Question Number	Answer	Additional Guidance	Mark
1(a)(i)	1. life expectancy is likely to be lower than {Aa / heterozygote} ; 2. because of higher chance of (developing) malaria / eq ; **OR** 3. life expectancy may be {higher / same } than {aa / homozygous recessive} ; 4. because of {less / similar} severity of anaemia ;		**(2)**

Question Number	Answer	Additional Guidance	Mark
1(a)(ii)	1. idea they (heterozygotes) are less likely to have { malaria / anaemia } ; 2. idea that { *Plasmodium* / parasite / eq } unable to reproduce (and cause wider infection) **OR** lower (functional) red blood cell count / blocking of blood vessels causes {pain / cell death / eq} ;	**2 ACCEPT** parasite will die	**(2)**

Question Number	Answer	Additional Guidance	Mark
1(b)	**(QWC – Spelling of technical terms must be correct and the answer must be organised in a logical sequence)** 1. reference to change in primary structure ; 2. reference to different R group ; 3. leading to different named bond e.g. ionic, hydrogen, disulfide ; 4. different { folding / secondary / tertiary / 3D structure / globular } ; 5. suggested change in properties of the haemoglobin e.g. change in solubility, flexibility, affinity for oxygen / eq ;	**QWC emphasis is on logical sequence** **Maximum of 3 from Mps 1 to 4** 1. **IGNORE** sequence of amino acids 3. **ACCEPT** type or position of bonds **IGNORE** peptide 5. **ACCEPT** {less/no} oxygen will bind to haemoglobin	**(4)**

Question Number	Answer	Additional Guidance	Mark
2(a)		**Do not piece together**	

	Fibrous	G	
1.	insoluble / large	Soluble / small	;
2.	hydrophobic on outside	hydrophilic on outside	;
3.	mainly secondary structure	3D /folded / compact shape / tertiary / eq	;
4.	repeated amino acid sequences	little repetition	;
5.	structural / eq	enzymes / hormones / eq	

3 ACCEPT chains / straight proteins
IGNORE quaternary

(3)

Question Number	Answer	Additional Guidance	Mark
*2(b)	**(QWC – Spelling of technical terms must be correct and the answer must be organised in a logical sequence)**	**QWC emphasis is on correct spelling of biological terms**	
	1. reference to {*post-transcriptional modification* / *splicing*} (of mRNA) ;	**1 ACCEPT** post-transcriptional changes	
	2. reference to *spliceosomes* ;		
	3. reference to {removal / eq} of *introns* ;		
	4. idea that different {number / length} of *exons* are put together (in the different sexes) ;		
	5. idea that the length of the *mRNA molecules* will be different (for males and females) ;		
	6. idea that the longer mRNA will have more *codons* ;		
	7. and therefore more *amino acids* will be coded for ;	**7 ACCEPT** converse	
	8. reference to (during) *translation* ;	**8 in the context of Mp7 ACCEPT** converse	
	9. idea of removal of some amino acids post-translation ;		
			(6)

Question Number	Answer	Additional Guidance	Mark
3(a)(i)	1. (skin flora) {prevent growth of / kill} {pathogens / microorganisms / bacteria / eq} ; 2. competition for {space / nutrients / water / minerals / eq} ; 3. release of {chemicals / toxins / antimicrobials / lipids / enzymes /eq } ;	**1 ACCEPT** prevent colonisation **IGNORE** antigens / viruses / infections / diseases **2 IGNORE** food / resources **3 NOT** sebum / lysozymes	**(2)**

Question Number	Answer	Additional Guidance	Mark
3(a)(ii)	**B** they have antimicrobial properties that inhibit the growth of bacteria		**(1)**

