1)

(a)	Any 3 of the following: 1. consists of (α) glucose ; 2. (joined by 1,4 / 1,6) glycosidic bonds ; 3. branched structure / eq ; 4. idea of compact structure ; Any 3 of the following: 5. idea that it is {easily / rapidly / eq} hydrolysed ; 6. (leading to) more {glucose / eq} in a smaller space (in a cell)/ eq ; 7. idea of low solubility ; 8. it does not diffuse out of cells /eq ; 9. it has no osmotic effect / eq ;	**(4)**
(b)(i)	1. increasing intensity {increases carbohydrate use / decreases fat use / eq} / eq ; 2. {low intensity exercise / intensity below {39 / 40} au} uses more energy derived from fats / eq ; OR {high intensity exercise / intensity above {39 / 40} au} uses more energy derived from carbohydrates / eq ; 3. at {39 / 40} au both sources of energy used equally / eq ; 4. credit correct manipulation of figures to compare energy usage ;	**(3)**
b)(ii)	1. idea that this diet is suitable for {a high intensity / eq} event ; 2. credit suitable example of athletic event e.g. any endurance or power event ; 3. reference to more carbohydrate being used (than fat) above {39 / 40} a.u. / eq ; 4. reference to carbohydrate being stored as glycogen ; 5. idea of {maximum / more / lots of} glycogen (stored) ; 6. idea that breakdown of glycogen provides energy (for the event) ;	**(3)**

2)

(a)(i)	1. different tissues have different activities of catalase / eq ; 2. Z has highest (activity) / eq ; 3. Y has the lowest (activity) / X and Y have very similar levels / eq ; 4. credit correct manipulation of figures e.g. Z has 12 more than Y / Z has 11 more than X ;	(3)
(a)(ii)	1. idea activity in mussel E is not higher than M in all tissues ; 2. mussel E has lower (activity) in tissue X / eq OR (activity) is the same in tissue Y / eq OR mussel E has higher (activity) in tissue Z / eq ; 3. mussel E has more (overall activity)/ eq ; 4. credit correct comparative manipulation of figures ; 5. Idea that both mussels have tissues with same order of activity e.g. Y X Z ;	(2)
(b)	1. reference to measuring volume of oxygen ; 2. suitable reference to time e.g. oxygen produced in unit time, time taken to produce same volume of oxygen ; 3. idea of measuring the initial rate of reaction ; 4. reference to controlled variable in relation to the mussel e.g. age, part of mussel, mass, surface area ; 5. reference to a controlled variable in relation to the experiment e.g. volume of hydrogen peroxide, temperature, concentration, pH ; 6. suitable reference to repeats ;	(4)

3)

* (a) QWC	(QWC – Spelling of technical terms must be correct and the answer must be organised in a logical sequence) 1. {damage / eq} to {endothelial cells/ epithelial cells / lining / eq} of artery ; 2. ref to inflammatory response ; 3. ref to migration of white blood cells into area / eq ; 4. build up of cholesterol /eq ; 5. reference to formation of atheroma / plaque ; 6. reference to {calcium salts / fibrous tissue} ; 7. ref to {loss of elasticity (of artery) / narrowing of lumen} / eq ; 8. idea that this process is self–perpetuating ;	(4)
b)(i)	{the alleles / eq} present (in an organism) / eq ;	(1)
b)(ii)	a (different) form of one gene / eq ;	(1)
c)	Any **two** from: More saturated fat / more cholesterol / more salt /obesity / more alcohol / more age / male / post-menopausal women / high blood pressure / smoking / diabetes / less activity / stress ;	(1)
(d)	1. muscle {inflammation / pain / eq} ; 2. liver {damage / failure/ eq} ; 3. joint {aches / pains/ eq} ; 4. nausea/constipation/diarrhoea ; 5. kidney {damage / failure / eq} ; 6. cataracts ; 7. diabetes ; 8. allergies / skin inflammation / skin rash / eq ; 9. respiratory problems / persistent cough / eq ; 10. headaches / dizziness / depression ;	(2)

