PEARSON EDEXCEL A-LEVEL BIOLOGY A · 9BN0

BIOLOGY



MARK SCHEME

TOPIC 1: LIFESTYLE, HEALTH AND RISK

SCORE	PERCENTAGE
/236	%

STEMUP

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Mark Scheme

Q1.

Question Number	Answer	Additional guidance	Mark
	An answer that makes reference to the following: • percentage incidence (of VTE) higher in {older people /people older than 70 } (1) • in younger people larger percentage (of VTE patients) have the factor V mutation (1) • (therefore) genotype has a greater influence on incidence (of VTE) in younger people (1) • (therefore) greater incidence (of VTE) in older people probably a result of environmental factors (1)	ALLOW converse – incidence of VTE lower in {younger people/ people under 20} ALLOW converse - lower percentage of older people have the factor V mutation ALLOW converse – genotype has less influence on incidence of VTE in older people	**(4)**

Q2.

Question Number	Answer	Additional Guidance	Mark
(i)	A description that makes reference to two of the following: • carrier protein (in cell surface membrane) • (glucose moves from) high to low concentration • glucose binds to (carrier) protein / (carrier) protein changes shape to move glucose (across the membrane) (1)	IGNORE channel protein ALLOW 'down a concentration gradient'	**(2)**

Question Number	Answer	Additional Guidance	Mark
(ii)	An explanation that makes reference to three of the following: • polymer of glucose • to provide glucose for respiration • {branched / contains 1,6-glycosidic bonds / has many terminal ends} for rapid hydrolysis • compact to allow large amount (of glucose / energy) to be stored in a small space / insoluble therefore no osmotic effect on cells	ALLOW polysaccharide /made of many glucose monomers DO NOT ALLOW β- glucose IGNORE 'easy to hydrolyse' ALLOW break down instead of hydrolyse	**(3)**

Q3.

Question Number	Answer	Additional Guidance	Mark
(i)	A description that makes reference to the following: • (LDL / lipoproteins carry) cholesterol in the blood • (cholesterol) is deposited to form atheroma (1) • in the endothelium of an artery	ALLOW LDLs increase blood cholesterol ALLOW plaque formation ALLOW artery wall	**(3)**

Question Number	Answer	Additional Guidance	Mark
(ii)	An explanation that makes reference to the following: • narrowing of (lumen of) coronary arteries • which reduces {blood flow / oxygen} to the cardiac muscle • which reduces aerobic respiration	ALLOW coronary arteries blocked ALLOW heart muscle ALLOW more anaerobic respiration / build- up of lactic acid	**(3)**

Q4.

Question Number	Answer	Additional guidance	Mark
(i)	A description that makes reference to the following: • thrombin is an enzyme (1) • (which catalyses) the conversion of fibrinogen into fibrin (1) • a mesh of fibrin traps { platelets / red blood cells } to form a clot (1)	IGNORE 'platelet plug'	**(3)**

Question Number	Answer	Additional guidance	Mark
(ii)	An explanation that makes reference to the following: • (mutation in the gene) changes the sequence of the amino acids (in the factor V molecule) (1) • (overactive factor V will) increase the production of thrombin (1) • increases blood clotting (1)	ALLOW the mutation results in a change to the {primary structure/ polypeptide chain} ALLOW increased risk of blood clotting	**(3)**

Q5.

Question Number	Answer	Additional Guidance	Mark
	An answer that makes reference to three of the following: • the water has an uneven distribution of charge (making it a dipole) (1) • so water forms hydrogen bonds with other water molecules (1) • (and) it requires a lot of { heat / thermal } energy to break these bonds (1) • and allow water to evaporate (taking the heat energy with it) / high latent heat of evaporation (1)	ALLOW description of dipole ALLOW – a lot of heat energy is required to evaporate water	**(3)**

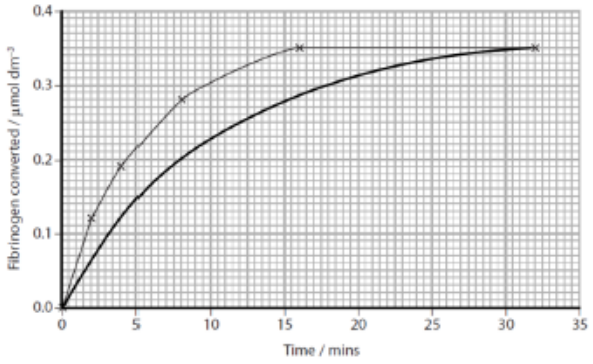
Q6.

