PEARSON EDEXCEL IAL BIOLOGY · YBI11

BIOLOGY



MARK SCHEME

UNIT 1: MOLECULES, TRANSPORT AND HEALTH

SCORE	PERCENTAGE
/601	%

STEMUP

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Mark Scheme

Q1.

Question number	Answer	Additional guidance	Mark
(a)	• change in the base {sequence / order} of DNA	**ACCEPT** change in the number of chromosomes / damage to chromosome / loss of part of chromosome	(1)

Question number	Answer	Additional guidance	Mark
(b)(i)	• a change in one variable is reflected in a change in another variable	**ACCEPT** a description that onlymentions 'change' once **DO NOT ACCEPT** causes / results in	(1)

Question number	Answer	Additional guidance	Mark
(b)(ii)	A description that includes the following points: • incidence of skin cancer increases with (an increase in) age (1) • incidence of skin cancer increases with an increase in the years (1) • males have higher incidence of skin cancer than females (1)	**ACCEPT** converse throughout **ACCEPT** in either context of males or females or both **ACCEPT** in either context of males or females or both	(3)

Question number	Answer	Additional guidance	Mark
(b)(iii)	An answer that includes three of the following points: • as age increase there is more time for mutations to {build up / occur} (1) • people are spending more time in the sun (1) • more UV light reaching the earth's surface (1) • more men have {jobs / hobbies} outside (1) • men have a greater genetic disposition to skin cancer (1)	**ACCEPT** the older you are the more exposure to risk factors / the more cell divisions the more chance of mutations **ACCEPT** an example of why this may happen e.g. going on more holidays in hot countries **ACCEPT** ozone layer depletion **ACCEPT** men smoke more	(3)

Question number	Answer	
* **(c)**	Indicative content: Repeatability: • sample size is small • smokers are being studied and their sample size is very small* • no statistical data available • no indication of the location of the individuals (could be a validitycomment as well) Validity: • mean age at diagnosis is similar but not identical • there is a greater range of ages for males than females • no indication of the actual ages of the people • so there could be more people at the extremes in one group • no information about other lifestyle factors • e.g. working in polluted environment, living in the city • no information about non-lifestyle factors • e.g. ethnicity • no indication if individuals lived with other smokers (passivesmokers) • no indication of how long people been smoking for* • no indication of how many cigarettes were smoked by the smokerseach day* • no indication if the non-smokers had ever smoked previously* • no indication of severity of emphysema* • no indication if emphysema is self-diagnosed or clinical diagnosis*	**Level 1 : comments on the design of the study** 1 mark = 1 comment 2 marks = 3 comments **Level 2 : comments on the design of the study** 3 marks = 4 comments, at least one of which isfrom each category 4 marks = 5 comments, at least one of which isfrom each category **Level 3 : comments on the design of the studyand makes at least one link correctly with repeatability or validity** 5 marks = 5 comments at least one of which islinked to repeatability or validity 6 marks = 6 comments at least one of which is linked to repeatability or validity **and** includes aspecific comment about {smoking / emphysema}* **ACCEPT** reproducible / reliable **IGNORE** accurate / precise **(6)**

Q2.

Question number	Answer	Additional guidance	Mark
(a)(i)	• 100 (cm)		**(1)**

Question number	Answer	Additional guidance	Mark
(a)(ii)	An answer that includes the following points: • height^2 calculated (1) • equation rearranged and values substituted in (1) • answer given to {1 decimal place / 3 significant figures} (1)	2.4025 (m^2) / 24025 (cm^2) mass = 36 × 2.4025 / 86.49 86.5 **NB** CE if rounded cm^2 value to 865000 Correct answer of 86.5 with no working shown should be awarded 3 marks. An answer of 86.49 or 865 000 withno working shown should be awarded 2 marks.	**(3)**

Question number	Answer	Additional guidance	Mark
(a)(iii)	An answer that includes the following points: • using WHR the two women appear to have the same riskof developing CVD (1) • however using {mass / BMI} female K is at a greater risk(1)		**(2)**

Question number	Answer	Additional guidance	Mark
(a)(iv)	An explanation that includes the following points: • by the tape being pulled tighter around the waist so the waistvalue is smaller (1) • by the tape being held loosely around the hips so the hip value isgreater (1) • so that the waist to hip ratio is smaller (1)	**ACCEPT** breathing in whilst taking the measurement of the waist **ACCEPT** make the waist measurementsmaller and the hip measurement larger **NB** If both methods given but nojustification = 1 mark	**(2)**

Question number	Answer	Additional guidance	Mark
(b)(i)	An answer that includes two of the following points: • the distribution of fat under the skin is not even (1) • exercise will replace fat under the skin with muscle (1) • the woman has had a child (1) • liposuction (1) • lipoedema (affecting the arms) (1)	**ACCEPT** exercising some parts of bodywill reduce fat / stopping exercise to some parts of body will increase fat	(2)

Question number	Answer	Additional guidance	Mark
(b)(ii)	• moderate	**DO NOT ACCEPT** low / low to moderate	(1)

Q3.

Question number	Answer	Additional guidance	Mark
(a)	An explanation that includes the following points: • to widen (the lumen of) the (coronary) artery / (blood) vessel (1) • so that more blood can flow to the heart {cells / muscle} (1) • for respiration (in the heart muscle) / so that heart muscle cancontract (1)	**ACCEPT** increase in {diameter / cross-sectional area} **IGNORE** larger / increase in area	(3)

Question number	Answer	Additional guidance	Mark
(b)(i)	An answer that includes the following points: • percentage of one group developing thrombosis calculated (1) • correct difference calculated (1)	1.5% of 800 = 12 **OR** 1.0% of 400 = 4 difference = 8 Correct answer with no working gainstwo marks	(2)

Question number	Answer	Additional guidance	Mark
(b)(ii)	• blocks the (coronary) {artery / vessel} {so the brain doesnot get oxygen / causing a stroke}	**ACCEPT** so that the heart muscle doesnot get oxygen / causing a heart attack	(1)

Question number	Answer	Mark
(b)(iii)	**D** thrombin and thromboplastin The only correct answer is D. *A is incorrect because prothrombin is inactive* ***B** is incorrect because prothrombin is inactive* ***C** is incorrect because prothrombin is inactive*	(1)

Question number	Answer	Mark
(b)(iv)	**C** fibrinogen and thromboplastin The only correct answer is C *A is incorrect because fibrin is insoluble* ***B** is incorrect because fibrin is insoluble* ***D** is incorrect because other factors are also soluble e.g. thromboplastin*	(1)

Question number	Answer	Additional guidance	Mark
(b)(v)	anticoagulants / platelet inhibitors	**ACCEPT** named anticoagulants / platelet inhibitors **e.g.** heparin, aspirin, warfarin **DO NOT ACCEPT** antihypertensives / statins	(1)

Q4.

Question number	Answer	Mark
(a)	**C** glycogen The only correct answer is C. *A is incorrect because amylopectin is found in plant cells only* ***B** is incorrect because cellulose is found in plant cells only* ***D** is incorrect because starch is found in plant cells only*	(1)

Question number	Answer	Mark
(b)	**D** lactose and sucrose The only correct answer is D. *A is incorrect because fructose is a monosaccharide and therefore not digested* ***B** is incorrect because fructose and galactose are both monosaccharides and therefore not digested* ***C** is incorrect because galactose is a monosaccharide and therefore not digested*	(1)

Question number	Answer	Additional guidance	Mark
(c)(i)	• 190 900 000 / 191 000 000 / 191 million / 1.909×10^8 / 1.91×10^8		(1)

Question number	Answer	Additional guidance	Mark
(c)(ii)	An explanation that includes three of the following points: • because (prenatal testing) can cause abortion (1) • because false negative or false positive results can be avoided (ifpatient already has diabetes) (1) • because of issues arising if another genetic condition is found (1) • because an individual could live a healthy life (as only a geneticpredisposition) (1) • because of the ethics associated with destroying embryos (IVF) (1)		(3)

Q5.

Question number	Answer	Mark
(a)	**The only correct answer is C** (two) A is incorrect because thromboplastin is an active enzyme found in the platelets but is not converted into thrombin B is incorrect because thromboplastin is an active enzyme found in the platelets but is not converted into thrombin D is incorrect because thromboplastin is an active enzyme found in the platelets but is not converted into thrombin	**(1)**

Question number	Answer	Additional guidance	Mark
(b)	An answer that includes the following points: • 1.8 to 3.5 (1) • below 1.8 there is a high risk of stroke (1) • above 3.5 there is an increased risk of bleeding (within the skull) (1) **OR** • 1.8 to 2.5 (1) • below 1.8 there is a high risk of stroke (1) • above 2.5 the risk of bleeding (within the skull) starts to increase (1) **OR** • 2.0 to 2.5 (1) • both risks are low / they are the lowest (combination) (1) • 3.1-3.5 has a lower risk of stroke but a higher risk of bleeding (1)	**ACCEPT** other ranges {have either high risk of bleeding or high risk of stroke / both risks are low} = 1 mark if mp 2 and 3 not awarded **ACCEPT** other ranges {have either higher risk of bleeding or high risk of stroke / both risks are low} = 1 mark if mp 2 and 3 not awarded	**(3)**

Question number	Answer	Additional guidance	Mark
(c)	An explanation that includes the following points: • warfarin reduces {a blood clot forming / thrombosis} (1) • (if a blood clot does not form) it cannot block the coronary artery (1) • if oxygen is supplied to the heart {muscle / cells} it will continue to {contract / respire} (1)	**ACCEPT** no blood clots forming less blood clotting reduces blood clot (size)	**(3)**

Question number	Answer	Additional guidance	Mark
(d)(i)	• 1012 / 1013 (1)		**(1)**

Question number	Answer	Additional guidance	Mark
(d)(ii)	An answer that includes the following points: • select a group of patients who have had a heart attack (1) • of similar {age / sex at birth / background / lifestyle} (as in the first study) (1) • give each person the same quantity of warfarin (used in the first study) (1) • (monitor for) {the same time period / four years} (1) • use of a statistics (1)	**ACCEPT** other appropriate factors no other health issues **ACCEPT** in context of one group split into two groups **ACCEPT** description of double-blind trial / double-blind trial / suitable named statistics test	**(4)**

Q6.

Question number	Answer	Additional guidance	Mark
(a)	A calculation which: • measured widths of wall as 10 mm and 30 mm (1) • shows the difference between widths, divided by smaller value (1) • × 100% (1) Example of calculation: (30 – 10) = 20 mm (20 ÷ 10) × 100 = 200%	Accept measurements consistent with printed image Correct answer with no working gains all 3 marks	(3)

Question number	Answer	Mark
(b)	An explanation that includes the following points: • formation of blood clot / thickening of artery wall (1) • therefore {blocks / narrows} coronary arteries (1) • therefore reduces blood flow (1) • therefore deprives heart muscle of {oxygen / nutrients} (1)	(4)

Question number	Answer	Additional guidance	Mark
(c)	Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material indicated as relevant. Additional content included in the response must be scientific and relevant. **Indicative content** • increased cholesterol increases chance of dying from CVD • cholesterol concentrations are different in different countries • same cholesterol level does not confer same risk in different countries • greater the cholesterol to HDL ratio, the greater the risk of CVD • the smaller the diameter the LDL, the greater the risk of CVD • individuals at greatest risk of CVD are those with a large cholesterol to HDL ratio and small LDL diameter and a high cholesterol concentration • not possible to say if different risks for a particular cholesterol concentration in the first study are due to differences in cholesterol to HDL ratio / diameter of LDL	Allow differences in the first study may be due to differences in cholesterol to HDL ratio / diameter of LDL	(6)

Level	Marks	Descriptor
	0	No awardable content.
1	1-2	A scientific assessment is made of a factor, supported by the application of limited relevant evidence from the scientific information provided. No conclusion is attempted.
2	3-4	A scientific assessment is made of some of the factors, supported by the application of some relevant evidence from the analysis and with some interpretation of the scientific information. A conclusion, where needed, is made, demonstrating linkages to elements of biological knowledge and understanding, with some evidence to support the assessment being made.
3	5-6	A scientific assessment is made of the factors, supported throughout by sustained application of relevant evidence from the analysis and interpretation of the scientific information. A conclusion, where needed, is made, demonstrating sustained linkages to biological knowledge and understanding, with sufficient evidence to support the assessment being made.

Q7.

<table>
<tr><th>Question number</th><th>Answer</th><th>Additional guidance</th><th>Mark</th></tr>
<tr><td>(a)</td><td>
<table>
<tr><th>Name</th><th>Role</th><th>Property</th></tr>
<tr><td>thromboplastin</td><td>(catalyses the) conversion of prothrombin into thrombin (1)</td><td>soluble</td></tr>
<tr><td>thrombin (1)</td><td>catalyses the conversion of fibrinogen into fibrin</td><td>soluble (1)</td></tr>
<tr><td>fibrin</td><td>Any two of the following points:
• form a network of fibres / mesh (1)
• trap {platelets / blood cells} (1)
• form a scab to {seal the wound / stop bleeding} (1)
• form a scab to prevent the entry of bacteria (1)</td><td>insoluble (1)</td></tr>
</table>
</td><td>IGNORE reference to calcium ions / vitamin K

ACCEPT unsoluble

ACCEPT two points made in one sentence
DO NOT ACCEPT completely wrong statements</td><td>(6)</td></tr>
</table>

Question number	Answer	Additional guidance	Mark
(b)	An explanation that includes the following points: • because {gene / (defective) allele} located on the X chromosome (1) • because defective allele is recessive (1) • therefore, males with {defective / haemophilia} **allele** will only have that **allele** (1)	**ACCEPT** X-linked disease / sex-linked disease / inherited on the X chromosome **ACCEPT** {mutated / affected} allele / {haemophilia / disease} is recessive **ACCEPT** males will not carry a {healthy / normal} allele females need {both defective alleles / to be homozygous for defective alleles} to have haemophilia	(3)

Q8.

Question number	Answer	Additional guidance	Mark
(a)(i)	An answer that includes the following points: • thromboplastin (1) • active site (1) • platelets / (red / white) blood cells / erythrocytes (1)	**IGNORE** calcium ions / Ca^{++} **IGNORE** clot / scab	(3)

Question number	Answer	Mark
(a)(ii)	A The only correct answer is **A**. ***B*** *is incorrect because antihypertensives are used to lower blood pressure* ***C*** *is incorrect because platelet inhibitors affect platelets* ***D*** *is incorrect because statins lower blood cholesterol*	(1)

Question number	Answer	Additional guidance	Mark
(b)	• tangent drawn at 2 days (1) • correct answer up to 2 decimal places and units (1)	**Example of calculation:** **ACCEPT** straight line touching outsideof curve at 2 **ACCEPT** in range of 2.7 to 4.5 {s day^{-1} /s per day / s/day} **ACCEPT** with or without a minus sign	(2)

Q9.

Question number	Answer	Additional guidance	Mark
(a)	The correct answer is **C**, fibrin ***A*** *is incorrect because cholesterol is not part of the wound* ***B*** *is incorrect because collagen is inside the artery wall* ***D*** *is incorrect because fibrinogen is soluble*		(1)

Question number	Answer	Additional guidance	Mark
(b)	The correct answer is **A**, 1 ***B*** *is incorrect because prothrombin is the only inactive enzyme precursor in the list* ***C*** *is incorrect because prothrombin is the only inactive enzyme precursor in the list* ***D*** *is incorrect because prothrombin is the only inactive enzyme precursor in the list*		(1)

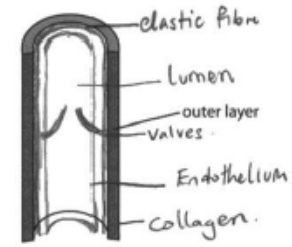
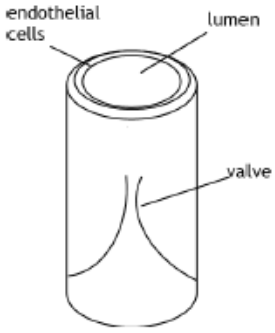
Question number	Answer	Additional guidance	Mark
(c)	The correct answer is **C**, 3 ***B*** *is incorrect because fibrin is the only insoluble molecule in the list* ***C*** *is incorrect because fibrin is the only insoluble molecule in the list* ***D*** *is incorrect because fibrin is the only insoluble molecule in the list*		**(1)**

Question number	Answer	Additional guidance	Mark
(d)	An explanation that includes three of the following points: • to keep thromboplastin separate from prothrombin (1) • so that prothrombin will not be converted into thrombin (1) • the blood clotting process will be prevented (1) • to have thromboplastin {available / released quickly} (when needed) (1)	**ACCEPT** other descriptions of what will not happen e.g. fibrin will not be formed **ACCEPT** will be at a high concentration (when needed) **NB** award mps if candidate clearly states what would happen if the thromboplastin was NOT inside platelets	**(3)**

Q10.