Question Number	Answer	Additional Guidance	Mark
3(b)(i)	**C** keratin		**(1)**

uestion Number	Answer	Additional Guidance	Mark
3(b)(ii)	1. idea of little {tertiary / quaternary } structure / eq OR mainly secondary structure ; 2. made up of {long / linear / straight / eq} {molecules / (poly)peptides / polymers }; 3. idea of cross-linking (between one polypeptide chain and another) ; 4. idea of repeating amino acid sequences / eq ; 5. insoluble / eq ; 6. tough / strong / eq ;	 **3 NOT** peptide bonds **5 IGNORE** hydrophobic on outside	**(4)**

Question Number	Answer	Additional Guidance	Mark
3(b)(iii)	1. {DNA / (m)RNA} contains the {genetic code / triplet codons / base sequence coding for amino acids / eq}; DNA : 2. idea that the DNA strand is used {in transcription / to make (m)RNA / eq} ; mRNA : 3. (m)RNA is a copy of the DNA ; 4. mRNA carries this {information / code /eq} {out of the nucleus / to the ribosomes / eq} ; 5. idea that amino acids {arranged in sequence / eq } ;	**1 ACCEPT** (DNA) template **4 IGNORE** to cytoplasm	**(4)**

Question Number	Answer	Mark
4(a)(i)	D ;	(1)

Question Number	Answer	Mark
4(a)(ii)	A ;	(1)

Question Number	Answer	Mark
4(a)(iii)	B ;	(1)

Question Number	Answer	Mark
4(a)(iv)	D ;	(1)

Question Number	Answer	Additional guidance	Mark
4(b)(i)	1. idea that only one factor has changed ; 2. if intake went up, increase risk / obesity a risk factor / if intake went down could decrease CHD risk / eq ;	1. CCEPT Less valid investigation / method , to allow comparison, variables need to be controlled IGNORE reliability, fair test	(2)

Question Number	Answer	Additional guidance	Mark
4(b)(ii)	1. both diets decrease the risk / eq ; 2. both diets have less saturated fats / eq ; 3. saturated fat associated with heart disease / eq ; 4. idea that changing to unsaturated lipids has the greater effect ; 5. idea that excess carbohydrates may be stored as saturated lipids ; 6. idea that unsaturated lipids change HDL/LDL ratio ;	4. 30% more decrease	(3)

Question Number	Answer	Additional Guidance	Mark
5(a)	Diagram clearly showing: 1. central carbon wit {R / H / eq} and H attached by single bonds ; 2. {N / $NH3^+$ } attached to carbon by single bond ; 3. OOH / COO^- } attached to carbon by single bond ;	1. ust show C, H and R or a plausible R group 2. and 3 CCEPT 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 e.g. C=OH ACCEPT if correct group attached to wrong molecule e.g. glucose	**(3) p**

Question Number	Answer	Additional Guidance	Mark
5 (b) (i)	1. idea that enzymes reduce activation energy ; 2. reference to active sites (of enzyme) ; 3. reference to effect on collisions between enzymes and substrates / enzyme substrate complexes / eq ; 4. idea of number of active sites occupied ; 5. (levels off when) substrate becomes limiting factor ;	IGNORE increases the rate of the reaction 1. Accept 'decreases energy needed f reaction', provides an alternative reaction pathway 4. ACCEPT below 6a.u. all sites occupied OR above 6 a.u. not all occupied	**(3) p**

Question Number	Answer	Additional Guidance	Mark
5(b) (ii)	1. idea of a range of concentrations of enzyme (at least 5) 2. idea of substrate concentration not limiting ; 3. reference to mixing ; 4. description of how to measure dependent variable with time ; 5. description of how to measure the initial rate of reaction ; 6. reference to an appropriate named controlled variable ; 7. reference to {replicates / repeats} at each enzyme concentration ; 8. control {described / used as comparison} ;	4. a 5. Must relate to reaction / enzyme named 5. CCEPT clear indication of rate measured soon after mixing, plot and calculate rate from linear part of graph NOT time taken for all substrate to be converted but could get Mp4 6. CCEPT e.g. pH, temperature, volume, concentration of substrate 7. IGNOR repeat for other concentrations ACCEPT repeat whole experiment 8. CCEPT control used is with {no enzyme / distilled water}	**(4)** **Exp**