Question number	Answer	Additional guidance	Mark
(i)	A description that makes reference to the following: • condensation (1) • involving OH groups (on both molecules) / water is formed (1)		(2)

Question number	Answer	Additional guidance	Mark
(ii)	An answer that makes reference to the following: • both are formed from two molecules of (α)glucose / both contain a glycosidic bond (1) • maltose has (α-)1,4 linkage and trehalose has (α-)1,1 linkage / in trehalose one of the glucose monomers is inverted (1)	ALLOW both are disaccharides of glucose DO NOT ALLOW β - glucose	(2)

Q7.

Question Number	Answer	Additional Guidance	Mark
(i)	• correct values taken from the graph (1) • correct answer with correct units (1)	Example of calculation 0.12 ÷ 2 = = 0.06 μmol dm^{-3} min^{-1} = 0.06 μmol per dm^3 per minute or = 0.001 μmol dm^{-3} s^{-1} = 0.001 μmol per dm^3 per second Correct answer with no units gains one mark Correct answer with correct units but no working gains full marks	**2**

Question Number	Answer	Additional Guidance	Mark
(ii)	• curve that is less steep but reaches the same plateau (1)	e.g. 	**1**

Question Number	Answer	Additional Guidance	Mark
(iii)	An explanation that makes reference to the following: • the slower the initial rate of reaction the longer it will take for a clot to form (1) • because fibrin will be produced more slowly (1)	Allow converse arguments	**2**

Q8.

Question Number	Acceptable Answer	Additional guidance	Mark
(a)	Measurement in 5.5 cm / 55 mm correct (1) 55 ÷ 60 = 0.92 mm (1)	need to measure on paper	**(2)**

Question Number	Acceptable Answer	Additional guidance	Mark
(b)(i)	An explanation that makes reference to the following: • very high heart rate makes it difficult to count (1) • so greater chance of error (1)		**(2)**

Question Number	Acceptable Answer	Additional guidance	Mark
(b)(ii)	Calculation of mean = 55 (1) Answer = 55 ÷20.2 = 2.72 (1)		**(2)**

Question Number	Acceptable Answer	Additional guidance	Mark
(b)(iii)	An explanation that makes reference to three of the following: • control of variables (1) • returning fleas to ambient temperature for specified time (1) • acclimatisation (1) • use smaller intervals (1)		**(3)**

Question Number	Acceptable Answer	Additional guidance	Mark
(c)	An answer that makes reference to the following: • undeveloped nervous system so don't feel pain and there aren't ethical issues (1) • unethical to use any living organism in an experimental procedure (1) • relativism would state that it is acceptable under certain circumstances to use invertebrates (i.e. if there is potential benefit to human health) (1) • absolutism promotes use of invertebrates under any circumstance or under no circumstance (1)		**(4)**

Q9.

Question Number	**Answer**	**Additional Guidance**	**Mark**
	An answer that makes reference to the following: • simpler nervous system / does not feel pain (1)	ALLOW – feels less pain	**(1)**

Q10.

Question Number	Acceptable Answer	Additional Guidance	Mark
(a)	pyruvate and { reduced coenzyme / reduced NAD }		**(1)**

Question Number	Acceptable Answer	Additional Guidance	Mark
(b)(i)	A description that makes reference to the following: • Final electron acceptor		**(1)**

Question Number	Acceptable Answer	Additional Guidance	Mark
(b)(ii)	An explanation that makes reference to the following: • carbon monoxide binds to cytochrome oxidase (1) • prevents oxygen binding to the enzyme (1) • blocks the electron transport chain / prevents oxidation of reduced electron carriers (1)		**(3)**

Question Number	Acceptable Answer	Additional Guidance	Mark
(c)	An explanation that makes reference to the following: • NO binds to cytochrome oxidase in endothelium (of blood vessels) (1) • diverts oxygen to smooth muscle cells (1) • contraction of muscle cells causes vasoconstriction in arterioles (1)		**(3)**

Question Number	Acceptable Answer	Additional Guidance	Mark
(d)	An answer that makes reference to three of the following: • free radicals interact with transcription factors (1) • activation of gene for P53 (1) • production of mRNA from activated gene (1)		

Question Number	Acceptable Answer	Additional Guidance	Mark
	• translation of mRNA (1) resulting in synthesis of P53 on ribosomes		**(3)**

Question Number	Acceptable Answer	Additional Guidance	Mark
(e)	A description that makes reference to three of the following: • inner membrane { is folded / has a larger surface area / has cristae } (1) • outer membrane is impermeable to H^+ ions (1) • only inner membrane contains { ETC (proteins) / ATP synthase / stalked particles} (1) • only inner membrane contains H^+ pump (1)		**(3)**

Question Number	Acceptable Answer	Additional Guidance	Mark
(f)	An answer that makes reference to the following: • myocardial infarction causes cell death in the heart (1) • due to lack of oxygenated blood reaching cardiac muscle cells (1) • NIR affects cytochrome oxidase involved in aerobic respiration (1) • diversion of oxygen to cardiac muscle cells would reduce death of these cells (1)		**(4)**

