Question			Expected Answers	Marks	Additional Guidance
1	(a)		double helix ; anti-parallel ; sugar-phosphate ; hydrogen ;	4	
	(b)	(i)	percentages / amount , C & G similar (in all organisms) ; percentages / amount , A & T similar (in all organisms) ; different / named , organisms have different proportions of , bases / named base / AW ; greatest similarity between human and grasshopper ; least similarity between *E coli* and the other three ; *E. co* has similar proportions of all bases / *E.coli* has slightly more CG than AT / (named) eukaryote has more AT than CG ; comparative figs with units to support any statement ;	3 max	mp 1 & 2 **DO NOT CREDIT** ref to a single organism mp 1 & 2 **IGNORE** ref to complementary **DO NOT CREDIT** statements in context of organism size e.g. statement that human has more A than *E. coli* / human has the most AT / *E. coli* has the most CG This mark is for a general statement e.g. human C = 19.8 % and G = 19.9 % human A = 30.9 % and *E. coli* A = 24.7 % 'human has more A (30.9%) than wheat (27.3%)' **= 2** (mp 3 & 7)

Question			Expected Answers	Marks	Additional Guidance
	(b)	(ii)	(suggests) A , bonds / pairs / links / connects / joins , to T ; (suggests) C , bonds / pairs / links / connects / joins , to G ; (suggests) purine bonds to pyrimidine ; (evidence for) complementary base pairing / which bases pair with each other / base pairing rules ; suggests bases point 'inwards' rather than 'outwards' ;	2 max	**IGNORE** A – T or A = T unqualified **IGNORE** C – G or C = G unqualified **ACCEPT** 'bond' instead of 'pair'

<table>
<tr><th colspan="3">Question</th><th>Expected Answers</th><th>Marks</th><th>Additional Guidance</th></tr>
<tr><td></td><td>(c)</td><td></td><td>Award 1 mark per correct row

<table>
<tr><th>feature</th><th>DNA</th><th>RNA</th><th></th></tr>
<tr><td>number of strands</td><td>two / double</td><td>one / single</td><td>;</td></tr>
<tr><td>bases present</td><td>thymine / T
(+ adenine
+ c tosine
+ guanine</td><td>uracil / U
(+ adenine
+ c tosine
+ guanine</td><td>;</td></tr>
<tr><td>sugar present</td><td>deoxyribose</td><td>ribose</td><td>;</td></tr>
</table>
</td><td>3</td><td>If a choice of answers is given, do not credit unless both answers are valid (e.g. two and double strands for DNA / ribose and pentose sugar)

ACCEPT letters instead of names of bases
Names of bases must be unambiguous, so
DO NOT CREDIT adenosine / thiamine / cysteine / etc.
If more bases mentioned than T and U, then all bases must be included

DO NOT CREDIT dioxyribose / oxyribose/ hexose / sugar
IGNORE pentose</td></tr>
<tr><td></td><td>(d)</td><td></td><td>carries / transfers, the (complementary DNA) ,
code / genetic information / copy of gene ;
out of the nucleus ;
(transfers it) to the, ribosome / RER / site of translation ;
for, protein / polypeptide, synthesis ;</td><td>2 max</td><td>IGNORE transcription
DO NOT CREDIT ref to the whole DNA code / molecule

ACCEPT ‘to make protein’</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>14</td><td></td></tr>
</table>

Question			Expected Answers	Marks	Additional Guidance
2	(a)	(i)	**A** hydrogen **;** **B** glycosidic **;**	**2**	**DO NOT CREDIT** 'H bond' as this is not a name Correct spelling only. **IGNORE** α or β or numbers
	(a)	(ii)	hydrolysis / addition of water **;**	**1**	
	(a)	(iii)	β / beta **,** glucose **;**	**1**	Must be qualified as β or beta or B or b
	(b)		enzymes are specific **;** the **,** carbohydrate molecules / substrates **,** are different shapes **;** active site and substrate are complementary **;** so that substrate will fit / formation of ESC **;** lock and key / induced fit **;**	**3 max**	

