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General Certificate of Education (A-level)
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Human Biology HBIO1

(Specification 2405)

Unit 1: The Body and its Diseases

Final

Mark Scheme

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Question	Marking Guidance	Mark	Comments
1(a)	**A** – receptor /extrinsic (protein); **B** – transmembrane/intrinsic/channel/carrier (protein); **C** – phospholipid;	3	Accept glycoprotein/antigen Accept hydrophobic tail Ignore ref. to bilayer
1(b)	Cell wall; Capsule/slime layer; (Bacterial) flagellum; Circular DNA/chromosome; Plasmid; Mesosome;	2 max	Accept smaller/70S ribosome(s) Accept DNA without histone Reject capsid

Question	Marking Guidance	Mark	Comments
2(a)	Reverse transcriptase; Enzyme uses (HIV) RNA to make DNA (copy); DNA joined to (host) cell's DNA/chromosome; DNA used to make HIV RNA (copies); And HIV capsid proteins/enzymes; Made at (host) ribosomes; Assembly of new virus particles; Budding off from membrane (of host cell);	4 max	Accept integrase/description of action of Accept (HIV) DNA replicated when (T) cell divides
2(b)	Not enough/no T-cells to activate B-cells/lead to antibody production/activate immune system; Person unable to fight /more prone to (opportunistic) infections/cancer; Example of infection/cancer;	2 max	Accept death of T-cells weakens the immune system Accept diseases E.g. TB, pneumonia, cryptosporidium

Question	Marking Guidance	Mark	Comments
3(a)	Active transport against / facilitated down with concentration gradient; Active transport uses ATP/energy, /facilitated doesn't; Active uses carrier (proteins), / facilitated (often) uses channel (proteins);	2 max	Accept answers in terms of water potentials Reject – along/across gradient
3(b)	Lipid/fatty acid part of membrane is non-polar/hydrophobic; Oxygen and carbon dioxide small/ non-polar (molecules); Oxygen/carbon dioxide can diffuse through/dissolve in/get between molecules in this layer; Down a concentration gradient;	2 max	Accept lipid/fatty acid bilayer
3(c)	Brings more oxygen/removes carbon dioxide; Maintains diffusion/concentration gradients; Between alveoli and blood/capillaries;	2 max	Reject references to surface area

Question	Marking Guidance	Mark	Comments
4(a)	Protein; Catalyst; (For reaction involving a) specific substrate; Lowers activation energy;	2 max	Accept speeds up a reaction (but is not changed by the reaction)
4(b)	Enzyme D binds/collides with substrate E; Active site forms/changes shape to fit substrate/E; (By) induced fit; (As) enzyme-substrate complex forms; (Breaks down to give) products F and G; Enzyme is unchanged (at end);	3 max	Ignore lock and key references Max 2 if no reference to letters

Question	Marking Guidance	Mark	Comments
5(a)	SAN/sinoatrial node (starts each beat); Beats initiated in/by the heart/originates in/doesn't need stimulation by nerve/nerve impulses to contract/beat;	2	Accept beats on its own
5(b)	First-degree block; Each contraction/electrical activity of the atria is followed by ventricle contraction/activity of AVN (so not second or third-degree); But there is a long delay; During block, compared to rest of trace/normal;	3 max	Accept any qualified delay
5(c)	Provide (electrical) stimulation to/regulates ventricles/AVN/Bundle of His; To make the heart contract at correct time/ (straight) after atria/shorten the delay;	2	

Question	Marking Guidance	Mark	Comments
6(a)	Veins taken (from leg); Used to by-pass blockage (in coronary artery); Increasing/allowing blood flow to (heart) muscle/tissue/cell;	2 max	Accept 'blood vessel' but reject 'capillary'
6(b)	(Slight) negative correlation; As (average energy intake as) fat increases, (slight) decrease in CHD/ deaths;	2	
6(c)	Suitable reason; with explanation; e.g. Average fat intake given; Might be individuals taking in lots of fat (and so getting CHD); This is all saturated fats; Some might cause more CHD than others; Dietary advice quite recent; May take time to affect diet/CHD; Other factor that affects CHD/the results (in population); Named example (e.g. smoking); Correlation weak/not clear/doesn't prove causal link; Need more results/stats to show if significant; Need experimental work to prove relationship;	2 max	Accept something else causing greater CHD

Question	Marking Guidance	Mark	Comments
7(a)	Faulty CFTR protein/chloride ion channel/carrier (protein); Not enough chloride ions moved <u>out</u> of (epithelial) cells / into mucus; Water potential of mucus not low enough; Water does not enter mucus (from cells)/water remains in cells;	3 max	Accept faulty CFTR gene
7(b)	To show any effects due to antitrypsin/not due to saline; To give baseline/starting levels to compare against;	1 max	Reject control unqualified Reject compare unqualified Accept to compare against alpha-1-antitrypsin/drug
7(c)	Fewer bacteria, so fewer infections/white cells (that damage lungs); (Fewer white cells) so less trypsin/elastase/enzymes to damage lungs; Fewer white cells suggests less inflammation (which leads to damage);	2 max	Ignore reference to FEV