Question Number	Acceptable Answer	Additional Guidance	Mark
(g)(i)	A description that makes reference to the following: • restriction endonuclease enzyme (1) • extraction of gene that codes for light-sensitive protein (1) • use of a suitable vector (1) • insertion of gene into the { genome / DNA } in the nucleus of the neurone (1)		**(4)**

Question Number	Acceptable Answer	Additional Guidance	Mark
(g)(ii)	An explanation that makes reference to the following: • { depolarisation / action potential } occurs (1) • (nerve) impulse reaches { synapse / presynaptic membrane } (1) • calcium ion channels open causing calcium ions to enter presynaptic neurone (1) • vesicles containing neurotransmitter fuses with presynaptic membrane (1) • neurotransmitter released (1)		**(5)**

Question Number	Acceptable Answer	Additional Guidance	Mark
(h)	An explanation that makes reference to three of the following: • fMRI detects changes in blood flow in the brain (1) • MRI signal reflects state of haemoglobin / magnetic fields repelled by oxygen rich blood / deoxygenated haemoglobin more magnetic than oxygenated haemoglobin (1) • allows areas of greater brain activity to be detected as an image created by magnetic resonance (1) • areas of the brain that are involved in an auditory memory task { were using more oxygen / had an increased flow of blood } (1)		**(3)**

Q11.

Question Number	Answer	Additional Guidance	Mark
(i)	An explanation that makes reference to following: • the use of nandrolone reduces the (mean maximum percentage) recoil of the { aorta / artery } (1) and two from: • increased risk of damage to the endothelium of arteries (1) • inflammatory response / white blood cells accumulate (1) • build-up of { cholesterol / calcium salts / fibrous tissue } leads to formation of { atheroma / plaque } (1)		(3)

Question Number	Answer	Additional Guidance	Mark
(ii)	An answer that makes reference to three of the following: • nandrolone reduces the production of (both) proteins when exercise is allowed (1) • these proteins are involved in { ATP production / oxidative phosphorylation } (1) • nandrolone has no effect on ATP production if there is no exercise (1) • nandrolone reduces ATP production if exercise takes place (1)	ALLOW nandrolone has no effect on the production of the proteins in absence of exercise	(3)

Question Number	Answer	Additional Guidance	Mark
(iii)	An explanation that makes reference to the following: • without exercise the values for mRNA for Tfam overlap for groups with and without nandrolone (1) • as when exercise is carried out and nandrolone taken, the values for mRNA for Tfam overlap with no exercise and no nandrolone (1)	ALLOW overlap between groups P and Q ALLOW overlap between groups P and S	(2)

Q12.

Question Number	Answer	Additional Guidance	Mark
	An explanation that makes reference to the following: • {control / placebo} **(1)** • to allow a comparison with {A and B / the other groups} **(1)**		**(2)**

Q13.

Question Number	Answer	Additional Guidance	Mark
	An explanation that makes reference to two of the following: • lumen of capillaries blocked • preventing supply of {oxygen / glucose} (to tissues or cells) • therefore respiration stops (and tissues die) / anaerobic respiration causes build-up of lactic acid	ALLOW build-up of carbon dioxide	**(2)**

Q14.

Question Number	Answer	Additional guidance	Mark
	An explanation that makes reference to two of the following: • more elastic tissue to allow recoil (1) • more collagen to withstand high pressure (1) • more muscle tissue to maintain pressure in the aorta (1)	ALLOW converse argument for vena cava ALLOW 'to withstand high pressure' ALLOW converse argument for vena cava	**(2)**

Q15.

Question Number	Answer	Additional Guidance	Mark
	An explanation that makes reference to the following: • fibrin forms a mesh that collects {platelets / red blood cells} • (tranexamic acid) { prevents plasmin digesting fibrin / stops the breakdown of fibrin } • allowing clots to remain in place	ALLOW fibrin is involved in forming blood clots	**(3)**

Q16.

Question Number	Answer	Additional Guidance	Mark
(i)	An explanation that makes reference to the following: • fibrinogen concentration is higher in individuals with CVD (1) • compare an individual's fibrinogen concentration with values in the table (1) • no overlap between fibrinogen concentrations for those with CVD compared with those without CVD (1)	ALLOW females above 321and males above 324 or females above 328 and males above 329 are identified as being at risk ALLOW values above mean without CVD + SD or mean with CVD –SD identified as at risk	**3**

Question Number	Acceptable answer	Additional Guidance	Mark
(ii)	An explanation that makes reference to the following: • increased concentrations of fibrinogen leading to increased fibrin (1) • increase the risk of blood clotting / more frequent and extensive clotting (1) • blocking lumen of {arteries / capillaries} (1)		**3**

Q17.