4)

(a)	<table><tr><td>x</td><td>✓</td></tr><tr><td>✓</td><td>x</td></tr></table> ;; [Any two correct for one mark]	(2)
(b)(i)	amniocentesis / chorionic villus sampling / CVS ;	(1)
(b)(ii)	1. idea of right to life ; 2. abortion is murder / ref to risk of miscarriage / eq ; **Or:** 3. false positive / negative / eq ; 4. consequences of false result e.g. abortion of (healthy) fetus ; **Or:** 5. who has right to decide if tests should be performed / eq ; 6. {implications of medical costs / discrepancies over next step} / parents {have a right to know / can prepare / eq} ; **Or:** 7. issues relating to confidentiality of {parents / child} / eq ; 8. idea that {some other abnormality may be found / paternal DNA does NOT match / other family members have right to know results} ; **Or:** 9. if abnormality found / eq ; 10. consequence of abnormality found e.g. abortion, comment on possible problems with {future employment / insurance / what constitutes a serious condition} / eq ; **Or:** 11. damage to fetus / risk of miscarriage ; 12. loss of fetus / risk to mother / eq ; **Or:** 13. ref. to stress to parents /eq ; 14. consequences of stress e.g. increased risk of miscarriage ;	(2)
(c)(i)	1. reference to faulty {alleles / genes / DNA / eq} ; 2. idea that gene therapy uses {normal / functioning / healthy} {alleles / genes / eq} ; 3. so the normal {protein / gene product / RNA / eq } is produced (by the cells) / eq ;	(2)
(c)(ii)	1. reference to using {alleles / genes / eq} coding for the CFTR {protein / channel} ; 2. reference to introducing the {alleles / genes / eq} into the cells ; 3. of the {lungs / pancreas / reproductive tracts / eq} ; 4. that produce mucus / eq ; 5. using a {vector / named vector} ; 6. credit suitable delivery mechanism e.g. nebuliser, injection ; 7. idea that treatment needs to be repeated (due to cell replacement) ;	(3)

5)

(a)	1. platelets ; 2. thromboplastin ; 3. enzymes ; 4. prothrombin ; 5. thrombin ;	NB: allow phonetic spelling 1. ACCEPT thrombocytes 2. ACCEPT enzyme if not given in Mp3 3. ACCEPT thromboplastin if not given in Mp2	**(5)**
(b)(i)	1. central carbon with {R / H / eq} and H attached by single bonds ; 2. {NH_2 / NH_3^+} attached to a carbon by single bond ; 3. {COOH / COO^-} attached to a carbon by single bond ;	Mp1 Must show C, H and R or a plausible R-group MP2 and 3 ACCEPT groups attached to a central C that is not shown (chemical notation) ACCEPT groups written wrong way round e.g. C-H_2N NOT incorrect bonding within groups if shown e.g. C=OH ACCEPT if correct group attached to wrong molecule e.g. glucose	**(3)**
(b)(ii)	peptide (bond) ;	ACCEPT peptide link NOT polypeptide or dipeptide	**(1)**
(b)(iii)	1. Idea that fibrinogen is globular and fibrin is fibrous ; 2. fibrinogen is soluble and fibrin is insoluble ; 3. Idea that they are different sizes ;	ACCEPT marks to be pieced together across the response. NB: answers must be comparative e.g. fibrin is fibrous fibrinogen is not 1. ACCEPT fibrinogen globular and fibrin (long) strand or chain. 3. ACCEPT fibrinogen is {smaller / larger / more amino acids} than fibrin	**(2)**

6)