Question number	Answer	Additional guidance	Mark
(a)	An answer that includes the following points: • number of minutes in one day calculated (1) • volume in 24 hours given in standard form (1) OR • volume in one hour calculated (1) • volume in 24 hours given in standard form (1)	$1 \times 60 \times 24 = 1440$ 7.2×10^3 (litres) $5 \times 60 = 300$ 7.2 × 103 (litres) Correct answer with no working (2) Correct answer not in standard form = 1 mark	(2)

Question number	Answer	Additional guidance	Mark
(b)	An answer that includes one similarity and one difference: Similarities: • both have walls containing {muscle cells / elastic fibres / an endothelial cell lining / an (outer) collagen layer} (1) • both have a valve (at the point they leave the heart) (1) Differences: • aorta has a {lumen with a wider diameter / thicker wall / moreelastic tissue / more muscle tissue / more collagen} (1) • aorta has branches to more organs (1)		(2)

Question number	Answer	Additional guidance	Mark
(c)	An answer that includes three of the following points: • addition to diagram {additional one or two layers of wall / valves}.If valves, must be correct orientation (1) Any two from: • {endothelial cell / tunica intima} lining labelled (1) • valve labelled (1) • {(smooth) muscle / elastic fibres / tunica media} labelled (1) • lumen labelled (1)	 	(3)

Q11.

Question number	Answer	Mark
(a)	A  The only correct answer is **A**. ***B** is incorrect because the arrow is pointing down the pulmonary vein* ***C** is incorrect because the flow of blood is in the wrong direction* ***D** is incorrect because the flow of blood is out through the pulmonary artery*	(1)

Question number	Answer	Mark
(b)	A deoxygenated blood flowing away from the heart | oxygenated blood flowing towards the heart The only correct answer is **A**. ***B** is incorrect because the pulmonary artery carries blood away from the heart and the pulmonary vein carries blood towards the heart* ***C** is incorrect because the pulmonary artery carries deoxygenated blood and the pulmonary vein carries oxygenated blood* ***D** is incorrect because the pulmonary artery carries deoxygenated blood and the pulmonary vein carries oxygenated blood*	(1)

Question number	Answer					Mark
(c)	Stage of the cardiac cycle	AV valves open and SL valves open	AV valves open and SL valves closed	AV valves closed and SL valves open	AV valves closed and SL valves closed	(3)
	atrial systole		X			
	ventricular systole			X		
	diastole		X			

Question number	Answer	Additional guidance	Mark
(d)	A description that includes the following points: • cardiac cycle is {shorter / faster /completed more frequently} (1) • ventricles contract more forcefully (during ventricular systole) (1)	**Answers must be comparative** ACCEPT cardiac cycles happens more often ACCEPT {diastole is getting shorter / gets through diastole quicker} ACCEPT cardiac cycle occurs at a higher rate IGNORE {heart rate increases / heart pumps blood faster / heart pumps more strongly / reference to number of heart beats} IGNORE Systole {faster / shorter} ACCEPT ventricles pump blood at higher pressure	(2)

Q12.

Question number	Answer	Additional guidance	Mark
(a)(I)	An answer that includes the following points: • difference between systolic and diastolic pressure is 5.3 (kPa) (1) • person is healthy (because pulse pressure is greater than 3.75 kPa) (1)	**ALLOW** 35 / 35.3 **ALLOW** (because {35 /35.3} % is higher than 25%) **CE applied** to second point and comparison adjusted accordingly	(2)

Question number	Answer	Additional guidance	Mark
(a)(II)	An answer that includes the following points: • suitable estimated values chosen (1) • answer calculated (1)	**ACCEPT** values in range of (diastolic) 9.5 to 9.7 and (systolic) 14.8 to 15.0 to **OR** (systolic) 15 and (Diastolic) 10 11 / 11.2 / 11.3 / 11.4 / 11.5 **OR** 11.7 Correct answer with no working gains 2 marks	(2)

Question number	Answer	Additional guidance	Mark
(a)(iii)	An explanation that includes the following points: • insufficient {oxygen / glucose} delivered to the {cells / tissues} (1) • credit an appropriate consequence (1)	**ACCEPT** oxygenated blood e.g. breathless, lack of energy, stroke, hypoxia, decrease in respiration, dizziness **IGNORE** death **NB** eg lack of oxygenated blood for cell respiration = 2 marks	**(2)**

Question number	Answer	Mark
(b)(i)	**D** $\frac{8\eta\lambda}{\pi r^4}$ The only correct answer is D. *A is incorrect because ΔP cancels out* *B is incorrect because ΔP cancels out* *C is incorrect because the equation is upside down*	**(1)**

Question number	Answer	Mark
(b)(ii)	**C** radius of the blood vessel lumen The only correct answer is **C** *A is incorrect* because ΔP *cancels out* *B is incorrect because length is only to the power 1 and radius is to the power 4 and vessels can change their diameter* *D is incorrect because the thickness of the wall is not part of the calculation.*	**(1)**

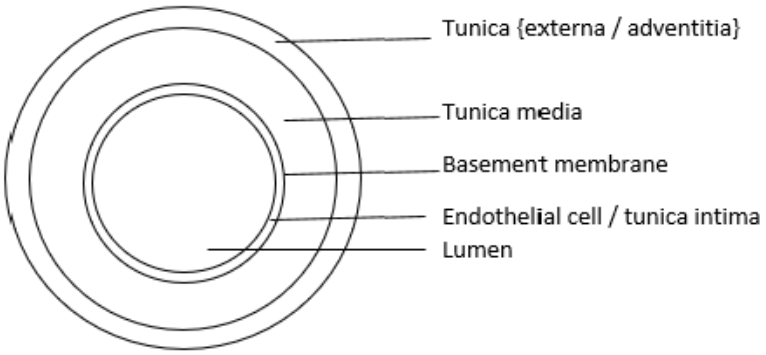
Question number	Answer	Additional guidance	Mark
(b)(iii)	An explanation that includes the following points: • (inside of arteries lined with layer of unfolded) {flattened / smooth} {endothelial cells / endothelium} (1) • to reduce {friction / surface in contact with blood} (1)		**(2)**

Question number	Answer	Additional guidance	Mark
(c)(i)	An explanation that includes the following points: • because elastic fibres (in wall of arteries) can {stretch / expand} (1) • therefore {widening the lumen / increasing the diameter (of the artery)} (1) • wall contains collagen to increase the strength (1)	**IGNORE** recoil **DO NOT ACCEPT** recoil	**(2)**

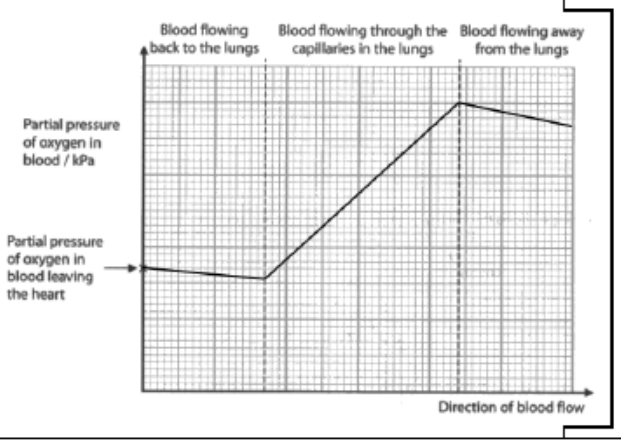
Question number	Answer	Additional guidance	Mark
(c)(ii)	An explanation that includes the following points: • (if compliance is reduced) damage to the endothelium lining (1) • therefore, {cholesterol / (cholesterol) plaque} can build up (1) • therefore {narrowing / blocking} the blood vessel (1) • reducing {flow of blood / oxygen} to the heart {cells / tissues / muscle} (1)	**N.B** A reference to an artery must be made for 3 marks to be awarded **ACCEPT** atheroma **IGNORE** by clots	**(3)**

Q13.

Question number	Answer	Additional guidance	Mark
(a)	A description that makes reference to the following points: • one structure (1) • linked function (1)	e.g. single layer of cells / pores / small diameter **ACCEPT** thin cells / walls e.g. (single layer) gas exchange / diffusion of gases (in the lungs) (pores) plasma forced out / WBC leave / molecules can leave (small diameter) all cells close to capillaries	(2)

Question number	Answer	Additional guidance	Mark
(b)	A drawing that shows the following points: • lumen + {three layers / three other layers + endothelial layer / two layers + endothelial layer} (1) • one feature correctly labelled (1) • a second feature correctly labelled (1)	 **ACCEPT** Epithelial {layer / lining / cells} / fenestrated membrane Tunica interna Layer of (smooth) muscle and elastic fibres (and collagen) for 1 layer Award marks for longitudinal section **NB** regards mp 2 and 3 1 right + 1 wrong label = 1 mark 2 right + 1 wrong label = 1 mark 1 right + 2 wrong labels = 0 marks	(3)

Question number	Answer	Additional guidance	Mark
(c)	An explanation that makes reference to the following points: • to prevent backflow (of blood) (1) • (as blood is usually returning) {under low pressure / (often) against gravity} (1)	ACCEPT so that blood returns to the heart blood flow is in one direction	(2)

Question number	Answer	Additional guidance	Mark
(d)	A drawing that shows the following points: • pp of O_2 remaining constant as blood flows to lungs (1) • pp of O_2 rising as blood flows through the capillaries (1) • pp of O_2 remaining constant as blood flows away from lungs (1)	**ACCEPT** within 1 sm square of the verticals in each section **ACCEPT** slightly decreasing (within 1 large square) **ACCEPT** slightly decreasing (within 1 large square) 	(3)

Q14.

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

Question number	Answer	Mark
(a)(ii)	C	(1)

Question number	Answer	Mark
(b)(i)	B at 0.4 seconds	(1)

Question number	Answer	Additional guidance	Mark
(b)(ii)	A calculation in which: • volume of blood per beat from graph = 59 cm^3 (1) • heart rate calculated from graph = 75 bpm (1) • volume of blood converted into dm^3 (1) Example of calculation: $(59 \times 75) \div 1000 = 4.425\ dm^3$	Accept 109 – 50 Correct answer with no working shown gains all three marks	(3)

Question number	Answer	Mark
(c)	An explanation that includes the following points: • dissociation curve for the llama is to the left of that for the human (1) • therefore llama haemoglobin has a higher affinity for oxygen (1) • llama haemoglobin will be fully saturated with oxygen at lower partial pressures (1) • this is necessary as there is less oxygen available in the atmosphere at high altitudes where llamas live (1)	(4)

Q15.

Question number	Answer	Mark
(a)(i)	**B** The only correct answer is **B**. ***A** is incorrect because fructose is a monosaccharide* ***C** is incorrect because both glucose and fructose are monosaccharides* ***D** is incorrect because fructose is a monosaccharide*	(1)

Question number	Answer	Mark
(a)(ii)	**C** peptide | condensation The only correct answer is **C**. ***A** is incorrect because ester bonds are in lipids* ***B** is incorrect because ester bonds are in lipids and hydrolysis splits bonds* ***D** is incorrect because hydrolysis splits bonds*	(1)

Question number	Answer	Mark
(a)(iii)	**B** absent / lower The only correct answer is **B**. *A is incorrect because saturated fatty acids have more hydrogens than unsaturated fatty acid of same length* ***C** is incorrect because there are no carbon carbon double bonds in saturated fatty acids* ***D** is incorrect because there are no carbon carbon double bonds in saturated fatty acids*	(1)

Question number	Answer	Additional guidance	Mark
(b)(i)	• volume of cylinder calculated (1) • ratio of surface area : volume to max 2 dps (1)	**Example of calculation:** $(3 \times 2 \times 2 \times 28 / \pi \times 2 \times 2 \times 28 / {}^{22}/_{7} \times 2 \times 2 \times 28)$ 336 / 352 (mm^3) e.g 1.02 : 1 / 1.07 : 1 / 1 : 1 **ACCEPT** ratio given the wrong way round e.g. 1 : 09 **NB** ecf if {incorrect rounding from above / diameterused} for 1 mark	(2)

Question number	Answer	Additional guidance	Mark
(b)(ii)	An explanation that includes two of the following points: • (because the insect is small) the cells will not be far from the {sinuses / blood} (1) • (so) diffusion can supply the {oxygen / nutrients / named nutrient} (from the blood) (1) • because the insect is small it does not have {double circulation /blood vessels / closed circulatory system / complex circulatory system / high pressure} **OR** • because the insect has a low {metabolic rate / oxygen demand}(1) • diffusion can supply the oxygen (from blood / tracheoles) / theoxygenated and deoxygenated blood does not need to be kept separate (1) • because the insect is small it does not have {double circulation /blood vessels / closed circulatory system / complex circulatory system / high pressure}	**IGNORE** ref to surface area to volumeratio **ACCEPT** small diffusion distance between cells and {sinuses / blood} **ACCEPT** remove carbon dioxide diffusion supplies oxygen to cells from the tracheoles **IGNORE** has an open system becausethis is in the question **IGNORE** has an open system becausethis is in the question	(2)

Question number	Answer	Additional guidance	Mark
(b)(iii)	A description that includes two of the following points: • fibrous protein (1) • {triple / three stranded} helix (held with hydrogen bonds) (1) • (short) repeating sequences of amino acids / high {hydroxyproline / proline / glycine} content / every third amino acid is glycine(1)	**IGNORE** refs to secondary / tertiary /quaternary structure throughout **NB** piece together **IGNORE** alpha	(2)

Q16.

Question number	Answer	Mark
(a)(I)	**B** 2 | 3 The only correct answer is **B** *A is incorrect because glucose and fructose are monosaccharides and lactose, maltose and sucrose are disaccharides* *C is incorrect because glucose and fructose are monosaccharides and lactose, maltose and sucrose are disaccharides* *D is incorrect because glucose and fructose are monosaccharides and lactose, maltose and sucrose are disaccharides*	(1)

Question number	Answer	Mark
(a)(II)	**B** glycosidic The only correct answer is B. *A is incorrect because ester bonds join organic acids and alcohols together* *C is incorrect because hydrogen bonds do not join two monosaccharides together* *D is incorrect because phosphodiester bonds join phosphate group to an organic alcohol*	(1)

Question number	Answer	Additional guidance	Mark
(a)(III)	An answer that includes two of the following points: • monosaccharides are not more or less sweet than disaccharides (1) • a disaccharide is the least sweet and a monosaccharide is the sweetest (1) • sucrose is the sweetest disaccharide and fructose is the sweetest monosaccharide (1)	**ACCEPT** lactose is the least sweet disaccharide and glucose is the least sweet monosaccharide	(2)

Question number	Answer	Additional guidance	Mark
(a)(iv)	An answer that includes three of the following points: • {sugars / sugar solutions} are tasted (1) • sugars should be the same concentration (1) • mouth is rinsed out between each sugar (1) • the (relative) sweetness is compared to sucrose (1) **OR** If students describe Benedict's test, allow the following two marks: • add Benedict's solution and heat (1) • rank sugar by {described colour changes / time taken to reach specific colour} (1)	**ACCEPT** sampled **IGNORE** amount **ACCEPT** the sugars are {compared against each other / given a rating}	(3)

Question number	Answer	Additional guidance	Mark
(b)	An answer that includes the following points: similarities: • both (polymers) composed of α glucose (1) • both contain 1 - 4 glycosidic {bonds / links} (1) differences: • amylose has {1 - 4 glycosidic bonds (only) / no 1 - 6 glycosidic bonds} and amylopectin has (1 - 4 and) 1 - 6 glycosidic bonds (1)	**DO NOT** piece together unless in same sentence or two linked adjacent sentences **ALLOW** composed of glucose if α glycosidic bonds are given **ACCEPT** amylose is {a chain / helical / linear / unbranched} and amylopectin is branched **NB** 'amylose has 1 - 4 glycosidic bonds and amylopectin has 1 - 4 and 1 - 6 glycosidic bonds' scores mark points 2 and 3	(3)

Q17.