Question Number	Acceptable Answer	Additional Guidance	Mark
(i)	An answer that makes reference to the following: • water (1) • glycosidic bond drawn correctly (1)		**(2)**

Question Number	Acceptable Answer	Additional Guidance	Mark
(ii)	maltose		**(1)**

Q18.

Question Number	Answer	Additional guidance	Mark
	An answer the makes reference to four of the following: • both have same volume (1)	ALLOW both have a volume of 64 mm^3	
	• animal A has a larger surface area (1)	ALLOW converse ALLOW figures given (e.g. 168 mm^2 v 96mm^2) or difference given as 72 mm^2	
	• animal A has a larger surface area to volume ratio (1)	ALLOW {168:64 / 2.6:1} compared to {96:64 / 1.5:1}	
	• so sufficient (surface area in animal A) for diffusion (1)	ALLOW converse	
	• distance to cells in centre of A is shorter than for B allowing {quicker/sufficient} diffusion / shorter diffusion distance (in A) (1)	ALLOW converse	**(4)**

Q19.

Question Number	Acceptable Answer	Additional Guidance	Mark
(a)(i)	A description that makes reference to the following: • gene is a length of DNA that codes for a { polypeptide / protein } (1) • genome is a complete set of { DNA / introns and exons } (1)		**(2)**

Question Number	Acceptable Answer	Additional Guidance	Mark
(a)(ii)	ligase / integrase		**(1)**

Question Number	Acceptable Answer	Additional Guidance	Mark
(a)(iii)	plasmid / virus		**(1)**

Question Number	Acceptable Answer	Additional Guidance	Mark
(a)(iv)	A description that makes reference to the following: • transcription of DNA to mRNA (1) • { translation of mRNA / protein synthesis } (1) on ribosomes		**(2)**

Question Number	Acceptable Answer	Additional Guidance	Mark
(b)	An explanation that makes reference to the following: • no prothrombin activated so thrombin not produced (1) • thrombin needed to convert fibrinogen to fibrin (1) • fibrin needed to trap { platelets / blood cells } to form the (blood) clot (1)		**(3)**

Q20.

Question Number	Answer	Additional Guidance	Mark
	• two obesity-related conditions given (1)	e.g. diabetes / wear and tear on joints / sleep apnoea / increased risk of cancer / {increased blood pressure /hypertension} / {CVD / CHD} / atherosclerosis / stroke / {heart attack / myocardial infarction } ALLOW one obesity-related condition and a relevant idea of a negative effect on the NHS	**(1)**

Q21.

Question Number	Acceptable Answer	Additional Guidance	Mark
(i)	An explanation that makes reference to the following: • low blood glucose levels (1) • less glucose for respiration (1) • less { energy / ATP } in muscle tissue (1)		**(3)**

Question Number	Acceptable Answer	Additional Guidance	Mark
(ii)	An answer that makes reference to the following: • range of enzyme concentration (1) • control of other named variables (1) • measurement of rate of glucose production (1)	e.g. temperature, pH, concentration of substrate	**(3)**

Q22.

Question number	Answer	Mark
(i)	**The only correct answer is D – hydrolysis** ***A*** *is not correct because anabolism is associated with forming more complex molecules* ***B*** *is not correct because catalysis is a general term for enzyme controlled reactions* ***C*** *is not correct because glycolysis is a sequence of reactions in respiration*	(1)

Question number	Answer	Additional guidance	Mark
(ii)	An explanation that makes reference to the following: • glucose used in respiration to provide { energy / ATP } (1) • glycogen is a polymer of glucose (1) • glycogen has lots of { branches / terminal ends } so it can release glucose rapidly (1) • breakdown of trehalose { makes two molecules of glucose available / provides a more immediate source of glucose } (1)	ALLOW glycogen contains lots of glucose ALLOW quickly hydrolysed	(4)

Q23.

Question Number	Answer	Additional Guidance	Mark
(a)	1. proteins consist of amino acids joined together by peptide bonds; 2. credit reference to named bonds (between R groups) involved in holding {3D structure / eq} ; 3. carbohydrates consist of {monsaccharides / glucose / eq} ; 4. reference to glycosidic {bonds / eq} between (adjacent) {glucose / eq} molecules ;		**(3)**

Question Number	Answer	Additional Guidance	Mark
(b)	1. idea that the drugs could {bind to / alter shape of} {glycoproteins / gp120} ; 2. idea that drugs bind to {receptors / antigens} on membrane / eq ; 3. called CD4 (antigen / molecules) ; 4. preventing virus attaching to T (helper / $CD4^+$) cells / eq ;		**(3)**