Question			Expected Answers	Marks	Additional Guidance
	(c)	(i)	pH much **,** higher / less acidic **,** than optimum (for enzyme 2) **;** change in charge of active site **;** hydrogen / ionic **,** bonds break **;** tertiary structure / 3D shape / active site shape **,** altered **;** enzyme / tertiary structure **,** denatured **;** substrate no longer fits active site / ESC does not form **;**	**3 max**	Needs idea of much greater or too high **DO NOT CREDIT** just 'higher than' or 'above' **DO NOT CREDIT** too / more **,** alkaline **DO NOT CREDIT** peptide / disulphide **,** bonds break **DO NOT CREDIT** in context of heat / vibration **IGNORE** ref to denaturing active site **IGNORE** ref to denaturing active site **DO NOT CREDIT** kill / die 'substrate doesn't bind to enzyme' is not quite enough
	(c)	(ii)	*Mark 1st response on each numbered line unless no answer on one line, then mark 1st 2 answers* temperature **;** substrate concentration **;** enzyme concentration **;**	**2 max**	**IGNORE** ref to time

Question		Expected Answers	Marks	Additional Guidance
(d)		***Marking points 2 – 6 can be applied to the standard solutions or the sample***		
	1	using **,** standard / known , concentrations (of reducing sugar) **;**		e.g. serial dilutions
	2	heat with **,** Benedicts (solution) / $CuSO_4$ + NaOH **;**		**ALLOW** boil / > 80^oC **DO NOT CREDIT** warm
	3	(use of) same volumes of solutions (each time) **;**		**DO NOT CREDIT** amount / quantity
	4	(use of) excess Benedicts **;**		
	5	changes to **,** green / yellow / orange / brown / (brick) red **;**		
	6	remove precipitate / obtain filtrate **;**		**CREDIT** description of method e.g. filtering / centrifuging & decanting
	7	calibrate / zero **,** colorimeter **;**		
	8	using **,** a blank / water / unreacted Benedicts **;**		
	9	use (red) filter **;**		
	10	reading of **,** transmission / absorbance **;**		**ACCEPT** 'measure how much light **,** does / does not **,** pass through'
	11	more transmission / less absorbance **,** of filtrate = more sugar present **;** **ora**		If precipitate is **clearly indicated** as being present in sample, **ALLOW** **'**less transmission / more absorbance **,** = more sugar present'
	12	(obtain) calibration curve **;**		
	13	plotting **,** transmission / absorbance **,** against (reducing) sugar concentration **;**		
	14	use reading of unknown sugar solution and read off graph to find conc. **;**	**6 max**	
		Total	**18**	

Question			Expected Answers	Mark	Additional Guidance
3	(a)	(i)	lives , in / on , host **;** gains nutrition / feeds , from (host) **;** at the expense of / harms (host) **;**	3	The word 'host' must appear at least once in order to gain 3 marks **IGNORE** lives off host **IGNORE** binds to host **ACCEPT** e.g. feeds on blood / get food from it / obtains nutrients from the larger organism **DO NOT CREDIT** sometimes harm **ACCEPT** causes disease
	(a)	(ii)	mosquito / vector / *Anopheles* , feeds on blood **;** breaks skin / skin cannot act as barrier / mosquito pierces skin / mosquito bites skin **;**	2	**IGNORE** insect **IGNORE** anticoagulant prevents clot formation (as primary defence has already been breached)