Question number	Answer	Mark
(a)(i)	**The only correct answer is B** contracted | relaxed *A is incorrect because the ventricles are relaxed* *C is incorrect because the atria are contracted and the ventricles are relaxed* *D is incorrect because the atria are contracted*	**(1)**

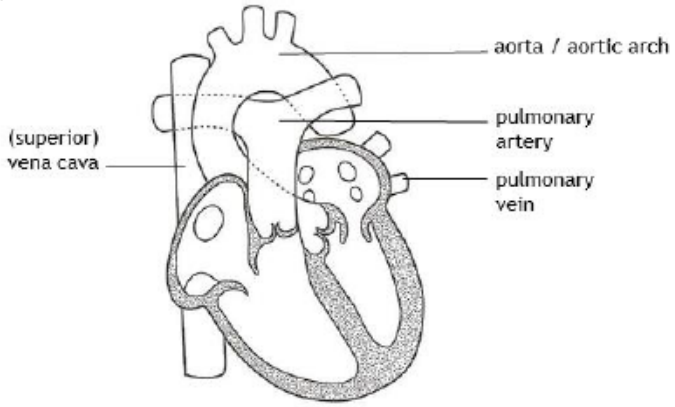
Question number	Answer	Additional guidance	Mark
(a)(ii)	An explanation that includes the following points: • because the atrioventricular valves have to close (before the ventricles contract) (1) • to prevent backflow of blood into the atria (1)	**ACCEPT** {bicuspid / mitral} valve **and** tricuspid valve **DO NOT ACCEPT** valves close during ventricular systole	**(2)**

Question number	Answer	Additional guidance	Mark
(a)(iii)	• cardiac cycle time multiplied by proportion of cycle spent in ventricular systole (1) • 3.2×10^2 / 3.23×10^2 (1)	Example of calculation: $0.86 \times {}^3/_8$ / 0.3225 / 0.32 / 0.323 Correct answer with no working gains 2 marks	**(2)**

Question number	Answer	Additional guidance	Mark
(a)(iv)	• 63% / 5/8 / 0.63	**ACCEPT** 0.625 / 62.5% / 5 out of 8	**(1)**

Question number	Answer	Additional guidance	Mark
(b)	• heart rate if cardiac cycle lasts 0.86 seconds (1) • heart rate if cardiac cycle last 0.46 seconds (1) • increase in heart rate = 60 / 61 beats per minute (1)	Example of calculation: 60 ÷ 0.86 = 69.76744186046512 60 ÷ 0.46 = 130.4347826 Answer in range of 60.2 to 60.7 gains 2 marks CE from calculations of heart rate Correct answer alone gains 3 marks	**(3)**

Q18.

Question number	Answer	Additional guidance	Mark
(a)		**IGNORE** ascending / descending **DO NOT ACCEPT** inferior All 4 correct for 3marks 3 correct for 2 marks 1 or 2 correct for 1 mark	(3)

Question number	Answer					Mark
(b)	**Structures**	**Present in arteries only**	**Present in capillaries only**	**Present in veins only**	**Present in arteries, capillaries and veins**	(3)
	Lining of endothelial cells				X	
	Valves along the length of the blood vessel			X		
	Wall only onecell thick		X			

Question number	Answer	Additional guidance	Mark
(c)	An answer that includes the following points: • {velocity / (blood) flow} decreases as blood flows through thearterioles (1) • {velocity / (blood) flow} low as blood flows through the capillaries(1) • {velocity / (blood) flow} increases as blood flows through thevenules (1)	**NB** penalise ref to blood pressureinstead of blood flow once **ACCEPT** from arteries to capillaries **IGNORE** descriptions of what happens inarteries **ACCEPT** slight increase **IGNORE** constant **ACCEPT** from capillaries to veins **IGNORE** descriptions of what happens inveins	(3)

Q19.

Question number	Answer	Mark
(a)(i)	The only correct answer is **A** ***B*** *is incorrect because a person can modify their alcohol intake* ***C*** *is incorrect because a person can modify their blood pressure* ***D*** *is incorrect because a person can change their level of activity*	**(1)**

Question number	Answer	Additional guidance	Mark
(a)(ii)	An explanation that includes the following points: • because many factors cause CVD (1) • different drugs treat different conditions (1)	**ACCEPT** two named drugs and what they treat **IGNORE** wrong drugs	**(2)**

Question number	Answer	Additional guidance	Mark
(b)(i)	An explanation that includes the following points: • because antioxidants reduce free radicals (1) • therefore {cell damage / damage to lining of blood vessels / oxidative stress} will be reduced (1) • therefore reducing {plaque / atheroma} formation (due to decreased free radicals) (1)	**ACCEPT** neutralise / donate electrons to / break down / stabilise **IGNORE** incorrect consequences	**(3)**

Question number	Answer	Additional guidance	Mark
(b)(ii)	An explanation that includes the following points: • {study / data} will not be valid (1) • diet has an impact on CVD (1) • credit an example explained (1)	**IGNORE** non-dietary factors **IGNORE** reliability / accuracy **ACCEPT** {increase risk / decrease risk} in correct context e.g. high salt causes high blood pressure high fibre reduces cholesterol absorption	**(3)**

Question number	Answer	Additional guidance	Mark
(b)(iii)	An explanation that includes the following points: • because diet affects a number of risk factors (1) • credit example of change in diet and the risk factor it reduces (1) • credit a second example of change in diet and the risk factor it reduces (1)	**IGNORE** non-dietary examples e.g. salt intake can be reduced to lower blood pressure {saturated / animal} fats can be reduced to reduce {cholesterol levels / atheroma formation} unsaturated fats can be increased to reduce {cholesterol levels / atheroma formation}	(2)

Q20.

Question number	Answer	Additional guidance	Mark
(a)(i)	An answer that includes three of the following points: • (in general) people's perceptions of risks are lower than the actual risks (except being overweight) (1) • people seem to have a realistic perception of the risk of {smoking / being overweight} (1) • overweight is the most common risk factor / smoking is the least common risk factor (1)	**ACCEPT** converse that actual risks are higher (in general) (in general) people underestimate their risks **ACCEPT** perception and actual risks are very close **IGNORE** perceived risk is lower that actual risk for overweight **ACCEPT** actual risk of high blood pressure and cholesterol are the same **IGNORE** the most number of people are overweight / least number of people smoke	(2)

Question number	Answer	Additional guidance	Mark
(a)(ii)	An explanation that includes three of the following points: • large group of people (1) • sample size is large for {repeatability / reproducibility} (1) • people should not know if they have underlying health risks (before being interviewed) (1) • no known health risks for validity / otherwise it is not a perception that is being studied (1)	**NB** mp 2, 4 and 6 can only be awarded if mp 1, 3 and 5 have been awarded, respectively **ACCEPT** large sample size / more people **ACCEPT** to allow for a statistical analysis / description of statistical analysis e.g. SD calculated **IGNORE** accurate / precise / valid / reliable **ACCEPT** named example e.g. family history should not be on medication for CVD	**(3)**
	• people should have some knowledge of CVD (1) • some knowledge for validity / to reduce the number of guesses / to make an informed decision (1)		

Question number	Answer	Additional guidance	Mark
(a)(iii)	An explanation that includes three of the following points: • lifestyle can be modified (to reduce the risk / slow down progression) (1) • they could have a {blood / health} test (to assess the risk / check on the progression) (1) • medication can be {prescribed / taken} (to reduce the risk / slow down progression) (1) • if perception is greater than actual, an unnecessary change may be made (1)	**ACCEPT** converse i.e. what a person would not do if they underestimated the risk for mp 1, 2 and 3 **ACCEPT** if people know they are at risk then they can do something about it **ACCEPT** a described change in a named example **ACCEPT** named example **ACCEPT** named example of a change may cause stress	**(3)**

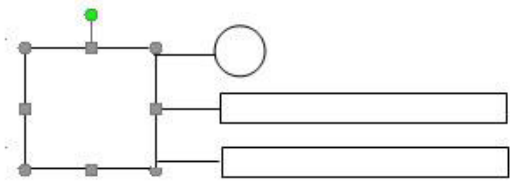
Question number	Answer	Additional guidance	Mark
(b)(i)	• points added up (1) • 8 (%) (1)	(-3 + 11 + 9 + 2) 19 Bald answer = 2 marks (11+9+ 2=22) 17(%) = 1 mark	**(2)**

Question number	Answer	Additional guidance	Mark
(b)(ii)	An explanation that includes two of the following points: • stop smoking as this would reduce {damage to the endothelial lining / lower blood pressure} (1) • reduce {cholesterol / saturated fats} in the diet so less to build up the {plaque / atheroma} (in the arteries) (1) • reduce {salt intake / stressful activities} as this would lower blood pressure (1)	**ACCEPT** the converse throughout for what would happen if the changes were not made **ACCEPT** increase antioxidants to reduce free radicals generated by smoking **ACCEPT** atherosclerosis increase in fibre to reduce absorption of cholesterol **ACCEPT** increase exercise / consume less caffeine	**(2)**

Question number	Answer	Mark
(b)(iii)	The only correct answer is **D**, antihypertensives and statins ***A*** *is incorrect because anticoagulants do not reduce blood pressure or blood cholesterol levels* ***B*** *is incorrect because anticoagulants do not reduce blood pressure or blood cholesterol levels* ***C*** *is incorrect because platelet inhibitors do not reduce blood pressure or blood cholesterol levels*	**(1)**

Question number	Answer	Additional guidance	Mark
(b)(iv)	An answer that includes two of the following points: • other factors are risk factors that have not been included (1) • the {cholesterol levels / blood pressure} may have to be estimated (1) • does not include {the number of cigarettes smoked / ex smoker} (1)	**ACCEPT** named factor e.g. body mass, activity levels, diabetic, genetic predisposition, passive smoking **IGNORE** sex / gender **ACCEPT** does not include {HDL / LDL:HDL} / diastolic B P **IGNORE** not accurate **IGNORE** under estimates / lying / passive smoking	**(2)**

Q21.

Question number	Answer	Additional guidance	Mark
(a)(i)	A diagram that makes reference to the following points: • one glycerol (squarish / labelled), two fatty acids (rectangular / labelled), one phosphate and three bonds shown (1) • all components drawn together correctly (1)	 ecf if: {one / three} fatty acids drawn attached to glycerol but rest correct glycerol missing but two fatty acids attached to head with bonds bonds missing but all four components are touching correctly	(2)

Question number	Answer	Mark
(a)(ii)	**The only correct answer is A** (ester) B is incorrect because glycosidic bonds are found in carbohydrates C is incorrect because there are no hydrogen bonds in phospholipids D is incorrect because peptide bonds are found in proteins	(1)

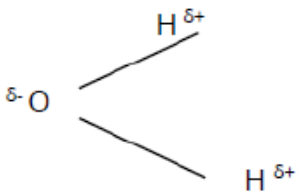
Question number	Answer	Mark
(b)(i)	**The only correct answer is B** (by diffusion) A is incorrect because active transport moves polar molecules C is incorrect because nonpolar molecules can diffuse through the nonpolar fatty acids D is incorrect because only water moves by osmosis	(1)

Question number	Answer	Mark
(b)(ii)	**The only correct answer is B** (one) A is incorrect because the second statement is the only correct one C is incorrect because the second statement is the only correct one D is incorrect because the second statement is the only correct one	(1)

Q22.

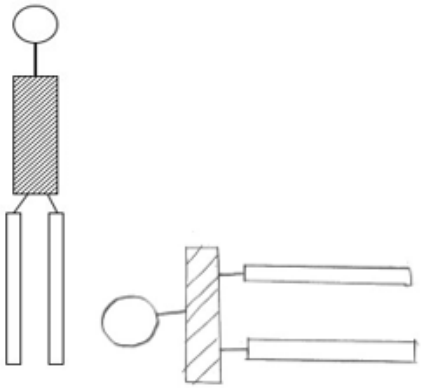
Question number	Answer	Additional guidance	Mark
(a)	An explanation that includes the following points: • because it shows that it is {made of two layers of phospholipid / abilayer} (1) • the size of a phospholipid is in the range 2.05 nm to 2.65 nm (1) • therefore the width of the membrane (5 nm) is within a bilayerrange (of 4.1 nm to 5.3 nm) (1)	**Accept** it shows two layers of phosphate heads separated by a band of lipids	(3)

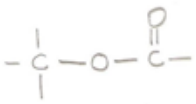
Question number	Answer	Additional guidance	Mark
(b)	An explanation that includes three of the following points: • cholesterol is a non-polar molecule (1) • fatty acid tails are non-polar (1) • cholesterol will be located within the {fatty acid tails / non-polarpart} of membrane (1) • OH group will be located near the phosphate heads (1)	**Accept** hydrophobic for non-polar inall points Accept {hydrocarbon tail / hydrocarbonrings} are non-polar	(3)

Question number	Answer	Additional guidance	Mark
(c)(i)	A description that includes the following points: • {small / weak / delta / partial} positive charge on hydrogen (1) • {small / weak / delta / partial} negative charge on oxygen (1)	Accept both points from a diagram 	(2)

Question number	Answer	Additional guidance	Mark
(c)(ii)	An explanation that includes the following points: • water is small enough to move by {osmosis / diffusion} (betweenthe phospholipids) (1) • steroid (is non-polar so) can diffuse through the {membrane / phospholipids} (1) • glucose (is polar so) passes through {protein channels / carrierproteins / by facilitated diffusion} (1) • ions (are polar so) pass through {protein channels / carrier proteins / by facilitated diffusion / active transport} (1)	**Accept** description of water movingthrough {protein channels / aquaporins} **Accept** steroid is not repelled by fattyacid tails **Accept** movement by active transport **Accept** ions are repelled by fatty acidtails so cannot get through membrane	(4)

Q23.

Question number	Answer	Additional guidance	Mark
(a)(i)	A diagram that includes the following points: • one glycerol (shaded / labelled), two fatty acids (not shaded / labelled), one phosphate and three bonds shown (1) • all components drawn together correctly (1)	 ecf if: {one / three} fatty acids drawn attached to glycerol but rest correct glycerol missing but fatty acids attached to head with bonds bonds missing but all four components are touching correctly {all shaded / nothing shaded} with no labels	(2)

Question number	Answer	Mark
(a)(ii)	 The only correct answer is **C,** ***A** is incorrect because it is not an ester bond* ***B** is incorrect because it is not an ester bond* ***D** is incorrect because it is not an ester bond*	**(1)**

Question number	Answer	Additional guidance	Mark
(b)(i)	An explanation that includes two of the following points: • because {phospholipids / molecules} have more (heat / kinetic) energy (1) • because {forces / interactions} between {fatty acid chains / phospholipids} break (1) • therefore <u>phospholipids</u> can move around (within the membrane) / phospholipid bilayer} more (1)	**IGNORE** proteins **ACCEPT** bonds break bonds between {fatty acids and cholesterol / phospholipids} Van der waals forces	**(2)**

Question number	Answer	Mark
(b)(ii)	The only correct answer is **C** **Has double bonds between two carbons:** yes **Number of hydrogens:** fewer than the saturated fatty acid ***A** is incorrect because unsaturated fatty acids have double bonds between carbons* ***B** is incorrect because unsaturated fatty acids have double bonds between carbons* ***D** is incorrect because unsaturated fatty acids have fewer hydrogen*	**(1)**

Question number	Answer	Additional guidance	Mark
(b)(iii)	An explanation that includes the following points: • cholesterol interacts with {phospholipids / fatty acids} (1) • (if less cholesterol) movement of <u>phospholipids</u> no longer restricted (by interaction with cholesterol) (1)	**NB** we are not looking for the idea that cholesterol is acting as a barrier or taking up space **ACCEPT** bonds **ACCEPT** so <u>phospholipids</u> can move around more	(2)

Question number	Answer	Additional guidance	Mark
(b)(iv)	• will require less (kinetic) energy to move / because there are fewer interactions (with {other fatty acids / phospholipids / cholesterol}) (1)	**ACCEPT** bonds converse for longer chains	(1)

Question number	Answer	Additional guidance	Mark
(c)(i)	An answer that includes the following points: • convert saturated fatty acids into unsaturated fatty acids (1) • convert long side chains into shorter ones (1)	**ACCEPT** become unsaturated / increase in unsaturated / decrease in saturated fats **ACCEPT** become shorter	(2)

Question number	Answer	Additional guidance	Mark
(c)(ii)	An answer that includes two of the following points: • to maintain the fluidity of the membrane (1) • so that membrane can change shape (1) • so that fusion of membranes can occur (1) • so that substances can continue to move across membrane (1)	**ACCEPT** otherwise the fluidity will decrease **ACCEPT** named example e.g phagocytosis, endocytosis, exocytosis, red blood cells, formation of vesicles **ACCEPT** named example e.g. of nuclei (during fertilisation) fusion of vesicles **ACCEPT** named substance	**(2)**

Q24.