Question Number	Answer	Additional Guidance	Mark
***(c)**	(QWC – spelling of technical terms must be correct and the answer must be organised in a logical sequence) 1. reference to reverse transcriptase ; 2. idea of formation of (viral) DNA ; 3. from (viral) RNA ; 4. reference to integrase ; 5. idea of integration of (viral) DNA into (host) DNA ; 6. idea that {T helper cells / eq} would be {destroyed / killed / burst / eq} (by virus particles leaving cell) ; 7. idea that more T (helper) cells would become infected ;	**QWC focussing on clarity of expression** 2. reject idea that RNA is {turned into / converted into} DNA 5. ACCEPT idea of {latency / formation of provirus / eq}	**(5)**

Q24.

Question number	Answer	Additional guidance	Mark
	A description that makes reference to the following: • starch can be {broken down / hydrolysed} into glucose (1) • by hydrolysis of the glycosidic bonds (1) • glycogen is formed by condensation reaction forming glycosidic bonds (between glucose molecules) (1)		Expert (3)

Q25.

Question Number	Answer	Additional Guidance	Mark
(i)	B (hydrolysis)		**(1)**

Question Number	Answer	Additional Guidance	Mark
(ii)	B (C - O - C)		**(1)**

Mark Scheme

Q1.

Question Number	Answer	Mark
(i)	**B** - X *The only correct answer is **B*** ***A** is incorrect because W is a relay neurone* ***C** is incorrect because Y is a motor neurone* ***D** is incorrect because Z is a multipolar neurone*	**(1)**

Question Number	Answer	Mark
(ii)	**D** - sugar molecules which are joined by glycosidic links *The only correct answer is **D*** ***A** is incorrect because glycolipids are not made of amino acids* ***B** is incorrect because glycolipids are not made of amino acids* ***C** is incorrect because sugar molecules are not joined by ester bonds*	**(1)**

Question Number	Answer	Additional Guidance	Mark
(iii)	An answer that makes reference to three of the following: • { form synapses / connections } with other neurones (1) • { integrate / receive } impulses from other neurones (1) • involved in summation • { propagate a signal / initiate an action potential } to the {cell body / axon}		**(3)**

Q2.

Question Number	Answer	Mark
(i)	**C** – location of a gene on a chromosome *The only correct answer is **C*** ***A** is incorrect because locus is not the genetic code for a protein* ***B** is incorrect because a centromere holds together sister chromatids and not a locus* ***D** is incorrect because a locus is not the paternal part of a genome*	**(1)**

Question Number	Answer	Additional Guidance	Mark
(ii)	An answer that makes reference to three of the following: Similarities • both have a carboxylic acid group • both have { hydrocarbon chains / chains formed from only hydrogen and carbon } Differences • saturated fatty acids have { no carbon to carbon double bonds / only have carbon to carbon single bonds } • saturated fatty acids are straight chains and unsaturated fatty acids have { bent chains / a kink in the chain }	ALLOW annotated diagrams used show similarities and differences ALLOW COOH ALLOW description of hydrocarbon chains ALLOW converse for unsaturated fatty acids	**(3)**

Q3.

Question Number	Answer	Additional Guidance	Mark
(i)	An answer that makes reference to one of the following: • { identify / remove } any anomalies (1)	ALLOW to gain more repeatable data ALLOW outliers for anomalies	
	• to calculate a mean / can make valid comparisons (1)	ALLOW produce / form for calculate	**(1)**

Question Number	Answer	Additional Guidance	Mark
(ii)	An explanation that makes reference to the following: • (because time is required) for the alcohol to be absorbed (1) • (because time is required) for acclimatisation (1)	ALLOW getting used to the new conditions / overcoming stress of being moved	(2)

Q4.

Question Number	Answer	Additional Guidance	Mark
	An answer that makes reference to the following: • alcohol concentrations between 0.00 and 0.17 mol dm^{-3} (1) • controlling one biotic variable (1) • controlling one abiotic variable (1) • determine the concentration at which the *Daphnia* show a decrease in heart rate (1) • use of microscope to count heart beats of *Daphnia* (1)	e.g. age, size, sex, species of *Daphnia,* e.g. temperature, volume of alcohol ALLOW the concentration at which the mean heart rate drops below 221 beats per minute	(5)

Q5.

Question Number	Answer	Additional guidance	Mark
	An answer that makes reference to the following: • cauliflower extract from same mass (of cooked and uncooked cauliflower) (1) • description of titration of cauliflower extract with DCPIP (1) • using same {volume / concentration} of DCPIP (1) • determine the vitamin C content in cooked and uncooked cauliflower by comparing with solution of known vitamin C concentration (1)	ALLOW cauliflower extracts of the same concentration produced e.g. volume of cauliflower extract taken to decolourise the DCPIP ALLOW volume of DCPIP added to cauliflower extract until the DCPIP is no longer decolourised e.g. by using a vitamin C calibration curve	**(4)**

Q6.