(a)	1. triplet code / 3 bases to each code / eq ; 2. reference to adenine, thymine, guanine and cytosine ; 3. idea that each triplet of bases codes for one amino acid ; 4. idea that the code is not overlapping ; 5. idea that code is universal ; 6. idea that code is degenerate ;	1. IGNORE codon, triple 2. ACCEPT phonetic spelling	**(2)**
* **b) QWC**	(QWC– Spelling of technical terms must be correct and the answer must be organised in a logical sequence) 1. reference to *semi-conservative replication* ; 2. DNA (*molecule* / strands) {unwinds / separate / eq} ; 3. *(mono)nucleotides* line up along (both) strands / eq ; 4. reference to *complementary* pairing between bases ; 5. reference to *hydrogen bonds* formed (between bases) ; 6. reference to formation of *phospho(di)ester* bonds (between adjacent *mononucleotides*) ; 7. ref. to condensation reaction; 8. name of an enzyme involved in DNA replication ;	QWC– Spelling of technical terms must be correct – penalise 1st error only – can still reach Max 5 marks if 6 points given. **If context is transcription, Max 2 marks from Mp2, 5, 6, 7, 8.** 1. ACCEPT clear description 2. ACCEPT unzipped / hydrogen bonds broken / eq 3. NOT RNA OR one strand only described IGNORE bases line up 4. ACCEPT description, NOT uracil / U 5. NOT between nucleotides in the same strand ACCEPT between (DNA) strands 8. e.g. (DNA) *polymerase*, (DNA) *helicase, ligase*	**(5)**

7)

(a)	1. {phosphate group / heads} are hydrophilic ; 2. Idea that heads can be attracted to water ; 3. {fatty acids / tails} are hydrophobic ; 4. Idea that tails orientate themselves away from water / eq ; 5. Idea of aqueous environment on both sides of the membrane ;	ACCEPT marks for annotated diagram, phonetic spelling OK IGNORE "water loving / hating" 1. ACCEPT polar 2. not just facing water 3. ACCEPT non polar 4. ACCEPT repel water, face away from water, away from polar environment 5. ACCEPT polar environment	**(3)**

8)

a)	1. mutation changes the sequence of bases / eq ; 2. reference to stop code / idea of {insertion / deletion / eq} changes all triplets / frame shift / eq ; 3. {transcription / translation} does not occur / mRNA too short / protein too short / a different protein is made / eq ;	1. ACCEPT correct sequence of bases not there 2. IGNORE changes one triplet / codon ACCEPT no start codon, no ribosome binding site 3. IGNORE change of an amino acid ACCEPT wrong protein made, different sequence of amino acids	**(2)**
(b)	1. in the (cell surface) membrane ; 2. of mucus-producing cells / eq ;	1. ACCEPT in phospholipid bilayer, apical membrane NOT on, attached, basal membrane 2. ACCEPT {epithelial/endothelial / lining} cells of appropriate named organ or system e.g. cells lining respiratory, digestive, reproductive	**(2)**
(c)	1. (change in) {number / type / sequence / eq} of {amino acids / R groups} ; 2. So the {bonding / named bond } will be different / eq ;	2. ACCEPT hydrogen, disulfide bridges, van der Waal forces, ionic NOT peptide, glycosidic, ester bond, etc IGNORE references to shape including active sites	**(2)**
(d)	1. CFTR is a channel protein / eq ; 2. idea that {fewer / no} chloride ions will be able to {enter / bind to / pass through / eq} the CFTR protein ; 3. idea that fewer chloride ions will leave the cell ;	NOT chlorine penalise once 1. NOT carrier 2. ACCEPT CFTR has a specific shape for chloride ions ACCEPT other ions can pass through	**(2)**
(e)	1. less {chloride ions / water} in mucus / eq ; 2. idea that mucus is different e.g. thicker, stickier ; 3. in the {respiratory system / lungs / digestive system / pancreas / reproductive system / oviducts / fallopian tubes / cervix / sperm duct / vas deferens / eq } ; 4. credit correct reference to a consequence of thicker mucus ;	E.g. less ventilation, enzyme release, absorption of nutrients, more chest infections, reduced fertility, etc	**(2)**
(f)	1. by {enzymes / proteases} ; 2. by hydrolysis / eq ; 3. of peptide bonds ;		**(2)**