Question number	Answer	Additional guidance	Mark
(a)(i)	A description that includes three of the following points: • fibrous protein (1) • (protein) composed of {three polypeptide chains / three-stranded / triple} helix (1) • held by hydrogen bonds (between the chains) (1) • credit details of the chains (1)	e.g every third amino acid is a glycine, repeating sequences of amino acids, high content of {glycine / proline / hydroxyproline}	**(3)**

Question number	Answer	Additional guidance	Mark
(a)(ii)	An explanation that includes the following points: • gives (the wall) (tensile) strength (1) • so that the aorta {does not get damaged by / can withstand} pressure (of the blood leaving the heart) (1)	**IGNORE** refs to elastic properties and recoil **IGNORE** prevents aorta from collapsing	**(2)**

Question number	Answer	Additional guidance	Mark
* **(b)**	Indicative content: Graph 1 • older male monkeys have more stiffness than younger males (D) • older female monkeys have more stiffness than younger females (D) • older males have more stiffness than older females (D) • probably significant as error bars do not overlap (C) • not much difference in stiffness between younger males and females (D) • as error bars overlap (C) • age increases aortic stiffness in both males and females (C) • age has a greater effect on aortic stiffness in males than females (C) Graph 2 • density of collagen decreases slightly with age (D) • males of all ages have (slightly) more collagen that females (C) • probably not significant as error bars overlap (C) • neither age nor sex affects density of collagen (C) • changes in stiffness do not appear to be related to the density of collagen (C) Graph 3 • higher type 1 in younger monkeys than older ones (D)	**Level 1** 1 mark = description made from one graph (D) 2 marks = descriptions made from two graphs (D) **Level 2** 3 marks = plus one conclusion made (C) 4 marks = plus two conclusions made (C) **Level 3** 5 marks = two conclusions and comments on the other two graphs 6 marks = three conclusions that includes the asterisked conclusion (C*) and comments on the other two graphs **Description = comparison of one variable** **Conclusion = summary statement that includes both age and sex**	**(6)**

	• more type 1 in females than males at each age (D) • no error bars shown to judge significance (C) Graph 4 • more type 8 in older male monkeys (D) • may not be a difference in type 8 between older and younger females (D) • no error bars to judge significance (C) • the type of collagen appears to determine stiffness (C) • stiffness associated with decrease in type 1 and increase in type 8 (C*)	**interpretation of error bar and significance of data – not reliability** **links between 2 graphs**	

Q25.

Question number	Answer	Additional guidance	Mark
(a)	A calculation in which: • actual height of elephant • how many times taller the elephant is than the mouse	Example of calculation: 4.5 ÷ 0.02 = 225 / 230 / 235 (cm) 75 / 76.67 / 76.7 / 77 / 78 / 78.3 / 78.33 **IGNORE** units	**(2)**

Question number	Answer	Additional guidance	Mark
(b)	A description that includes the following points: • attachment of lungs to {chest cavity / diaphragm} {increases volume / decreases pressure} (1) Any **two** from: • alveoli provide a large surface area for faster diffusion (1)	**ACCEPT** to {take in / hold} large volume of air **ACCEPT** thin walls	(3)
	• alveoli formed from {one cell layer / flattened / squamous} epithelial cells for small diffusion distance (1) • concentration gradient maintained by {ventilation / blood flow / good blood supply} (1)	**ACCEPT** large network of capillaries	

Question number	Answer	Mark
* (c)	Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material indicated as relevant. Additional content included in the response must be scientific and relevant. **Indicative content** • oxygen dissociation curve for the mouse is shifted to the right • mouse haemoglobin has a lower affinity for oxygen than the elephant haemoglobin • therefore haemoglobin can supply oxygen to the tissues at lower pp of oxygen • because the rate of respiration in the mouse is higher • a mouse has a higher mass-specific metabolic rate than the elephant • because the mouse loses more body heat • because it has a larger surface area to volume ratio • because the mouse is more active • because it has to escape predators • the rate of respiration of the mouse is going to be	(6)

	greater than the elephant • therefore pp of oxygen in mouse tissues will be lower • therefore haemoglobin needs to be releasing oxygen • when blood cannot supply oxygen at a fast enough rate	

Level	Marks	
	0	No awardable content.
1	1-2	An explanation may be attempted but with limited interpretation or analysis of the scientific information and with a focus on mainly just one piece of scientific information. The explanation will contain basic information, with some attempt made to link knowledge and understanding to the given context.
2	3-4	An explanation will be given, with occasional evidence of analysis, interpretation and/or evaluation of both pieces of scientific information. The explanation shows some linkages and lines of scientific reasoning with some structure.
3	5-6	An explanation is made that is supported throughout by sustained application of relevant evidence of analysis, interpretation and/or evaluation of both pieces of scientific information. The explanation shows a well-developed and sustained line of scientific reasoning, which is clear and logically structured.

Q26.

Question number	Answer	Additional guidance	Mark
(a)	<table><tr><th>Polymer</th><th>Monomer</th><th>Elements in monomer</th><th>Type of bond</th></tr><tr><td>Carbohydrates</td><td>monosaccharide</td><td>carbon, hydrogen and oxygen</td><td>glycosidic</td></tr><tr><td>Nucleic acids</td><td>(mono)nucleotide</td><td>carbon, hydrogen, oxygen, phosphorus and nitrogen</td><td>phosphodiester</td></tr><tr><td>Proteins</td><td>amino acid</td><td>carbon, hydrogen, oxygen, (sulfur) and nitrogen</td><td>peptide</td></tr></table>	**ACCEPT** chemical symbols C, H, O **ACCEPT** chemical symbols C, H, O, **N**, S	**(4)**

Question number	Answer	Additional guidance	Mark
(b)	A description that includes three of the following points: **TWO FROM** • (one) glycerol and three fatty acids (1) • joined by {condensation reaction / ester bond} (1) • by enzymes (1) **AND** • (at least) one fatty acid is {unsaturated / has a CC double bond}(1)		**(3)**

Q27.

Question number	Answer	Additional guidance	Mark
(a)	An answer that includes the following points: • high salt intake increases the {hazard ratio / risk of death} for all causes of death (1) • high salt intake increases the {hazard ratio / risk of death} the most for CAD (1)	Allow piecing together for mp1 Allow CHD for CAD throughout Both marking points must be about increased {risk of death / hazard ratio} not increased risk of getting disease ACCEPT a description for all causes of death eg CAD, CVD and all other causes ACCEPT from a comparative calculation. ACCEPT high salt intake has the {hazard ratio / risk of death} for CAD	(2)

Question number	Answer	Additional guidance	Mark
(b)(i)	An explanation that includes the following points: • age and smoking both increase the {risk of death / hazard ratio} (1) • credit an explained example (1) • the study would not be {valid / reproducible / repeatable} if either or both of these factors were not controlled (1)	Piece together for mp1 This can be for either factor e.g. smoking increases blood pressure, with increasing age arteries lose elasticity IGNORE references to reliability	(3)

Question number	Answer	Additional guidance	Mark
(b)(ii)	An answer that includes two of the following points: • gender / sex (1) • blood pressure (1) • blood cholesterol levels (1) • level of exercise / activity (1)	ACCEPT; Obesity / BMI Level of {fat /cholesterol / sugar} in diet Type 2 diabetes Stress levels Ratio of LDL to HDL Genetic factors Level of alcohol consumption IGNORE: diet / unhealthy diet (unqualified) / lifestyle / exercise (unqualified) / level of salt in diet	(2)

Question number	Answer	Additional guidance	Mark
(c)	An answer that includes the following points: • needed a means of comparison (1) • the (increased) risk of death due to high salt intake is compared to the risk of death (from a low salt intake) (1)	Accept reference point / baseline IGNORE control If they get MP 2 will also get MP 1 Risk of death is eq. to hazard ratio	(2)

Question number	Answer	Additional guidance	Mark
(d)(i)	• A measure of the (linear) relationship between 2 (quantitative) {variables / factors} (1)	ACCEPT a change in one variable is reflected by a change in another variable ACCEPT link between two variables ACCEPT a technique to show {if / how strongly} pairs of variables are related ACCEPT positive / negative correlation described eg as one variable increases another increases, or an example of this DO NOT ACCEPT {causes / is caused by / leads to}	(1)

Question number	Answer	Additional guidance	Mark
(d)(ii)	An answer that includes the following points: • {difficult / impossible} to control all the {variables / risk factors} (1) • unreliable estimate of risk factors e.g. number of cigarettes smoked (1)	ACCEPT too many {factors / variables} to control IGNORE examples of variables ACCEPT no clear definition of {low / high} salt intake ACCEPT people may lie about data / self-reporting not reliable IGNORE reference to low sample size	(2)

Q28.

Question number	Answer	Additional guidance	Mark
* (a)	Indicative content: **Graph:** • HDL involved in removal of LDL from blood by liver (SE) • not just level of HDL that influences risk (D) • higher levels of LDL increase risk (D) • risk decreases with increase in HDL (D) • HDL results in uptake of cholesterol by liver (SE) • LDL forms the plaque (SE) • risk is a {combination / ratio} of HDL and LDL levels (SE) • the higher the HDL:LDL ratio the lower the risk (SE) **Other risk factors:** • the more cholesterol in the blood the more cholesterol to build up the atheroma (SE) • high blood pressure increases chance of damage to endothelial celllayer (SE) • smoking causes high blood pressure (SE) • smoking produces CO that binds to haemoglobin putting strain on heart (SE) • high salt in diet causes high blood pressure (SE) • obesity increases risk because of strain put on heart (SE) • age increases risk because affects heart muscle (SE) • genetic predisposition affects risk (SE) **Extended explanation:** • damage to the endothelial layer results in an inflammatory response • damage to the endothelial layer causes {build up of cholesterol / plaque} • plaque causes {more cholesterol to build up / blood clot to form • coronary artery becomes blocked • resulting in less oxygen reaching heart {cells / tissues} • heart attack results as heart cells cannot respire	**Level 1:** **1 mark** = 1 {risk factor named / comment on graph} **2 marks** = 2 {risk factor named / comment on graph} **Or** outline of how cholesterol causes CVD ierecall of the story **Level 2:** **3 marks** = 2 simple explanations **4 marks** = 3 simple explanations **Level 3:** **5 marks** = as for 4 marks + 1 point from extended explanation **6 marks** = as for 5 marks + 2 points from extended explanation	**(6)**

Question number	Answer	Additional guidance	Mark
(b)(i)	An answer that includes three of the following points, one of which mustbe a similarity for full marks: Similarities • both contain ApoA-1(1) • both contain a phospholipid layer (1) Differences • altered HDL is larger (1) • altered HDL has more CE (1) • altered HDL has fewer (long-chain polyunsaturated) PC (1)	**ACCEPT** converse throughout **DO NOT PIECE TOGETHER** **ACCEPT** altered HDL has no {ApoM / S1P / RBP4/ CRABP1}	(3)

Question number	Answer	Additional guidance	Mark
(b)(ii)	An explanation that includes the following points: • less reduction (in the number) of free radicals (1) • therefore {cell damage / damage to lining of blood vessels /oxidative stress} will not be reduced (1) • therefore formation of {plaque / atheroma} will not be reduced(1)	**ACCEPT** free radicals will not be {reduced / neutralised} **IGNORE** free radicals won't increase **ACCEPT** {cell damage / oxidative stress}will occur **ACCEPT** more plaques **NB** max 1 mark if not in context ofreduced antioxidant properties	(3)

Q29.

Question number	Answer	Additional guidance	Mark
(a)(i)	• 9 : 1	**ACCEPT** 6 : 1 / 5 : 1	(1)

Question number	Answer	Additional guidance	Mark
(a)(ii)	A description that includes the following points: • will not have any effect on the total membrane phospholipids (1) • the inner layer will have a relatively higher content of the other phospholipids / the outer layer will have a relatively lower content of the other phospholipids (1)	**ACCEPT** increase phospholipid content in outer layer and decrease content in inner layer	(2)

Question number	Answer	Additional guidance	Mark
(a)(iii)	A description that includes the following points: • will alter membrane {properties / permeability / fluidity} (1) • so that platelets will release thromboplastin (1) • thromboplastin is {an enzyme / a catalyst} (1) • that converts prothrombin into thrombin (1)	**NB** thromboplastin catalyses prothrombin into thrombin = 2 marks	(4)

Question number	Answer	Additional guidance	Mark
(b)	An explanation that includes the following points: • thrombin is an <u>enzyme</u> (1) • because the inhibitor will change the shape of the active site (of thrombin) (1) • therefore thrombin cannot bind to fibrinogen (1) • therefore {less / no} fibrinogen will be converted into fibrin (1) • therefore there is {less / no} {mesh / fibrin / fibres} to trap {blood cells / platelets} (1)	**ACCEPT** inhibitor blocks the active site / fewer active sits available **ACCEPT** {less / no} thrombin to bind to fibrinogen / fewer collisions / fewer enzyme substrate complexes formed **ACCEPT** slower conversion	(4)

Q30.

Question number	Answer	Additional guidance	Mark
(a)(i)	An answer that includes two of the following points: • (46 / 48 /94 patients is) not a very large sample size (1) • {18 countries / variety of people} probably means that othervariables not taken into account (1) • but AHP is a very rare disorder so not many patients available (1)	**IGNORE** refs to reliability, validity **ACCEPT** in the context of 'these' people named variable e.g. lifestyle,diet, other diseases **IGNORE** sex / age	(2)

Question number	Answer	Additional guidance	Mark
(a)(ii)	• mass of drug needed for that patient (1) • {0.8 / 0.85 / 0.847} cm^3 (1) **OR** • volume of drug to give 2.5 mg (1) • {0.8 / 0.85 / 0.847} cm^3 (1)	**Example of calculation:** 64 × 2.5 / 160 **IGNORE** units **ACCEPT** cc / mls 2.5 ÷ 189 / 0.0132275 **ACCEPT** cc / mls **NB** Bald answer of {0.8 / 0.85 / 0.847} cm^3 = 2 marks Bald answer of {160 / 0.01 / 0.013 / 0.132} = 1 mark	(2)

Question number	Answer	Additional guidance	Mark
(a)(iii)	• 27% of 48 calculated (1) • 12 / 13 (1)	**Example of calculation:** 27 × 48 ÷ 100 / 12.96 **ACCEPT** 25 as an ecf for 1 mark (27% of94)	(2)

Question number	Answer	Additional guidance	Mark
(b)(i)	G U C U U U C	All correct = 2 marks One wrong base given OR one wrongbase given consistently = 1 mark	(2)

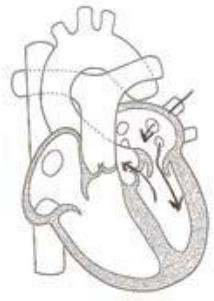
Question number	Answer	Additional guidance	Mark
(b)(ii)	A description that includes three of the following points: • phosphodiester bonds between (adjacent) {ribose and phosphate / (mono)nucleotides} (in each strand) (1) • covalent bonds attaching base to a {ribose (sugar) / sugar} (1) • {hydrogen / H} bonds between (complementary) bases (holdingtwo strands together) (1) • {hydrogen / H} bonds holding double helix together (1)	**ACCEPT** sugar **DO NOT ACCEPT** deoxyribose **ACCEPT** between {C and G / U and A} **DO NOT ACCEPT** between {T and A / other incorrect base pairs} **IGNORE** incorrect number of H bonds	(3)

Question number	Answer	Additional guidance	Mark
(b)(iii)	An answer that includes three of the following points: • {no / less / affected} translation of the mRNA (1) • (altered mRNA) affects shape of {protein / active site} (1) • {no / less / slower} haem production (1) • {no / less} (toxic) porphyrin (1)	**ACCEPT** a description of translation**DO NOT ACCEPT** transcription / description of transcription **ACCEPT** no {protein / enzyme} formed	(3)

Q31.