7(d)	Treatment can't reverse/repair damage already done; Treatment only prevents further damage/doesn't effect the lung tissue (directly) / only effects enzymes; Treatment not long enough (to produce change); Takes time for lung tissue to repair;	2 max	Ignore references to time for mucus to clear

Question	Marking Guidance	Mark	Comments
8(a)	Droplet (infection); People inhale drops/bacteria;	2	Ignore references to coughs and sneezes
8(b)	Allows comparison (between cultures); With different numbers of bacteria/sample sizes; ***OR*** Respiration supplies energy for growth/survival of bacteria; So reduction indicates less growth/death of bacteria/antibiotic/meropenem working;	2 max	Accept different sizes of culture
8(c)	(Trend) respiration <u>reduced</u> <u>more</u> with clavulate; Greater decrease with increasing concentration (of meropenem); Could be due to greater death of bacteria; But reduced respiration may not mean bacteria are dead/bacteria might be less active not dead;	2 max	
8(d)	Clavulate binding causes change in shape of enzyme/binds to active site; Change in shape prevents formation of active site/binding of substrate/ binding to active site prevents formation of ES complex;	2	Accept ref. to competitive or non-competitive inhibitors Accept alters specificity/loses specificity/denatured

Question	Marking Guidance	Mark	Comments
9(a)	Zevalin/antibody binds to specific receptor/cell surface protein/antigen; (Only found) on B-cells;	2	
9(b)	Patient **P** treated with Zevalin/yttrium (no mark), Where indium/antibody (only) on lymphatic system/groin and armpits; So only (cancerous) B-cells killed; In patient **P** high concentration of radioactivity/antibodies high enough to kill cancer cells; Patient **Q** – radioactivity in places where other body cells could be killed/organs damaged/named example; Could harm patient more than cancer; Patient **Q** cancer has spread; So too late to treat;	3 max	Assume 'Zevalin' means 'with yttrium' unless they state otherwise
9(c)	Patient **Q** – (cancerous) B-cells outside of lymphatic system/metastasis; <u>So</u> antibody bound in other parts of the body (as well); Patient **Q** – has different receptors/distribution of receptors compared to patient **P**; Other body cells (than B-cells) have receptors for antibody;	2 max	

9(d)	Might be allergic to mouse antibody/protein; (Mouse) antibody acts as an antigen; Causes an immune response/antibody production; Antibody destroys Zevalin; Releases radioactivity into body/prevents activity against the cancer;	2 max	

Question	Marking Guidance	Mark	Comments
10(a)	Two suitable ways;; with explanation;; e.g. No (green) vegetables; So low in fibre/mineral ions/vitamins; (Burger) high in saturated/animal fats; So increasing risk of atheroma formation/coronary heart disease; (Burger/chips) high in fats/joules/calories; So a lot of energy intake (leading to fat formation/obesity); Chips high in starch/carbohydrate; (So) no/little vegetable content/so a lot of energy intake (leading to fat formation/obesity);	4 max	Accept named vitamin/mineral ion
10(b)	Increases blood volume; Increasing resistance to flow/makes heart work harder/puts more liquid in a closed system;	2	
10(c)	(High blood pressure) in arteries; Damages lining/endothelium/epithelium; Damaged area invaded by white blood cells/foam cells; Plaque forms/description of formation; Calcium deposits (in plaque);	4 max	Max 3 if no reference to arteries Accept ref. to increased turbulence in blood flow (leading to damage)

10(d)	7 × 1160 divided by 32 300; 0.25 kg;;	2	I mark for sum 2 marks for correct answer
10(e)	Made from two monosaccharides/single sugars; Joined together / condensation reaction;	2	 Accept glycosidic bond

10(f)	Suitable evaluations, e.g. It's the balance (in the diet) that matters; It's the total amount eaten that matters; Agree, Fruit (juice) contains sugar/named example; Which contain a lot of energy; So, drinking a lot of this will/could lead to weight/mass gain; The sugar in fruit/fruit drinks could make children thirstier, so drink more sugar-containing drinks; (Some) vegetables/vegetable juices do not contain (much) sugar/ disaccharides/sucrose/fructose, so less fattening; Disagree, (Some) vegetables may contain a lot of starch/polysaccharides/sugars that could be fattening; Fruit juice contains less sugar than fizzy drinks; Fruit/fruit juice/vegetables also contain, Useful vitamins, such as e.g.; And mineral ions, such as e.g.; And fibre; And starch/sugars as an energy source rather than fat/low GI; Fruit juice still contains less sugar than fizzy drinks;	6 max	Maximum of 5 marks if they only consider one side of the argument