Question number	**Answer**	**Additional guidance**	**Mark**
	An explanation that makes reference to two of the following: • water is a component of blood (1) • ions are charged (1) • dipole nature of water allows it to {surround / bond to / interact with} ions (1)	IGNORE water and ions form hydrogen bonds	**(2)**

Q7.

Question Number	Answer	Mark
(i)	• D validity *The answer is not A as controlling the variety of mice does not improve data accuracy* *The answer is not B as controlling the variety of mice does not improve data precision* *The answer is not C as controlling the variety of mice does not improve data reliability*	**(1)** **Comp**

Question Number	Answer	Additional Guidance	Mark
(ii)	An answer that makes reference to the following: • there is no difference in { the number of offspring born / fertility } { if genetically modified or not / if supplied drug K or not / between the treatments }	IGNORE 'significant' ALLOW between the groups	**(1)** **Exp**

Question Number	Answer	Additional Guidance	Mark
(iii)	An answer that makes reference to the following: • { the GM mice / group P } had very few offspring (1) • therefore raised HDL levels lead to reduced fertility (1) • {non-GM mice / group R } had fewer offspring than {group Q / GM mice given drug K } (1) • suggesting that HDL levels below a certain concentration reduce fertility (1)	ALLOW GM mice had fewest offspring ALLOW converse ALLOW converse ALLOW – some HDL required for fertility	**(4)** **Exp**

Q8.

Question number	Answer	Additional guidance	Mark
	An explanation that makes reference to three of the following points: • pressure increases in the ventricles (1) • greater pressure (in the ventricles) than in the { atria / arteries } (1) • causing atrioventricular valves to close (1) • causing the semilunar valves to open / forcing blood into the arteries (1)	IGNORE reference to events during atrial systole	(3)

Q9.

Question Number	Acceptable Answer	Additional Guidance	Mark
(i)	An answer that makes reference to the following: • as heart rate increases, so does incidence of {both conditions / CHD and cancer } **(1)** • relationship between heart rate and CHD quantified **(1)** • relationship between heart rate and cancer quantified **(1)** • greater increase in incidence of cancer with increased heart rate **(1)** • at a heart rate >99bpm there is a reduction in incidence of both conditions / plateaus / little difference **(1)**	ALLOW converse e.g. 1.95x increase up to 99 bpm / 1.88x increase at >99 e.g. 4.0x increase up to 99 bpm / 3.8x increase at >99 ALLOW converse	**(5)**

Question Number	Answer	Additional Guidance	Mark
(ii)	An answer that makes reference to the following: • mid heart beat rate is more common in the (general) population / heart rate is normally distributed in the population **(1)** • fewer people available at low and high heart rate because of other health risks **(1)**	ALLOW high and low heart rates are less common	**(2)**

Question Number	Answer	Additional Guidance	Mark
(iii)	An answer that makes reference to two of the following: • still (statistically) a large sample size **(1)** • wide range of heart rates considered **(1)** • percentage incidence used (rather than number) **(1)**		**(2)**

Q10.

Question Number	Answer	Additional Guidance	Mark
	• hydrolysis		**(1)**

Q11.

Question number	Answer	Additional guidance	Mark
	An explanation that makes reference to the following: • beta-blockers reduce blood pressure (1) • therefore reducing the risk of {atherosclerosis / heart disease /CVD} (1)	ALLOW prescribed to people with {highblood pressure / irregular heart beat / anxiety} ALLOW because high blood pressure can {cause atherosclerosis / damage the endothelium} ALLOW heart attack	(2)

Q12.

Question Number	Answer	Mark
	The only correct answer is A - the ventricles contract, atrioventricular valves close and semilunarvalves open *B is incorrect because the AV valves do not open* *C is incorrect because the ventricles do not relax* *D is incorrect because the semilunar valves do not close*	**(1)**

Q13.

Question Number	Acceptable Answer	Additional Guidance	Mark
(a)	17.0 ÷140 (1) =121.43 cm^3 (1)		**(2)**

Question Number	Acceptable Answer	Additional Guidance	Mark
(b)(i)	An explanation that shows elements of reasoning /justification in the form of a linked response from the following points: • the higher pressure is in the left ventricle / lower pressure is in the right ventricle (1) • because the left ventricle has more muscle (1) • because it needs a higher pressure to get blood through the aorta to the body (except lungs) (1)	Allow appropriate structural consequential comments for right ventricle.	**(3)**

Question Number	Acceptable Answer	Additional Guidance	Mark
(b)(ii)	D		**(1)**

Q14.