Question number	Answer	Additional guidance	Mark
(a)	An explanation that includes the following points: • because (X / coronary artery) carries {oxygen / oxygenated blood} to the heart {cells / muscle / tissue} (1) • for {(aerobic) respiration / metabolism} (in the heart) (1) • aorta is closest blood vessel carrying oxygenated blood (1)	**IGNORE** glucose / nutrients **ACCEPT** aorta supplies X blood with <u>high levels of</u> oxygen	(3)

Question number	Answer	Additional guidance	Mark
(b)(i)	An explanation that includes the following points: • diastole / atrial systole / ventricular diastole (1) • because the {atrioventricular / AV / bicuspid / tricuspid} valves are open (1)	**ACCEPT** semi lunar valves are closed	(2)

Question number	Answer	Additional guidance	Mark
(b)(ii)	An answer that includes the following points: • arrows shown on left-hand side of heart (only) (1) • arrows pointing in correct direction (1) • arrows shown entering atrium through pulmonary vein and leaving through the aorta (1)	<u>example of diagram</u> 	(3)

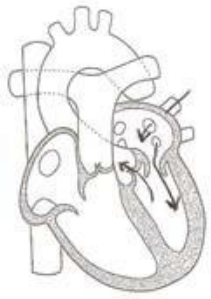
Question number	Answer	Additional guidance	Mark
(c)	An explanation that includes the following points: • increase in diameter due to {high pressure / large volume / surge} of blood (leaving the left ventricle) (1) • therefore expansion of elastic fibres (1) • decrease in diameter due to recoil (of elastic fibres) (1)	**ACCEPT** to reduce pressure of blood	(3)

Mark Scheme

Q1.

Question number	Answer	Additional guidance	Mark
(a)	An explanation that includes the following points: • because (X / coronary artery) carries {oxygen / oxygenated blood} to the heart {cells / muscle / tissue} (1) • for {(aerobic) respiration / metabolism} (in the heart) (1) • aorta is closest blood vessel carrying oxygenated blood (1)	**IGNORE** glucose / nutrients **ACCEPT** aorta supplies X blood with <u>high levels of</u> oxygen	(3)

Question number	Answer	Additional guidance	Mark
(b)(i)	An explanation that includes the following points: • diastole / atrial systole / ventricular diastole (1) • because the {atrioventricular / AV / bicuspid / tricuspid} valves are open (1)	**ACCEPT** semi lunar valves are closed	(2)

Question number	Answer	Additional guidance	Mark
(b)(ii)	An answer that includes the following points: • arrows shown on left-hand side of heart (only) (1) • arrows pointing in correct direction (1) • arrows shown entering atrium through pulmonary vein and leaving through the aorta (1)	<u>example of diagram</u> 	(3)

Question number	Answer	Additional guidance	Mark
(c)	An explanation that includes the following points: • increase in diameter due to {high pressure / large volume / surge} of blood (leaving the left ventricle) (1) • therefore expansion of elastic fibres (1) • decrease in diameter due to recoil (of elastic fibres) (1)	**ACCEPT** to reduce pressure of blood	(3)

Q2.

Question number	Answer	Mark
(a)(i)	A α glucose molecules join together by a condensation reaction B is incorrect because bonds form by condensation reactions C is incorrect because α glucose molecules join together D is incorrect because α glucose molecules join together by condensation reactions	(1)

Question number	Answer	Additional guidance	Mark
(a)(ii)	glycosidic (bond / link)	**Accept covalent** (bond) Ignore any numbers eg 1,4 glycosidic	(1)

Question number	Answer	Additional guidance	Mark
(a)(iii)	An explanation that includes the following points: • {polymer of glucose / polysaccharide} therefore has a highenergy content (1) • {large molecule / polymer / polysaccharide} therefore {insoluble / has no osmotic effect} (1) • branched structure therefore {broken down / energy released /hydrolysis is} faster (1) • compact therefore has a high energy density (1)	**Accept** {large molecule / polymer} sodoes not diffuse **Accept** branched so can be broken down from several points at the sametime **Ignore** easier to break down **Accept** compact so {high energy stored in a small space / many glucosemolecules stored in a small space}	(3)

Question number	Answer	Additional guidance	Mark
(b)(i)	Answer that includes the following points: • estimate of number of babies with GSD (1) • estimate of mean number of babies with Von Gierke disease (1)	Accept any value between 150 and 200 Accept any value between 38 and 50 Accept non-whole numbers eg 38.5 Correct answer with no working (2)	(2)

Question number	Answer	Additional guidance	Mark
(b)(ii)	An answer that includes the following points: • because allele for Von Gierke disease may be recessive (1) • therefore (both) parents may be heterozygous (1) • because individuals with Von Gierke disease are less likely to have babies (1)	**Accept** disease caused by tworecessive alleles **Do not accept** {gene / disease} is recessive **Accept** parents may be carriers (of theallele) **Ignore** mutation	(2)

Q3.

Question number	Answer	Additional guidance	Mark
(a)(i)	• bind to an {oxygen (molecule) / O_2} (1)	**Do not accept** O **Ignore** binding to carbon dioxide	(1)

Question number	Answer	Additional guidance	Mark
(a)(ii)	An explanation that includes the following points: • must have R groups that are {polar / hydrophilic} (1) • so that the {haemoglobin / protein} {can dissolve in (red bloodcell) cytoplasm / is soluble in water} (1)	**Accept** they are {polar / hydrophilic} **Ignore** dissolve in blood / plasma	(2)

Question number	Answer	Additional guidance	Mark
(b)(i)	An explanation that includes two of the following points: • oxygen dissociation curve for {maternal / adult} Hb is shifted tothe right of curve for fetal Hb (1) • because oxygen needs to diffuse from {maternal / adult} bloodinto fetal blood (1) • therefore fetal haemoglobin needs to have a higher affinity foroxygen (1)	Accept shifted down for shifted to theright Accept converse Accept converse Accept because oxygen needs to dissociate from maternal haemoglobinand bind to fetal haemoglobin	(2)

Question number	Answer	Additional guidance	Mark
(b)(ii)	An answer that includes the following points: • total number of amino acids in haemoglobin calculated (1) • percentage of amino acids that are different calculated (1)	574 / 287 14 / 13.6 / 13.59 Correct answer with no working (2)	(2)

Q4.

Question number	Answer	Mark
(a)(i)	**The only correct answer is B.** ***A*** *is incorrect because it should be* $C_n H_{2n} O_n$ ***C*** *is incorrect because it should be* $C_n H_{2n} O_n$ ***D*** *is incorrect because it should* $C_n H_{2n} O_n$	(1)

Question number	Answer	Additional guidance	Mark
(a)(ii)	• condensation (reaction)	**IGNORE** polymerisation	(1)

Question number	Answer	Mark
(b)(i)	**The only correct answer is C.** ***A*** *is incorrect because amylose is a polysaccharide found in plants.* ***B*** *is incorrect because galactose is a monosaccharide.* ***D*** *is incorrect because sucrose is found in plants.*	**(1)**

Question number	Answer	Mark
(b)(ii)	**The only correct answer is C.** ***A*** *is incorrect because amylopectin is a polysaccharide.* ***B*** *is incorrect because galactose is a monosaccharide.* ***D*** *is incorrect because sucrose contains fructose.*	**(1)**

Question number	Answer	Mark
(b)(iii)	**The only correct answer is C.** ***A*** *is incorrect because amylose is found in plants.* ***B*** *is incorrect because fructose is a disaccharide found in plants.* ***D*** *is incorrect because sucrose is a disaccharide found in plants.*	**(1)**

Question number	Answer	Mark
(b)(iv)	**The only correct answer is B.** ***A*** *is incorrect because amylose is not branched.* ***C*** *is incorrect because fructose is a monosaccharide.* ***D*** *is incorrect because maltose is a disaccharide.*	**(1)**

Q5.

Question number	Answer	Mark
(a)	**The only correct answer is B.** ***A*** *is incorrect because anticoagulants prevent blood clotting.* ***C*** *is incorrect because platelet inhibitors reduce blood clotting.* ***D*** *is incorrect because statins reduce cholesterol levels.*	**(1)**

Question number	Answer	Additional guidance	Mark
(b)	An explanation that includes the following points: • because there is a link between (total) blood cholesterol levels and heart disease (1) • because {HDL is not thought to be a risk factor / LDL is associated with the development of heart disease / the {ratio / balance} of LDL : HDL determines the level of risk} (1)	**ACCEPT** CHD / CVD / atherosclerosis for heart disease throughout **ACCEPT** causes / leads / is a risk factor / correlation **ACCEPT** HDL reduces risk / HDL needed to get the LDL	(2)

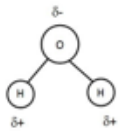
Question number	Answer	Additional guidance	Mark
(c)	An explanation that includes the following points: • (10 year CHD risk) increases (1) • because smoking {increases blood pressure / increases heart rate / damages (endothelial) lining of arteries} (1) • damage to lining results in {atheroma / plaque} building up OR {high blood pressure / increase in heart rate} makes the heart work harder (1)	**ACCEPT** CVD / CHD / heart disease / atherosclerosis / throughout **ACCEPT** increases the chance of blood clotting / makes platelets sticky **ACCEPT** blood clots can block arteries	(3)

Question number	Answer		Mark
(d)(i)	• salt intake / fibre intake / alcohol intake / (body) mass / BMI / obesity / hip waist ratio / level of exercise / stress levels / family history / genetic factors / taking statins / diastolic blood pressure	**IGNORE** LDL / antihypertensives / blood pressure	(1)

Question number	Answer	Additional guidance	Mark
(d)(ii)	• {salt / low fibre / alcohol / high BMI / obesity / little exercise / stress / family history / genetic factors / high diastolic blood pressure} increase the risk value OR {low salt / high fibre / low alcohol / suitable mass / exercise / low stress levels / taking statins / low diastolic blood pressure} decrease the risk value	**ACCEPT** if answer given in (i)	(1)

Question number	Answer	Additional guidance	Mark
(d)(iii)	An explanation that includes two of the following points: • because there are other (risk) factors not included (1) • because people will underestimate {their mass / how much they smoke} (1) • because {total cholesterol / HDL / blood pressure} might be an estimate (1)	**ACCEPT** named factor but not those shown on the risk calculator **ACCEPT** {total cholesterol / HDL / blood pressure} are variable are not aware that they have diabetes	**(2)**

Q6.

Question number	Answer	Additional guidance	Mark
(a)	A diagram that includes the following: • 2 hydrogens joined to an oxygen (by covalent bonds) (1) • the charge distribution (1)	  e.g. lines, overlapping circles, shared electrons	(2)

Question number	Answer	Additional guidance	Mark
(b)(i)	A description that includes the following points: • for F increase in temperature increases solubility (1) • for G increase in temperature increases up to 30°C and then decreases the solubility (1) • for H temperature has no effect (on solubility) (1)	ACCEPT 'It' for solubility throughout ACCEPT positive correlation Do not piece together ACCEPT solubility {remains constant / does not change} with an increase in temperature	(3)

Question number	Answer	Mark
(b)(ii)	The only correct answer is B 1.67 A is incorrect because 50 ÷ 30 = 1.67 C is incorrect because 50 ÷ 30 = 1.67 D is incorrect because 50 ÷ 30 = 1.67	(1)

Q7.

Question number	Answer	Mark
(a)	**The only correct answer is A** (position R, position P) *B is incorrect because P will have a carboxyl group and R will have an amino group (Q will have a carboxyl group)* *C is incorrect because P will have a carboxyl group and R will have an amino group (Q will have a carboxyl group)* *D is incorrect because P will have a carboxyl group and R will have an amino group (Q will have a carboxyl group)*	**(1)**

Question number	Answer	Additional guidance	Mark
(b)(i)	• 39 / 39.3 / 39.29 (1)		**(1)**

Question number	Answer	Additional guidance	Mark
(b)(ii)	• 0.13 : 1 / 0.1 : 1 / 0.13 / 0.1 (1)	**ACCEPT** 1 : 7.5 / 1 : 8	**(1)**

Question number	Answer	Additional guidance	Mark
(c)	A description that includes the following points: • hydrolysis / using enzymes (1) • of the peptide bonds between P and the connecting chain <u>and</u> R and the connecting chain (1)	**ACCEPT** protease **ACCEPT** of peptide bonds between A chain and connecting region <u>and</u> B chain and connecting region	**(2)**

Question number	Answer	Additional guidance	Mark
(d)	An answer that includes the following points: Similarities : • αlpha glucose (1) • contain C, H and O (only) (1) Differences : • glucose is a monosaccharide and glycogen is a polysaccharide (1) • glycogen has (1-4 / 1-6) glycosidic bonds but glucose does not (1)	**DO NOT PIECE TOGETHER**	**(3)**

Question number	Answer	Mark
* **(e)**	Indicative content: Healthy rats given water • levels of glucose {fell slightly / maintained} (D) • because the healthy rats were producing insulin (E) • so were controlling the blood glucose levels naturally (E) Healthy rats given cinnamon • levels of glucose very slightly lower (D) • as cinnamon was adding to the effect of insulin (CE) OR • levels of glucose very similar (D) • as cinnamon had no (added) effect in healthy rats (CE) Diabetic rats given water • levels of glucose rose (D) • levels of glucose were higher that healthy rats (D) • because diabetic rats had no insulin to control their blood glucose levels (E) Diabetic rats given cinnamon • unhealthy rats given cinnamon had fairly constant levels of glucose (D) • cinnamon lowered blood glucose by moving it into the liver (E) • cinnamon stimulated enzymes to convert glucose into glycogen (E) • so that it could not diffuse back into the blood (E) • levels of glucose were higher than in the healthy rats (D) • because cinnamon not as effective as insulin (CE) • possibly {not absorbed well / worked slowly / did not stimulate so many enzymes} (CE) • fluctuations in levels of glucose (D) • depending on how much glucose is used (E)	**(6)**

			Additional guidance
Level 0	0	No awardable content	
Level 1	1-2	An explanation may be attempted but with limited interpretation or analysis of the scientific information and with a focus on mainly just one piece of scientific information. The explanation will contain basic information, with some attempt made to link knowledge and understanding to the given context.	Simple descriptions of data with no real attempt of an explanation 1 mark = some description of the data 2 marks = detailed description of the data
Level 2	3-4	An explanation will be given, with occasional evidence of analysis, interpretation and/or evaluation of both pieces of scientific information. The explanation shows some linkages and lines of scientific reasoning, with some structure.	Some explanation given using the information given / own knowledge (E) 3 marks = simple explanation of what {cinnamon / insulin} is doing 4 marks = more detailed explanation of how {cinnamon / insulin} decreases glucose level
Level 3	5-6	An explanation is made that is supported throughout by sustained application of relevant evidence of analysis, interpretation and/or evaluation of both pieces of scientific information. The explanation shows a well-developed and sustained line of scientific reasoning, which is clear and logically structured.	Data logically explained with extended use of information provided (CE) 5 marks = plus a comparison made of effectiveness of cinnamon compared to insulin 6 marks = data explained in detail

Q8.

