks	

Q17.

Question number	Answer	Notes	Marks
(a) (i)	any three from • prevents excessive loss of blood (1) • forms scab over wound (1) • prevents entry of bacteria /pathogens/microorganisms(1) • so prevents infection (1) • allows wound to heal (1)		3
(ii)	• (allele) on X/sex chromosome (1) • passed on to offspring/inherited by children (1)		2
(b) (i)	D; (X^hY) A the genotype is not X^hX^h B the genotype is not X^HX^h C the genotype is not X^HY		1
(ii)	B; (X^HX^h) A the genotype is not $X^h X^h$ C the genotype is not X^HY D the genotype is not X^hY		1
(iii)	• offspring genotypes X^HX^h and X^hY (1) • 1 carrier female to 1 haemophiliac male = 50%/0.5/½ (1)	full marks for correct figures only.	2
(iv)	• unusual for female to be haemophiliac (1) • both alleles have to be affected (1) • must have a haemophiliac father and mother with haemophilia/carrier (1)	any correct reference to excessive blood loss	3
		Total for question = 12 marks	

Q18.

<table>
<tr><th>Question number</th><th>Answer</th><th>Notes</th><th>Marks</th></tr>
<tr><td>(a) (i)</td><td>  </td><td></td><td>1</td></tr>
<tr><td>(ii)</td><td>In the following order only:

phagocytes;
enzymes;</td><td></td><td>

1
1</td></tr>
<tr><td>(iii)</td><td>produce antibodies/release antitoxins;</td><td></td><td>1</td></tr>
<tr><td>(b)</td><td><table><tr><th>Bacterial cell</th><th>Human skin cell</th></tr><tr><td></td><td>✓</td></tr><tr><td>✓</td><td>✓</td></tr><tr><td></td><td></td></tr><tr><td>✓</td><td></td></tr></table></td><td>One mark for each correct row</td><td>3</td></tr>
<tr><td>(c)</td><td>D (a single-stranded helix containing the bases AUGC);

A is incorrect as RNA is not a double-stranded helix
B is incorrect as RNA is not a double-stranded helix
C is incorrect as RNA does not contain the base T</td><td></td><td>1</td></tr>
<tr><td colspan="4">Total question = marks</td></tr>
</table>

Q19.

Question number	Answer	Notes	Marks
(a)	<table><tr><td>Blood group</td><td>A</td><td>B</td><td>AB</td><td>O</td></tr><tr><td>Antigen</td><td>A</td><td>B</td><td>A and B</td><td>none</td></tr></table>	all four correct = 2 1-3 correct = 1	2
(b)	• agglutination (1) • blocks vessels (1) • causes death (1)		3
(c)	recipient blood group A = A and O (1) recipient blood group B = B and O (1) recipient blood group AB = AB, O, A and B/allgroups (1) recipient blood group O = O (1)		4
(d)	• 10 + 4 = 14% (1) • $\frac{14 \times 750}{100}$ (1) • = 105 (1)	full marks for correct answer	3

Q20.

Question number	Answer	Notes	Marks
(a) (i)	C; (red blood cells)		1
(ii)	any three from • more carbon dioxide (1) • less oxygen (1) • moister (1) • warmer (1)		3
(iii)	• large surface area (1) • thin (walled)/wall one cell thick (1) • good blood supply (1) • moist lining (1)		3
(b)	• thin wall (1) • narrow lumen (1)	Allow references to only one blood cell passing through	2
(c)	• breathing (out)/exhalation more difficult/not smooth/shortness of breath/faster breathing rate (1) • as lungs would not squeeze out air/forced exhalation(1)		2