Question Number	Answer	Additional Guidance	Mark
(i)	• calculation of { largest difference in concentration / largest value at 0 minutes and smallest value at 30 minutes } (1) • calculation of rate of decrease in nicotine concentration per minute (1)	Example of calculation (35.0 + 9.3) / 44.3 and (24.1 – 5.6) / 18.5 25.8 ÷ 30 = 0.86 Correct answer without working gains full marks	**(2)**

Question Number	Answer	Additional Guidance	Mark
(ii)	An answer that makes reference to two of the following: • percentage change greater for {the lower concentration of / 0.1 mg } nicotine (1) • a higher concentration causes a positive (percentage) change whilst the lower concentration leads to a negative (percentage) change (1) • correct calculation of percentage change for both rat groups (1)	2.08% for { 1.0 mg nicotine / group A } and 6.25% for { 0.1mg nicotine / group B }	**(2)**

Question Number	Indicative content
*(iii)	Answers will be credited according to candidates' deployment of knowledge and understanding of 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 which is relevant. Additional content included in the response must be scientific and relevant. Give examples of relevant biological knowledge and understanding: <u>Validating the statement</u> • Investigation involved rats inhaling nicotine which humans do during smoking • Rats are mammals so can extrapolate to humans <u>Not validating the statement</u> • Nicotine inhaled (for both nicotine concentrations) leads to vasoconstriction and then vasodilation and then returns to original diameter • Blood pressure for 1mg nicotine concentration increases and decreases but drops below original value • Presence of nicotine leads to noradrenaline release which increases heart rate • Blood pressure (for both nicotine concentrations) increases and decreases • No reference to rats inhaling smoke, only nicotine • Rats are not the same as humans • Sample size too small to make a valid statement <u>Comment</u> • whether agree or disagree with statement

			Additional guidance
Level 0	Marks	No awardable content	
Level 1	1-2	Limited scientific judgement made with a focus on mainly just one method, with a few strengths/weaknesses identified. A conclusion may be attempted, demonstrating isolated elements of biological knowledge and understanding but with limited evidence to support the judgement being made.	An answer that refers to just one piece of evidence – either lumen size or blood pressure Simple conclusion drawn from the evidence
Level 2	3-4	A scientific judgement is made through the application of relevant evidence, with strengths and weaknesses of each method identified. A conclusion is made, demonstrating linkages to elements of biological knowledge and understanding, with occasional evidence to support the judgement being made.	An answer that refers to evidence concerning both lumen size and blood pressure Links made between lumen size, vasoconstriction and blood pressure
Level 3	5-6	A scientific judgement is made which is supported throughout by sustained application of relevant evidence from the analysis and interpretation of the scientific information. A conclusion is made, demonstrating sustained linkages to biological knowledge and understanding with evidence to support the judgement being made.	An answer that refers to data about vasoconstriction and vasodilation and links it to effect of nicotine on the release of noradrenaline and therefore on blood pressure Conclusion made considering validity of data collected from rats and how it can be applied to humans

Q15.

Question number	Answer	Additional guidance	Mark
	An answer that makes reference to the following: • (strong) positive correlation	ALLOW velocity of blood flow is (directly) proportional to the lumen diameter ALLOW description of relationship e.g. as lumen diameter increases velocity of blood flow increases	**(1)**

Q16.

Question number	Answer	Additional guidance	Mark
(i)	A description that makes reference to the following: • the allele (G20210A) increases the risk of suffering a deep vein thrombosis / two copies of the allele (G20210A) increases risk (1) • there is a {2.5 fold increase in risk with one allele / 20 fold increase in risk with two alleles / 8-fold increase in risk with two alleles compared to one allele} (1)	ALLOW abbreviations for G20210A ALLOW DVT IGNORE 1.5 x, 17.5 x and 19 x as these come from incorrect subtractions of risk factors	**(2)**

Question number	Answer	Additional guidance	Mark
(ii)	Choose an item. • correct proportion of homozygous individuals calculated (1) • correct probabilities (p and q) determined for Hardy-Weinberg equation (1) • correct number of heterozygotes determined (1)	Example of calculation P^2 or q^2 = 0.005 p =0.0707 q = 0.9293 or 2pq = 0.1314 = 10 000 x 0.1314 = 1314 ALLOW p = 0.071 and q = 0.929 or 2pq = 0.1319 = 10 000 x 0.1319 = 1319 ALLOW three marks for 1302 ALLOW two marks for 1300 Correct answer with no working gains full marks	**(3)**

Q17.

Question Number	Answer	Additional guidance	Mark
	An explanation that makes reference to the following: • hydrolysis / description of hydrolysis (1) • of glycosidic bonds (1)		**(2)**

Q18.