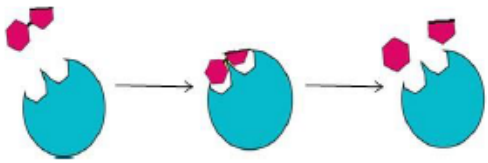
Question number	Answer	Additional guidance	Mark
(a)	An explanation that includes the following points: • because the rate of miscarriage increases with (increase in) age(1) • there is no evidence age is causing the miscarriage (1)	**ACCEPT** directly proportional to eachother it shows that an increase in onevariable is reflected by an increase in the other variable **ACCEPT** no evidence of causation	(2)

Question number	Answer	Additional guidance	Mark
(b)(i)	An explanation that includes the following points: • aneuploidy results in miscarriage because the screened embryosresult in fewer miscarriages (1) • other {factors / named factor} cause miscarriages because {screened embryos / embryos that do not have aneuploidy} aremiscarried (1)	**ACCEPT** converse where appropriate **e.g.** age, mutations, the process of implanting embryos, smoking, alcohol, dietary factors **IGNORE** lifestyle / screening causes miscarriage	(2)

Question number	Answer	Additional guidance	Mark
(b)(ii)	An explanation that includes three of the following points: • because no indication of sample size (1) • because no statistics presented (1) • because no idea how many of the unscreened embryos had aneuploidy (1) • other {lifestyles / factors / named factor} not {taken into account / not shown} (1) • false (negative / positive) results (1)	**ACCEPT** small sample size **IGNORE** age / sex	(3)

Question number	Answer	Additional guidance	Mark
(c)	An answer that includes three of the following points: • (preimplantation) screened embryos still result in miscarriages soraising false hopes (1) • issues surrounding the embryos (that have aneuploidy) (1) • false (positive) results resulting in unnecessary {wastage / destruction} of embryos (1) • other (genetic) defects may be found (1)	**DO NOT ACCEPT** {fetus / baby} e.g. discarding the embryos is unethical **ACCEPT** false (negative) result leads touse of that embryo	(3)

Q9.

Question number	Answer	Mark
(a)(i)	**B**  The only correct answer is **B**. ***A*** *is incorrect because it shows the substrate unchanged* ***C*** *is incorrect because it shows lactose being made not broken down* ***D*** *is incorrect because the two substrates have not been bonded together*	(1)

Question number	Answer	Mark
(a)(ii)	**B** galactose and glucose The only correct answer is **B**. ***A** is incorrect because sucrose is not a monosaccharide* ***C** is incorrect because glucose and fructose are the monomers of sucrose* ***D** is incorrect because sucrose is not a monosaccharide*	(1)

Question number	Answer	Mark
(b)	C reaction without enzyme | Q The only correct answer is **C**. ***A** is incorrect because line P shows the reaction without enzyme* ***B** is incorrect because line P shows the reaction without enzyme* ***D** is incorrect because R is the activation energy with the enzyme not the decrease*	(1)

Question number	Answer	Additional guidance	Mark
(c)(i)	An explanation that includes the following points: • as the concentration (of substrate) increases there are more (substrate) molecules / particles (1) • (therefore) a greater chance of {collisions with active site / enzyme substrate complexes forming} increasing the rate of reaction • {rate/graph} levels off when {all active sites are filled (at any one time) / enzyme is saturated} (1)	ACCEPT converse for mp1 and 2 Piece together ACCEPT substrate concentration is limiting factor in the first part of the graph ACCEPT {greater frequency of collisions / collisions more likely to occur} etc ACCEPT enzyme for active site / "successful collisions" for collisions with active site} IGNORE {more collisions / more enzyme-substrate complexes forming} ACCEPT {rate / graph} levels off {when enzyme becomes rate limiting / as enzyme is limiting factor} IGNORE idea of substrate being used up as reaction proceeds	(2)

Question number	Answer	Additional guidance	Mark
(c)(ii)	An answer that includes the following points: • correct values for V_{max} and K read from the graph (1) • correct answer for values substituted into the formula (1)	V_{max} = 50 K = 1.9 $V = \frac{50 \times 4}{1.9 + 4} = 33.898 / 34$ (ignore units) ACCEPT 33.9 IGNORE 33.90 / 33.89 Correct answer gets 2 marks ecf for mp2 if wrong values read from graph	(2)

Q10.

Question number	Answer	Mark
(a)(i)	C galactose and glucose A is incorrect because lactose consists of glucose and galactose monomers B is incorrect because lactose consists of glucose and galactose monomers D is incorrect because lactose consists of glucose and galactose monomers	(1)

Question number	Answer	Additional guidance	Mark
(a)(ii)	An explanation that includes three of the following points: • lactase is soluble because of its {globular shape / external polarR groups} (1) • (and therefore) lactase collides with lactose (1) • active site of lactase is complementary to the lactose (1) • Formation of enzyme-substrate complex lowers the activationenergy (1)	**Accept** hydrophilic for polar **Accept** active site of lactase binds tolactose / active site allows enzyme-substrate complex to form **Accept** R group interactions break the glycosidic bonds	(3)

Question number	Answer	Additional guidance	Mark
(b)(i)	• {lactase / enzyme} is reusable / milk is not contaminated with {lactase / enzyme} (1)	**Accept** higher enzyme activity	(1)

Question number	Answer	Additional guidance	Mark
(b)(ii)	An explanation that includes four of the following points: • pH {below 5 / above 5} reduces lactase activity (1) • because pH affects the shape of the active site (1) • due to ionisation of the R groups (1) • immobilised lactase is active at wider range of pH values (1) • immobilisation holds the R groups in place so active site does notchange shape (1)	**Accept** pH 5 is the optimum for both enzymes / pH 4-6 is the optimum for both enzymes **Accept** active site denatured by pH **Accept** bonds between R groups are broken	(4)

<table>
<tr><th>Question number</th><th>Answer</th><th>Additional guidance</th><th>Mark</th></tr>
<tr><td>(b)(iii)</td><td>An answer that includes the following points:

• measure the decrease in concentration of lactose over time
• see table for units

OR

• measure the increase in concentration of {glucose / galactose} over time
• see table for units</td><td>Accept measure rate of loss of lactose
Ignore: measure how long it takes for lactose to be fullybroken down

Accept measure rate of production of {glucose /galactose}

Units can be expressed as:
• mass per volume per time
• mass volume^{-1} time^{-1}
• amount per volume per time
• amount volume^{-1} time^{-1}

<table><tr><td>mass</td><td>volume</td><td>time</td></tr><tr><td>g / mg / µg / kg</td><td>cm^{-3} / mm^{-3} / dm^{-3} / litre^{-1}</td><td>s^{-1} / min^{-1} / hour^{-1}</td></tr><tr><td></td><td></td><td></td></tr><tr><td>amount</td><td>volume</td><td>time</td></tr><tr><td>mmol / mol / µmol</td><td>cm^{-3} / mm^{-3} / dm^{-3} / litre^{-1}</td><td>s^{-1} / min^{-1} / hour^{-1}</td></tr></table></td><td>(2)</td></tr>
</table>

<table>
<tr><th>Question number</th><th>Answer</th><th>Additional guidance</th><th>Mark</th></tr>
<tr><td>(c)</td><td>An answer that includes two of the following points:

• mutation (that resulted in CLI) occurred in the {gene / DNA} (of people living in one country) (1)

• people from this country (had children that) stayed in this country(1)

• relatively new mutation so has not had the chance to spread (1)</td><td>Accept limited emigration from this country / reproduction with others from same country

Ignore idea that mutation is causedby drinking milk / not drinking milk</td><td>(2)</td></tr>
</table>

Q11.

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

Question number	Answer	Mark
(a)(ii)	A calculation in which: kJ of energy = mass of lactose in 200 g of milk × energy per gram Example of calculation: 4.9 × 2 × 16 = 156.8 kJ	(1)

Question number	Answer	Additional guidance	Mark
(b)	An answer that includes the following points: similarities: • both polysaccharides / formed from many (alpha) glucose monomers (1) • joined by glycosidic bonds (1) differences: • starch is composed of two polysaccharides, glycogen only one (1) • amylose is a {straight / helical} chain, amylopectin and glycogen are both branched molecules (1)	Allow description of glycosidic bonds as 1,4 and 1,6	(4)

Question number	Answer	Additional guidance	Mark
(c)(i)	An answer that includes one of the following points: • saturated lipids have no carbon - carbon double bonds **and** unsaturated lipids have a carbon - carbon double bond or • saturated lipids have straight chains **and** unsaturated lipids have bent chains or • saturated lipids have a greate**r** ratio of hydrogen to carbon / unsaturated lipids have a lowe**r** ratio of hydrogen to carbon	Answer must be comparative	(1)

Question number	Answer	Mark
(c)(ii)	An description that includes the following points: • one glycerol molecule and three fatty acid molecules (1) • which react via a condensation reaction (1) • and are joined by ester bonds (1)	(3)

Q12.

Question number	Answer	Additional guidance	Mark
(a)(i)	An explanation that includes the following points: • because both lines rise and fall (in parallel) (1) • but the line for deaths from lung cancer is a period of time afterthe line for cigarettes smoked (1)	**Accept** {delay / timelag} for deaths	(2)

Question number	Answer	Additional guidance	Mark
(a)(ii)	An explanation that includes the following points: • alveoli will have a smaller surface area (to volume ratio) (1) • therefore the (rate of) diffusion of oxygen into the bloodstreamwill be slower (1)	**Accept** gas exchange area will besmaller **Accept** gas exchange for diffusion **Ignore** less gas exchange / diffusion	(2)

Question number	Answer	
*(b)	Indicative content:	
	Egg points (E)	1. {number / density of pores} 2. {width / size} of pores 3. area of pores 4. thickness of shell and membranes 5. rate of respiration of developing embryo 6. rate of blood flow of embryo 7. temperature 8. shell is impermeable / pores are permeable 9. shell supports membrane so there is a large SA for gas exchange
	Theory points (T)	10. Ficks Law of diffusion can be used to calculate diffusion rate 11. State Fick's Law (3) 12. because rate of diffusion depends on surface area / mp11 13. because rate of diffusion depends on diffusion distance / mp11 14. because rate of diffusion depends on concentration gradient / mp11 15. speed of molecules depends on temperature 16. because rate of diffusion depends on what substances oxygen is passing through egwater / air 17. diffusion coefficient through air 18. diffusion coefficient through membranes
	Explanation points (X) Accept converse for all	19. increasing SA (or any named factor increasing this) causes increase in rate of diffusion 20. increasing distance (or any named factor increasing this) causes decrease in rate ofdiffusion 21. increasing conc gradient (or any named factor increasing this) causes increase in rateof diffusion 22. increasing temperature increases rate of diffusion

	Level 1 Up to 4 points from anywhere; 2 points for one mark and 4 points for 2 marks Level 2 5 points or more, from two best categories; 5 points for 3 marks, 6 points for 4 marks. Must achieve 6 marks to progress to level 3 Level 3 As level 2 plus up to 2 points from third category; 7 points for 5 marks and 8 points for 6 marks

Q13.

Question number	Answer	Additional guidance	Mark
(a)	ACCEPT any two from : • BMI / body mass index • waist to hip ratio / hip to waist ratio • waist to height ratio / height to waist ratio • waist circumference • skin fold (thickness)	**IGNORE** risk factors **ACCEPT** mass ÷ height^2 / weight ÷ height^2	(1)

Question number	Answer	Mark
(b)(i)	**The only correct answer is B** B 1-6 only *A is incorrect because 1-4 bonds are present in straight chains only* *C is incorrect because 1-4 bonds are present in straight chains only* *D is incorrect because 1-6 bonds form the branches*	(1)

Question number	Answer	Additional guidance	Mark
(b)(ii)	• makes the person feel full / prevents so much food from being in the stomach / fills up the stomach so less food needed to satisfy hunger / glucomannan takes the space of the food (1)	**IGNORE:** reduces food intake decreases volume of stomach	(1)

Question number	Answer	Additional guidance	Mark
(b)(iii)	An explanation that includes the following points: • because it contains lots of {monosaccharides / glucose / energy} (1) • therefore {energy input could be greater than energy output / (excess) glucose converted to fat} (1) • glucomannan would no longer be filling up the stomach so more food could be eaten (1)	**ACCEPT** sugar for glucose polymer of glucose lots of mannose broken down into lots of {glucose / monosaccharides / mannose} **ACCEPT** excess energy stored as fat	**(2)**

Question number	Answer	Additional guidance	Mark
(c)(i)	An answer that includes the following points: • group on low fat diet lost 4.3 (kg) and group on very low-carbohydrate diet lost 8.1 (kg) (1) • (overall) loss of 8.1 (kg) is {1.88 / 1.9} times more weight (1) • which is slightly lower than the other studies are claiming (1) • claims are referring to low-carbohydrate diet but this one is a very low-carbohydrate diet (1)	**ACCEPT** group on low fat diet lost 3.8 (kg) more **ACCEPT** about twice as much / for low-fat diet this is 4.6% of starting weight and for very low-carbohydrate 8.9% starting weight **ACCEPT** results are at the lower end of the claim	**(3)**

Question number	Answer	Additional guidance	Mark
(c)(ii)	An answer that includes two of the following points: • (blood) {cholesterol / LDL} levels (1) • blood pressure (1) • heart rate (1)	**IGNORE** other named risk factors **ACCEPT** LDL : HDL	**(2)**

Q14.

Question number	Answer	Mark
(a)(i)	The only correct answer is C. fructose and glucose | sucrose only A is incorrect because glucose is also a monosaccharide not a disaccharide B is incorrect because fructose is also a monosaccharide and not a disaccharide D is incorrect because sucrose is not a monosaccharide and fructose is not a disaccharide	(1)

Question number	Answer	Mark
(a)(ii)	The only correct answer is B glycosidic A is incorrect because ester bonds join organic acids and alcohols together C is incorrect because peptide bonds join amino acids together D is incorrect because phosphodiester bonds joins mononucleotides together	(1)

Question number	Answer	Additional guidance	Mark
(b)(i)	A calculation showing the following steps: • the mean calculated (1) • the mean converted to g dm^{-3} (1)	Example of calculation : (1.22 + 1.02 + 1.00) ÷ 3 / 1.08 0.00108 / 0.0011 / 1.08 × 10^{-3} Correct answer with no working shown gains both marks.	(1)

Question number	Answer
(b) (ii)	Indicative content: • sugar solution with a lower water potential than the cytoplasm of the cell (D) • sugar solution should be hypertonic (D) • so that water will pass out of the cytoplasm by osmosis (E) • concentration of sugar solution should be the same as the cytoplasm (D) • so that sugars will not diffuse out (E) • each individual sugar concentration should be the same as the cytoplasm (D) • mean concentration of sugars stated (fructose = 1.52, glucose = 1.08, sucrose = 8.55) (D) • range of sugar concentrations stated (from table) (D) • so that concentration of each sugar remains the same (E) • another solute needs to be used (D) • so that the sugar concentration remains the same but the water passes out (E)

	Level 1 : description of conditions needed for osmosis and maintaining sugar concentration 1 mark = a description of one condition 2 marks = a description of each condition or an explanation of one condition Level 2 : explanation of conditions needed for both osmosis and maintaining sugar concentration 3 marks = a description of one condition and an explanation of the other condition 4 marks = an explanation of each condition Level 3 : indicates that concentration of each sugar needs to be the same as in the pineapple and another solute needs to be included. 5 marks = and includes one of the above 6 marks = and includes both of the above

Q15.