Question			Expected Answers	Mark	Additional Guidance
	(a)	(iii)	suitable / AW , climate / temperature , for , mosquito / vector / *Anopheles* **; ora** more mosquitoes live there / AW ; **ora** *idea of* relatively poor so methods of prevention less effective **;**	1	**ACCEPT** 'warm enough for mosquitoes' **IGNORE** tropical as AW for 'warm' **IGNORE** mosquito is adapted to survive there **ACCEPT** e.g. can't afford , drugs / mosquito nets / habitat management / insecticides **ACCEPT** lack of education
	(a)	(iv)	**1** climate change / global warming / AW , may result in spread to other parts of the world / AW **;** **2** *idea of* increased movement of (infected) people **;** **3** *idea that* (non-malaria) countries fund anti-malaria measures via international aid **;** **4** resistance of , parasite to drugs / mosquito to insecticides **;**	2 max	**2 ACCEPT** increased tourism / easier to travel **2 ACCEPT** inadvertent transport of mosquitoes **4 IGNORE** 'resistance' without further qualification **4 DO NOT CREDIT** immune
	(b)	(i)	**A** antigen **;** **B** (extension of) cytoplasm **;** **C** lysosome **;** **D** phagosome / phagocytic vesicle / phago-lysosome **;**	4	**Mark the first answer.** If the answer is correct and another answer is given that is incorrect or contradicts the original answer, then = **0 marks** **B ACCEPT** pseudopod (ia / ium) or close spelling **B IGNORE** neutrophil **C IGNORE** lysome / lysozyme **D ACCEPT** phagocytic vacuole / secondary lysosome

Question			Expected Answers	Mark	Additional Guidance
	(b)	(ii)	(different) chemicals that attract phagocytes (released from infected erythrocytes) **;**	1	**ACCEPT** in the context of chemicals released by erythrocyte or *Plasmodium* **ACCEPT** cytokines / histamine / interleukin , released **IGNORE** references to antigens on surface
	(c)		*Globular* **G1** ball (shaped) / spherical / AW **;** **G2** hydrophilic , (R-)groups / regions , on outside (of 3-D structure) / hydrophobic (R-)groups on inside **;** **G3** form H-bonds with water **;** **G4** soluble **;** **G5** example of globular protein (other than haemoglobin) **;** **H1** haemoglobin , carries / transports , oxygen / carbon dioxide **;** **H2** haemoglobin contains , prosthetic group / haem / Fe^{2+} / iron ion (to allow oxygen to be carried) ; **H3** (polypeptide chains within) haemoglobin have tertiary structure (in a ball shape) ;		**G1 IGNORE** round / globular **G5 ACCEPT** (named) enzyme / hormone / antibody / channel / carrier **G5 IGNORE** metabolic / transport **H1 ACCEPT** references to buffering **H2 IGNORE** Fe^{3+} **H3 ACCEPT** haemoglobin has tertiary structure

			F1 *Fibrous* linear / long (chain) **;** **F2** (chains can) form (H) bonds with adjacent (within a molecule) chains **;** **F3** insoluble / few hydrophilic groups **;** **F4** strong / provide strength **;** **F5** have structural role ; **C1** collagen has high proportion of glycine , so chains can lie close together / AW **;** **C2** collagen forms , crosslinks / covalent bonds , between molecules **;** **C3** crosslinks / ends of molecules, are staggered to avoid , weak points / AW **;** **C4** collagen forms part of , tendon / cartilage / ligament / bone / connective tissue / bronchi / bronchioles / trachea / skin **;**	**7 max**	**F1 ACCEPT** straight / rope-like **F1 IGNORE** strand **F2 IGNORE** fibre / fibril **F2 ACCEPT** 'strand' as AW for 'chain' for **F2** only **F2 ACCEPT** crosslink as AW for bond for **F2** only **F2 DO NOT CREDIT** molecule as 'AW' for 'chain' **F2 IGNORE** attractions / (named) covalent bonds **F4 IGNORE** flexible / inelastic / withstands pressure **C2 ACCEPT** (micro / macro) fibrils / fibres , as AW for molecules **C3 ACCEPT** (micro / macro) fibrils / fibres , as AW for molecules **C4 IGNORE** blood vessel / artery / vein , wall **C4 IGNORE** lips
			QWC – use of haemoglobin and collagen as examples	**1**	**AWARD** if any H mark **and** any C mark are awarded
			Total	**[21]**	