Question Number	Answer	Additional guidance	Mark
	A description that makes reference to two of the following: • polysaccharide made up of many monosaccharide components (1) • joined together by {condensation reactions / glycosidic bonds} (1) • (only)1-4 glycosidic bonds present / no 1-6 glycosidic bonds present(1)	ALLOW chain of glucose molecules	**(2)**

Q19.

Question Number	Answer	Additional Guidance	Mark
(i)	A description that makes reference to two of the following: • the valves are open { when atria contract / atrial systole / when blood pressure greater in atria (than ventricles) } (1) • the valves close { when ventricles contract / during ventricular systole/when pressure greater in ventricles (than atria) } (1) • valves prevent backflow of blood into the atria during ventricular systole (1)	ALLOW valves open to allow blood to flow from atria to ventricles ALLOW tendons prevent valves from inverting during ventricular systole	**(2)** **Exp**

Question Number	Answer	Additional Guidance	Mark
(ii)	An explanation that makes reference to the following: • { larger lumen / less muscle (in walls) / thinner walls } (1) • explanation { larger lumen as blood pressure lower / less muscle because contraction not needed to push blood back to the heart } (1)	IGNORE valves ALLOW thinner walls linked to lower blood pressure	**(2)** **Exp**

Q20.

Question number	Answer	Additional guidance	Mark
(i)	An explanation that makes reference to the following: • atheroma {reduces the diameter of / narrows} the lumen of arteries (1) • therefore reducing (the velocity of) blood flow (1)	ALLOW {atherosclerosis / plaques} reduce the diameter of the lumen of arteries ALLOW {atheroma / atherosclerosis / plaques} partially block the arteries	(2)

Question number	Answer	Additional guidance	Mark
(ii)	An explanation that makes reference to two of the following: • reduce supply of oxygen to the heart muscle (1) • resulting in reduced aerobic respiration (1) • resulting in {weaker heart muscle contraction / death of heart tissue} (1)	ALLOW less oxygen for respiration ALLOW more anaerobic respiration ALLOW causing heart muscle to contract more frequently ALLOW heart muscle contracts more slowly	(2)

Q21.

Question Number	Answer	Mark
(i)	**The only correct answer is B 1** The only conclusion that can be valid for these results is that 'each vegetable contains less vitamin C when it is cooked than uncooked' *A is incorrect because there is one valid conclusion* *B is incorrect because there is only one valid conclusion* *C is incorrect because there is only one valid conclusion*	**(1)**

Question Number	Answer	Additional guidance	Mark
(ii)	• recommended daily value divided by concentration in cooked cauliflower (1) • correct mass of cauliflower calculated (1)	<u>Example of calculation</u> (90 ÷ 20) = 4.5 450 g ALLOW 450 000 mg Correct answer with no working gains full marks	**(2)**

Q22.

Question Number	Answer	Additional Guidance	Mark
	An answer that makes reference to the following: • TENS provides pain relief **(1)** • high frequency {most effective / more effective than low frequency} **(1)** • quantified difference between before TENS and after TENS to show that A was the largest **(1)** • there was overlap between the {low frequency TENS / B} and {TENS with no pulses / placebo / control / C} **(1)**	ALLOW TENS is effective {4.8 / 65.8%} pain relief reduction for group A but only {2.8 /38.4% for group B} / {2.3 / 37.7% for group C}	**(4)**

Q23.

Question Number	Answer	Additional Guidance	Mark
	An answer that makes reference to the following: • BMI calculation for 2017 (1) • interpretation of data for BMI (1)	26.51 / 26.5 ALLOW if written in the table (just) in overweight category	(2)

Q24.

Question Number	Answer	Additional Guidance	Mark
	A description that makes reference to the following: • women requiring {pain relief / surgical intervention} (when they gave birth) **(1)** • condition of mothers **(1)**	e.g. same age / same number of babies / no pre-existing pain medication / same gestation period	**(2)**

Q25.

Question Number	Answer	Mark
(i)	**D** – is correlated with a reduction in CVD *The only correct answer is **D*** ***A** is not correct because the incidence of CVD decreases with increasing magnesium ion intake and it is not possible to infer causation from the data* ***B** is not correct because it is not possible to infer causation from the data in graph* ***C** is not correct because the incidence of CVD decreases with increasing magnesium ion intake*	**(1)**

Question Number	Answer	Mark
(ii)	**B** – 78 mg day^{-1} *The only correct answer is **B*** ***A** is not correct because 43 is the increase required to achieve a 0.05 reduction in relative risk* ***C** is not correct because 118 is the Mg^{2+} intake that is associated with a 0.25 reduction in relative risk* ***D** is not correct because 347 is the correct column chosen with no subtraction*	**(1)**