Question number	Answer	Additional guidance	Mark
(a)(i)	pressure exerted by one (type of) gas in a mixture of gases (1)	ACCEPT pressure exerted by oxygen in a mixture of gases/air ACCEPT is a measure of concentration of a gas / concentration of oxygen (ignore location) IGNORE amount of oxygen / amount of gas / % of gas / proportion of gas	(1)

Question number	Answer	Additional guidance	Mark
(a)(ii)	An explanation that includes three of the following points: • haemoglobin is composed of four sub-units (1) • binding of the first oxygen molecule is difficult (1) • binding of the other molecules becomes easier (1) • due to a conformational change (1) • as Hb becomes saturated less oxygen can bind (so the curve flattens out) (1)	ACCEPT context of release of oxygen from Hb for mp 2, 3 and 4 ACCEPT 4 haem groups / 4 polypeptide chains / 4 iron ions IGNORE slow binding ACCEPT cooperative binding ACCEPT increased affinity for other molecules IGNORE faster binding ACCEPT due to a change in the {3D / tertiary} structure IGNORE change of shape	(3)

Question number	Answer	Additional guidance	Mark
(b)(i)	An explanation that includes one of the following points: • {water vapour / carbon dioxide} is added to the air (1) • oxygen {used by cells / used in respiration} (1) • oxygen moves into {capillaries / blood} (1)	ACCEPT idea of carbon dioxide diffusing into the alveoli ACCEPT oxygen transported by blood IGNORE "to maintain a gradient for oxygen to diffuse"	(1)

Question number	Answer	Additional guidance	Mark
(b)(ii)	An explanation that includes the following points: • arteries take blood to {tissues / cells}, veins take blood away from {tissues /cells} (1) • oxygen diffuses (out of the capillaries) into {the tissues /cells} (1) • because there is a lower {partial pressure / concentration} in tissues / cells (1) • carbon dioxide is {increasing in / entering} (the blood) (1)	ACCEPT arteries take blood away from the heart and veins take it towards the heart. Can be pieced together. ACCEPT oxygen diffuses out of the blood ACCEPT oxygen {unloaded / released / dissociates} from haemoglobin ACCEPT because the {tissues / cells} are respiring (aerobically)	(3)

Question number	Answer	Additional guidance	Mark
(b)(iii)	Correct value for percentage saturation given (1)	81 ACCEPT 80 - 82	(1)

Question number	Answer	Additional guidance	Mark
(b)(iv)	An explanation that includes four of the following points: • partial pressure of oxygen (in the atmosphere) at high altitudes is low / lower (than at sea level)} (1) • (therefore) the partial pressure of oxygen in the alveoli will be lower (1) • the concentration gradient between the alveoli and the blood will be smaller (1) • (therefore) the rate of diffusion of oxygen into the blood will be slower (1) • (therefore) the haemoglobin will not be able to bind to as much oxygen (1)	ACCEPT converse for all marking points ACCEPT {concentration of oxygen / level of oxygen} for partial pressure in all marking points ACCEPT less oxygen (available) at high altitude ACCEPT difference in concentration of oxygen between the alveoli and the blood IGNORE less diffusion, this is about rate ACCEPT lower partial pressure of oxygen in the blood ACCEPT less oxyhaemoglobin produced IGNORE saturation of Hb is low	(4)

Q16.

Question number	Answer	Additional guidance	Mark
(a)(I)	A description that includes the following points: • smoking increases the risk of developing CVD (1) • age increases the risk of developing CVD (1)	**ACCEPT** a higher chance, positive correlation, smoking higher than not smoking **ACCEPT** a higher chance, positive correlation	(2)

Question number	Answer	Additional guidance	Mark
(a)(II)	An explanation that includes two of the following points: • smokers still have greater risk because cigarettes still contain same chemicals / smokers have lower risk than before because people smoking {e cigarettes / fewer cigarettes} (1) • risk lower because people more aware of other risk factors / risk higher because of other named risk factor (1) • risk lower as improvements in health care (1)	Accept no change if supported by an explanation **ACCEPT** more aware of their health e.g. poor diet, junk food, high fat, high salt, less exercise, obesity	(2)

Question number	Answer	Mark
(b)	C 57.1×10^6 The only correct answer is C. *A is incorrect because (17.7 million ÷ 31) × 100 = 57.1×10^6* *B is incorrect because (17.7 million ÷ 31) × 100 = 57.1×10^6* *D is incorrect because (17.7 million ÷ 31) × 100 = 57.1×10^6*	(1)

Q17.

Question number	Answer	Additional guidance	Mark
(a)	One from • high BMI / smoking / alcohol intake / high salt intake / high cholesterol intake And one from • age / sex / gender	Accept: obesity / overweight / high waist to hip ratiohigh level of {fat / sugar} in diet type 2 diabetes high stress levels air pollution	(1)

Question number	Answer	Additional guidance	Mark
(b)	A description that includes two of the following points: • increase in intensity of exercise decreases the riskof death from heart disease (1) • increase in the energy needed for exercise decreases the risk of death from heart disease (1) • for the same energy expenditure, {vigorous exercise / moderate exercise} decreases risk of death from CVD more than light exercise (1)	**Accept** converse throughout Accept if you expend 4000kJ per week, intensity of exercise makes no difference to risk of death fromCVD	(2)

Question number	Answer	Additional guidance	Mark
(c)(i)	An explanation that includes the following points: • because antioxidants reduce free radicals (1) • free radicals cause {cell damage /tissue damage / oxidative stress / damage to endothelial lining} (1) • (antioxidants) reduce {plaque / atheroma} formation (1)	**Accept** neutralise / stabilise / donate electrons **Accept** antioxidants {prevent cell damage / tissue damage / reduce oxidative stress / prevent damage to endothelial lining} **Accept** reduces {cholesterol build up / bloodclot formation / atherosclerosis}	(3)

Question number	Answer	Additional guidance	Mark
(c)(ii)	An answer that includes three of the following points: • use (a large number of) {healthy individuals / individuals with noknown heart condition} (1) • who have similar (lifestyle and non-lifestyle) risk factors (1) • compare group given antioxidants to a group using otherpreventative treatments (1) • monitor the incidence of heart disease over a (long) period oftime (1)	**Accept** control for named factor **Accept** give one group antioxidants and the other group {a placebo / no antioxidants} **Accept** at least 6 months if time isgiven	(3)

Question number	Answer
*(d) Indicative content:	

Outline of events (O points)	1. less blood reaches the heart muscle cells, 2. muscle cells are not supplied with enough oxygen 3. muscle cells are not supplied with enough glucose 4. aerobic respiration decreases
Contraction stops (C points)	5. anaerobic respiration produces lactic acid 6. lactic acid lowers pH and denatures enzymes 7. glycogen used as respiratory substrate 8. anaerobic respiration produces much less ATP / energy 9. therefore less / no blood is pumped by the heart 10. reference to effect on other organs
Use of graph / stem info(G points)	11. energy released from heart cells decreases with time after blockage 12. reference to data from graph (not mp13 or 15) 13. after 8 minutes the energy released is **52 - 54 a.u.** 14. after 8 minutes there is not enough energy for contraction 15. after 20 minutes the energy released is **23 - 24 a.u**. 16. which is too low to maintain cell viability / for cells to survive 17. cells die as not enough ATP for vital processes eg active transport

Level 1: up to two points from anywhere; one point for 1 mark and two points for 2 marks

Level 2: up to two points from each of two categories; 3 points for 3 marks, 4 points for 4 marksMust achieve 4 marks to progress to level 3

Level 3: Level 2 plus two points from the third category; five points for 5 marks and six points for 6 marks

Q18.

Question number	Answer	Additional guidance	Mark
(a)(i)	• GUG	**ACCEPT** guanine uracil guanine / CAC / cytosine adenine cytosine **IGNORE** val / valine	(1)

Question number	Answer	Additional guidance	Mark
(a)(ii)	• substitution	**DO NOT ACCEPT** frameshift / deletion / addition / insertion **IGNORE** {gene / point} mutation	(1)

Question number	Answer	Additional guidance	Mark
(a)(iii)	An answer that includes the following points: • the R groups (of these two amino acids) have different {properties / bonding} (1) • glu may have repelled polar groups on other haemoglobin molecules (1) • {val / hydrophobic R group / hydrophobic part} might form other (hydrophobic) interactions (with other haemoglobin molecules) (1) • (part of haemoglobin containing) val (R group) turns away from {water / cytoplasm} (1)	**ACCEPT** amino acids have different properties **ACCEPT** bonds / Van der Waals **DO NOT ACCEPT** incorrect named bonds **ACCEPT** repels water **DO NOT ACCEPT** blood / plasma	**(3)**

Question number	Answer	Additional guidance	Mark
(b)	• number of non-affected babies calculated (1) • 0.002 : 1 / 2 × 10^{-3} : 1 (1)	(140 million - 305 800 =) 139 694 200 0.002189 **ACCEPT** 0.0022 / 0.00219 / 0.002189 **ACCEPT** 1 : 457 / 456.8 **NB** 1 mark for 1 : 458 / 1 : 457.8 0.002184 : 1 (0.002 / 0.0022 / 0.0218) Bald answer = 2 marks	**(2)**

Question number	Answer	Additional guidance	Mark
(c)(i)	• values read correctly from the graph (1) • 3.3 / 3.4 (1)	**ACCEPT** 4.4 / 4.9 and 5.7 / 5.8 / 7.7 / 7.8 **ACCEPT** ecf for correct subtraction using {4.4 / 7.7 / 7.8} and one incorrect value Bald answer = 2 marks	**(2)**

Question number	Answer	Additional guidance	Mark
(c)(ii)	An answer that includes the following points: • person without the disease has higher saturation than person with the disease (at all partial pressures of oxygen) (1) • there is {greater variability / wider range} (in the saturation) of a person with the disease than a person without the disease (at a particular partial pressure of oxygen) (1)	**NB** accept converse throughout but all conclusions must be comparative **ACCEPT** refs to affinity (for oxygen) **IGNORE** graph shifted	**(2)**

Question number	Answer	Additional guidance	Mark
(c)(iii)	• 120 (days) (1)		**(1)**

Question number	Answer	Additional guidance	Mark
(c)(iv)	An explanation that includes three of the following points: • (change in structure of haemoglobin) haemoglobin {binds / carries} less oxygen (1) • (shape of red blood cell) smaller surface area so less oxygen diffuses in / red blood cells get lodged in blood vessels preventing flow of blood to cells (1) • therefore less oxygen to {cells / tissues} so {less available for (aerobic) respiration / switch to anaerobic respiration} (1) • credit an example of why less oxygen to cells could be fatal (1)	**NB** accept converse where appropriate **ACCEPT** named cell / tissue e.g. heart attack, stroke, sepsis, infection	**(3)**

C1

Q19.

Question number	Answer	Additional guidance	Mark
(a)(i)	An answer that includes the following points: Similarities: • the solubility of both sodium chloride and glucose increase with (increasing) temperature (1) Differences: • sodium chloride solubility increases linearly with (increasing) temperature but glucose {does not increase linearly / increases exponentially} (1) • (increasing) temperature has a greater effect on solubility of glucose than sodium chloride (1)	Piece within same / adjacent sentences, but not outside this Statement "temperature has no effect on solubility of sodium chloride" followed by "solubility of NaCl increases slightly" negates mp1 IGNORE references to dissolving faster with increasing temperature IGNORE attempts to describe glucose solubility unless compared to {linear / constant} increase for sodium chloride ACCEPT converse ACCEPT solubility of glucose increases more than solubility of sodium chloride ACCEPT manipulation if a direct comparison is made	(3)

Question number	Answer	Additional guidance	Mark
(a)(ii)	An answer that includes the following points: • six carbons, twelve hydrogens and six oxygens used in calculation (1) • molecular mass calculated (1)	ACCEPT formula written down (6 × 12) + (12 × 1) + (6 × 16) = 180 Correct answer gets 2 marks CE if wrong formula for glucose used (as long as formula is written)	(2)

Question number	Answer	Additional guidance	Mark
(a)(iii)	• correct answer (1)	CE from 4(a)(ii) applies 180 ÷ 58.44 = 3.08 ACCEPT 3 / 3.1	(1)

Question number	Answer	Additional guidance	Mark
(a)(iv)	An answer that includes the following points: • (glucose is a larger molecule than sodium chloride therefore) glucose can be surrounded by more water molecules (1) • glucose has {(many) hydroxyl groups / (more) polar groups} (1) • (therefore) glucose forms (more) hydrogen bonds with water molecules (1) • strength of bonding (between particles) is lower in glucose compared to sodium chloride (1)	ACCEPT converse for all marking points IGNORE glucose is {more polar / a polar molecule} ACCEPT increase in entropy is greater when glucose dissolves (for either mp1 or mp2)	(2)

Question number	Answer	Additional guidance	Mark
(b)	An explanation that includes the following points: • water is a polar solvent (1) • fatty acids have {hydrophobic / non-polar} tails (1) • {fatty acids / non-polar molecules} {do not form hydrogen bonds / do not dissolve in polar liquids / repel polar liquids} (1)	ACCEPT water is dipolar ACCEPT fatty acids are {hydrophobic / non-polar} ACCEPT fatty acids {stick together / aggregate / form micelles} ACCEPT {water/blood/ plasma} for polar liquids only in context of repulsion IGNORE fatty acids are too big to dissolve	(2)

Q20.

Question number	Answer	Additional guidance	Mark
(a)	The correct answer is **C** ***A*** *is incorrect because starch is insoluble in water and consists of amylose and amylopectin is insoluble in water* ***B*** *is incorrect because starch is insoluble in water and consists of amylose and amylopectin is insoluble in water* ***D*** *is incorrect because starch has 1-4 bonds as well as 1-6*		**(1)**

Question number	Answer	Additional guidance	Mark
(b)(i)	An answer that includes the following points: • glycosidic (1) • (α) glucose (1) • fructose (1) • galactose (1)	 **IGNORE** 1-4 / 1-6 **IGNORE** α and β **IGNORE** α and β	**(4)**

Question number	Answer	Additional guidance	Mark
(b)(ii)	• condensation (reaction) (1)	**ACCEPT** polymerisation	**(1)**

Question number	Answer	Additional guidance	Mark
(b)(iii)	The correct answer is **C** ***A*** *is incorrect because the molecular mass is 180 + 180 – 18 = 342* ***B*** *is incorrect because the molecular mass is 180 + 180 – 18 = 342* ***D*** *is incorrect because the molecular mass is 180 + 180 – 18 = 342*		**(1)**

Q21.

Question number	Answer	Additional guidance	Mark
(a)	An answer that includes three of the following points: Similarities **Any two from:** • both contain a glycerol (1) • both contain fatty acids (1) • both contain ester bonds (1) Differences • triglycerides have three fatty acids and phospholipids have two fatty acids (1) • triglycerides do not contain a phosphate group but phospholipids do contain a phosphate group (1)	**NB** Do not piece together from two descriptions in separate sentences **IGNORE** diagrams	**(3)**

Question number	Answer	Additional guidance	Mark
(b)	An explanation that includes the following points: • {protein / phosphate heads / phospholipid heads} are {soluble / hydrophilic / polar} and interact with {blood / plasma} (1) • {fatty acids / triglycerides /cholesterol} is {insoluble / non-polar / hydrophobic} (1) • therefore cholesterol is surrounded by {fatty acid tails / triglycerides} (1)		**(3)**

<table>
<tr><th>Question number</th><th>Answer</th><th>Additional guidance</th><th>Mark</th></tr>
<tr><td>(c)(i)</td><td>• volume of sphere calculated / values substituted into the equation (1)

• volume of sphere rounded up to nearest whole number (1)

• ratio calculated (1)</td><td>Example of calculation

= 6912 if using π = 3
= 7142.4 if using π = 3.1
= 7234.56 if using π = 3.14
= 7239.168 if using π = 3.142
= 7241.472 if using π = 3.143
= 7238.22947387 if pressing π on calculator

= 6912 / 7142 / 7235 / 7239 / 7238 / 7241
ACCEPT 6910 / 7140 / 7240
NB Just these values given = 2 marks

14 : 1
13 : 1 if 6910 / 6912

CE apply throughout
NB mark answer in table if different from in the working e.g.
<table><tr><th>Diameter of LDL / nm</th><th>Volume of LDL / nm^3</th><th>Volume of cholesterol / nm^3</th><th>Ratio of LDL volume to cholesterol volume</th></tr><tr><td></td><td></td><td></td><td></td></tr><tr><td></td><td>7235

= 2 marks</td><td></td><td>14 : 1

= 1 mark</td></tr></table></td><td>(3)</td></tr>
</table>

Question number	Answer	Additional guidance	Mark
* (c)(ii)	Indicative content: • as LDL increases, risk increases (K / G) • several factors beside LDLs can increase the risk of CVD (K) • example of a factor given e.g. high blood pressure (K) • LDLs can be different sizes (Q) • and therefore be absorbed by endothelial cells differently (Q) • and therefore get broken down at different rates (K / Q) • and therefore carry different volumes of cholesterol (Q) • level of HDL (in blood) affects risk (of CVD) (K / G) • example given from graph e.g. 0.65 a.u. has greater risk than 2.20 a.u. (G) • ratio of LDL : HDL affects risk (of developing CVD) (K / G) • the lower LDL : HDL the ratio the lower risk of CVD (K / G)		**(6)**
Own knowledge (K), information given in the graph (G), information in the question (Q) **Level 1 :** uses either (K), (G) **or** (Q) 1 mark = 1 comment, 2 marks = 2 comments **Level 2 :** uses two from (K), (G) **or** (Q) 3 marks = 3 comments, 4 marks = 4 comments **Level 3 :** uses (K), (G) **and** (Q) 5 marks = 5 comments, 6 marks = 6 comments			

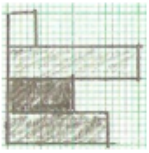
Q22.

Question number	Answer	Additional guidance	Mark
(a)	• surface area of one vein calculated (1) • total surface area = 1.4×10^3 / 1.5×10^3 (1) • length of vena cava = 40.7 / 40.8 / 42.7 (1)	37.68 **DO NOT ACCEPT** 37 ecf for wrong value in mp 1 but multiplied by 40 and incorrect standard form Bald answer in table or in space (provided same as in table if given) = 2 marks Bald answer of {36 / 37.68 / 37.7 / or in correct standard form} in box = 1 mark **NB** if they have shown the correct answer but not in standard form, award mp 1 as they must have calculated this value correctly (check the box below)	**(3)**

mp	Value used for π		
	3	3.14	calculator
1. S.A. of one vein	36	37.68	37.699111843077518 861551720599354
2. Total S.A	1,440 1.4×10^3	1,507.2 1.5×10^3	1,507.96447372310075446 20688239742 1.5×10^3
3. Length	42.6666666666666666 66666666666667 42.7	40.7643312101910828 02547770700637 40.8	40.743665431525205 956834243423363 40.7

Question number	Answer	Additional guidance	Mark
(b)	An explanation that includes the three of the following points: • blood in aorta is under higher pressure as it has just been pumped out of the {heart / (left) ventricle} (1) • aorta branches into many arteries /(blood flowing through) more vessels (1) • the {friction / resistance} between blood and vessel (slows the velocity down) (1) • blood cannot be pushed through because of {loss of elasticity in arteries / less elastic recoil} (1)	**NB** may need to piece together **NB** statements about the arteries do not need qualifying as the question is about arteries. If comparative statements about the aorta are made then they must be qualified **ACCEPT** velocity slower in arteries as they do not receive blood directly from the heart **ACCEPT** (total) cross-sectional area of arteries are greater than the aorta **ACCEPT** diameter of artery lumen is smaller / artery lumen is narrower diameter of aorta lumen is greater so velocity will be faster **ACCEPT** in the form of a comparison with the aorta being able to force blood because of more elastic fibres	(3)

Question number	Answer	Additional guidance	Mark
(c)	An explanation that includes the following points: • more plasma is able to leave (the capillaries) (1) • results in faster diffusion (1) • more capillaries are in contact with the cells (in the tissue) (1)	**ACCEPT** named molecule e.g. oxygen, glucose **ACCEPT** faster gas exchange / rate of diffusion is fast enough / diffusion is rapid **ACCEPT** capillaries are close to more cells / diffusion distance is short	**(2)**

Question number	Answer	Additional guidance	Mark
(d)(i)	The correct answer is **A**,  ***B*** *is incorrect because arteries have a high proportion of elastic fibres* ***C*** *is incorrect because arteries have an endothelial lining* ***D*** *is incorrect because artery walls contain collagen*		**(1)**

Question number	Answer	Additional guidance	Mark
(d)(ii)	• a diagram showing a bar for the endothelial cell layer only (1)	**ACCEPT** any length	**(1)**

Q23.

Question number	Answer	Additional guidance	Mark
(a)(i)	The correct answer is **B** ***A*** *is incorrect because the aorta takes blood away from the left hand side of the heart* ***C*** *is incorrect because pulmonary vein returns blood to the left hand side of the heart* ***D*** *is incorrect because the vena cava returns blood to the right atrium*		**(1)**

Question number	Answer	Additional guidance	Mark
(a)(ii)	The correct answer is **A** ***B*** *is incorrect because stage F which is ventricular systole* ***C*** *is incorrect because* ***F*** *is ventricular systole* ***D*** *is incorrect because* ***F*** *is ventricular systole*		**(1)**

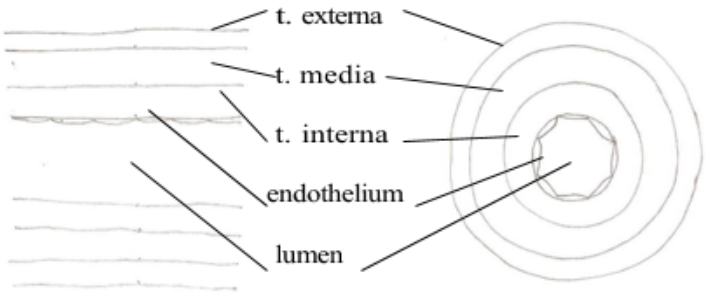
Question number	Answer	Additional guidance	Mark
(b)(i)	• values read from the graph and subtracted to give the time for one heart beat (1) • 75.0 (1)	0.8 / any pair of values that give 0.8 when subtracted **DO NOT ACCEPT** 75 ECF from mph 1 if values correspond to readings from graph Bald answer of 75.0 = 2 marks Bald answer of 75 = 1 mark	**(2)**

Question number	Answer	Additional guidance	Mark
(b)(ii)	An answer that includes three of the following points: • graph will be {the same / similar in} {shape / position} (1) • because the left hand side and right hand side beat simultaneously (1) • peaks will be lower (1) • because pressure in right hand side is lower {as blood is only pumped to <u>lungs</u> / to prevent damage to <u>alveoli</u>} (1)	**NB** 'It' refers to the line for the right ventricle **NB** accept converse where appropriate **ACCEPT** line **ACCEPT** description e.g. both ventricles contract at the same time **IGNORE** graph lower down **ACCEPT** because right ventricle has {less muscle / thinner walls} as blood is only pumped to <u>lungs</u> less force to <u>lungs</u> **NB If candidate says that there is something drawn on the graph you must send it to review**	**(3)**

Q24.

Question number	Answer	Additional guidance	Mark
(a)	answer to no more than one decimal place in the range of 1.3 to 2.4 (m)		(1)

Question number	Answer	Additional guidance	Mark
(b)	An explanation that includes two of the following points: • because blood has to be pumped under high pressure (from the heart) (1) • so that the blood can reach the { brain / head} (1) • pump blood against (the force of) gravity (to the upper parts of the body) (1)		(2)

Question number	Answer	Additional guidance	Mark
(c)(i)	A drawing that shows : • {3 layers / 3 layers and endothelium} + lumen (1) Any two from: • lumen (1) • endothelium / epithelium (1) • tunica {interna / intima} (1) • tunica media (1) • tunica {externa / adventitia} (1)	 ACCEPT inside line labelled if 2 layer diagram with no endothelium labelled IGNORE smooth muscle ACCEPT (smooth) muscle (cells) and elastic fibres ACCEPT collagen fibres N.B. If one incorrect label, max of 1 label mark If two incorrect labels then no label marks can be awarded	(3)

Question number	Answer	Additional guidance	Mark
(c)(ii)	An explanation that includes the following points: • the blood is under high pressure so that the {arteries need to widen / elastic fibres need to stretch} (1) • elastic recoil necessary to maintain the high blood pressure (1)	N.B. need to stretch and recoil to {maintain / accommodate} high pressure = 1 mark if no other mps awarded	(2)

Question number	Answer	Additional guidance	Mark
(d)(i)	An explanation that includes the following points: • because there will be less blood flowing (near the surface of the skin at any one time) (1) • therefore blood clot will form {more easily / faster} (1)	ACCEPT blood at {lower / low} pressure ACCEPT clotting will be {faster / easier} less blood lost whilst clot forming	(2)

Question number	Answer	Additional guidance	Mark
(d)(ii)	An explanation that includes the following points: • because (the smaller red blood cells will have) a greater surface area (1) • and therefore oxygen will be able to diffuse (into / out of the RBCs) faster (1)	IGNORE easier to diffuse / more can diffuse	(2)

Q25.

Question number	Answer	Mark
(a)	**The only correct answer is D** (vena cava) A is incorrect because the diagram shows a blood vessel bringing blood back into the right atrium B is incorrect because the diagram shows a blood vessel bringing blood back into the right atrium C is incorrect because the diagram shows a blood vessel bringing blood back into the right atrium	**(1)**

Question number	Answer	Additional guidance	Mark
(b)(i)	• (cardiac) diastole (1)	**ACCEPT** (heart / complete / total / ventricular and atrial / atrioventricular) diastole **DO NOT ACCEPT** diasystole / dystole / ventricular diastole / systic diastole	**(1)**

Question number	Answer	Additional guidance	Mark
(b)(ii)	An answer that makes reference to the following points: • length of one heart beat calculated (1) • 0.06 / 0.061 / 0.0608 (1)	Example of calculation 0.821917808219178082191780821917 81 6 / 6.1 / 6.08 % 5/82 Ecf if 73 ÷ 60 : 0.04 / 0.041 / 0.0411 4 / 4.1 / 4.11 % 3/73 Bald answer score two marks Bald answer with incorrect number of decimal places scores 1 mark.	**(2)**

Question number	Answer	Additional guidance	Mark
(c)(i)	• 104 / 104.17 / 104.2 (1)		**(1)**

Question number	Answer	Additional guidance	Mark
(c)(ii)	An explanation that makes reference to the following points: • to delay the movement of the impulse across the (atrioventricular) septum (1) • so that the atria can finish emptying (1) • so that the atrioventricular valves can close (1)	**ACCEPT** to delay the contraction of the ventricles **ACCEPT** so that ventricles can fill NB Accept answers that refer to right atrium and right ventricle	**(2)**

Q26.

Question number	Answer	Additional guidance	Mark
(a)	An explanation that includes the following points: • because antioxidants reduce free radicals (1) • free radicals cause {cell damage / oxidative stress} (1) • (antioxidants) reduce {plaque / atheroma} formation (1)	ACCEPT neutralise / stabilise / donate electrons ACCEPT antioxidants {prevent cell damage / reduce oxidative stress} ACCEPT reduces cholesterol build up	(3)

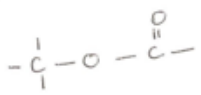
Question number	Answer	Additional guidance	Mark
(b)(i)	An explanation that includes the following points: • dark chocolate contains more flavenoids (than milk chocolate per 100g) (1) • and therefore more antioxidants to reduce the risk of CVD (1) • dark chocolate contains less energy (per unit mass) than milk chocolate (1) • so is less likely to cause obesity which {is a risk factor / decreases the risk} of CVD (1)	ACCEPT matching converse points ACCEPT description of what antioxidants do IGNORE incorrect descriptions ACCEPT calories ACCEPT overweight	(4)

Question number	Answer	Mark
(b)(ii)	The only correct answer is A cocoa mass B is incorrect because both types of chocolate contain similar % of milk fat C is incorrect because both types of chocolate contain similar % of sugar D is incorrect because milk chocolate contains more whole milk powder than dark chocolate	(1)

Question number	Answer	Additional guidance	Mark
(b)(iii)	An answer that includes three of the following points: • two groups of people one eating chocolate and one {control / not eating chocolate} (1) • who {have no (known) risk of / do not have} CVD (1) • credit description of control variable • incidence of heart disease recorded (over a period of time, at least a year) (1)	ACCEPT 3 groups if one has no chocolate, one has milk chocolate and one has dark chocolate ACCEPT healthy e.g. same sex, similar {size / age / lifestyle} ACCEPT same mass of chocolate if comparing dark with milk chocolate IGNORE amount ACCEPT monitor risk factors / examples e.g. blood pressure, cholesterol levels, BMI	(3)

Q27.

Question number	Answer	Mark
(a)(i)	The only correct answer is B 1 : 3 A is incorrect because triglycerides are composed of one glycerol molecule and three fatty acids C is incorrect because triglycerides are composed of one glycerol molecule and three fatty acids D is incorrect because triglycerides are composed of one glycerol molecule and three fatty acids	(1)

Question number	Answer	Mark
(a)(ii)	 The only correct answer is C. A is incorrect because this shows a peptide bond B is incorrect because an ester bond does not contain a nitrogen D is incorrect because there should be a double O on the carbon	(1)

Question number	Answer	Additional guidance	Mark
(a)(iii)	An explanation that includes the following points: • palmitoleic and linoleic (acid) (1) • because they {are unsaturated fatty acids / have double bonds (between carbon atoms)} (1) OR • linoleic (acid) (1) • because it has {two / the most} double bonds (between carbon atoms) (1)	ACCEPT converse in the context of butyric acid and stearic acid having the lowest risk IGNORE chain length ACCEPT polyunsaturated IGNORE chain length	(2)

Question number	Answer	Additional guidance	Mark
(b)(i)	An explanation that includes the following points: • because thrombin would not be able to bind to fibrinogen (1) • therefore fibrin is not formed (1)	ACCEPT fits active site / thrombin – fibrinogen complexes ACCEPT less fibrin formed	(2)

Question number	Answer	Additional guidance	Mark
(b)(ii)	An explanation that includes the following points: • because the platelets would not be able to bind to fibrin (1) • therefore the {mesh / clot} would not be formed (1) OR • and therefore do not release thromboplastin (if not binding to each other / endothelium) (1)	ACCEPT not able to bind to {blood cells / other platelets / endothelium} less sticky	(2)

Question number	Answer	Additional guidance	Mark
(b)(iii)	An explanation that includes the following points: • therefore plasmin {hydrolyses fibrin / breaks the peptide bonds in fibrin} (1) • because {without fibrin / with less fibrin} there is {nothing / less} to trap the {platelets / blood cells} (1)	ACCEPT {no / less} mesh formed	(2)

Q28.

Question number	Answer	Additional guidance	Mark
(a)	A description that includes the following point: • to be present in the blood (all the time) (1) and any **TWO** of the following: • needed to make thrombin (when blood needs to clot) (1) • which is an {enzyme / catalyst} (1) • so that fibrinogen can be converted into fibrin (1)	**ACCEPT** precursor of clotting process / inactive form of thrombin / inactive enzyme / inactive plasma protein **NB** thrombin catalyses fibrinogen into fibrin = 2 marks	**(3)**

Question number	Answer	Mark
(b)	**The only correct answer is A** A anticoagulant *B is incorrect because antihypertensives treat high blood pressure* *C is incorrect because platelet inhibitors inhibit platelets, which are involved in the cascade before prothrombin and prothrombin is made by the liver* *D is incorrect because statins treat high blood cholesterol levels*	**(1)**

Question number	Answer	Additional guidance	Mark
(c)(i)	An answer that includes the following points: • warfarin and vitamin K have a similar structure (1) • therefore warfarin {binds / blocks} to the {vitamin K epoxide reductase / VKOR} (1) • (as a result of warfarin binding to enzyme) {less / no} vitamin K reduced (1)	**ACCEPT** both have rings / double bond oxygen **ACCEPT** warfarin is a {competitive / active-site directed } inhibitor / description **DO NOT ACCEPT** non-competitive inhibitor / description of one binds to vitamin K	**(2)**

Question number	Answer	Additional guidance	Mark
(c)(ii)	An answer that includes the following points: • increase in vitamin K would compete with warfarin for the active site (of vitamin K epoxide reductase / VKOR) (1) • therefore {some / more} vitamin K will be reduced (if vitamin K binds to enzyme) (1)	**ACCEPT** a description e.g. more enzyme substrate complexes	**(2)**

Question number	Answer	Additional guidance	Mark
(d)	An explanation that includes the following points: • large groups of people (1) • (sample size is large) for reproducibility (1) • people in both groups consume the same {mass / volume / concentration} of vitamin K (1) • people in both groups consume the same concentration of drugs (1) • (variables controlled) for validity (1)	**ACCEPT** 20 + **IGNORE** reference to control groups **ACCEPT** repeatable / reliable **IGNORE** accurate / precise / valid **IGNORE** amount **ACCEPT** other appropriate named control variable e.g. sex, age, diet, level of activity, alcohol intake **IGNORE** same number of people in each group / amount **IGNORE** accurate / precise /reproducible / repeatable / reliable	**(4)**

Q29.

Question number	Answer	Additional guidance	Mark
	An answer that includes the following points (in order): • dipolar (1) • positive (1) • solvent (1) • hydrolysis (1) • lactose (1)	**ACCEPT** dipole / polar **ACCEPT** medium **DO NOT ACCEPT** hydration **DO NOT ACCEPT** lactase / other named molecules	**(5)**