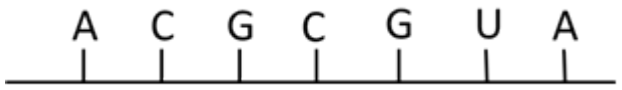
<table>
<tr><th colspan="3">Question</th><th>Expected Answers</th><th>Mark</th><th>Additional Guidance</th></tr>
<tr><td>1</td><td>(a)</td><td>(i)</td><td>thymine ;</td><td>1</td><td></td></tr>
<tr><td>1</td><td>(a)</td><td>(ii)</td><td>correct complementary sequence ;
bases joined by a backbone drawn below the letters ;</td><td>2</td><td>IGNORE bonds between bases


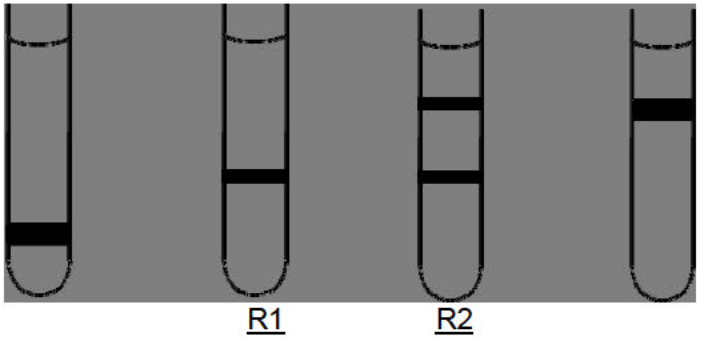
= 2 marks</td></tr>
<tr><td>1</td><td>(b)</td><td></td><td>
<table>
<tr><th>Statement</th><th>Incorrect statements</th></tr>
<tr><td>The DNA molecule unwinds</td><td></td></tr>
<tr><td>Hydrogen bonds between the base pairs break</td><td></td></tr>
<tr><td>Free RNA nucleotides join to bases on the exposed DNA strands</td><td>X ;</td></tr>
<tr><td>Both polypeptide strands act as a template</td><td>X ;</td></tr>
<tr><td>Hydrogen bonds form between complementary bases</td><td></td></tr>
<tr><td>3 hydrogen bonds form between bases A and T</td><td>X ;</td></tr>
<tr><td>DNA polymerase links the new nucleotides</td><td></td></tr>
<tr><td>Covalent bonds form between the phosphate of one nucleotide and the pentose sugar of the next nucleotide</td><td></td></tr>
</table>
</td><td>3</td><td>Four ‘X’s – max 2
Five ‘X’s – max 1
Six or more ‘X’s – DO NOT CREDIT any marks
If candidate does not use ‘X’, ACCEPT unambiguous system of indicating correct answers.</td></tr>
</table>

Question			Expected Answers	Mark	Additional Guidance
1	(c)				**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**
			1 individuals / organisms / species / phenotypes ;		**IGNORE** offspring
			2 genetic ;		**ACCEPT** inherited / genetical
			3 environment ;		**IGNORE** named example of environment, e.g. diet
			4 intraspecific ;		**ACCEPT** intraspecies
			5 selection / survival ;		**ACCEPT** breeding / reproduction **ACCEPT** natural selection / survival of the fittest
				5	
			Total	**[11]**	

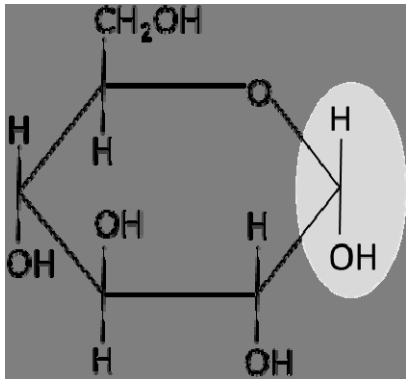
Question			Expected Answer	Mark	Additional Guidance
2	(a)	(i)	3 **;**	**1**	**IGNORE** triplet
2	(a)	(ii)	4^3 **or** 4 x 4 x 4 **or** 4 x 4^2 **;**	**1**	
2	(a)	(III)	Several, triplet(s) / codon(s) **,** code for one amino acid **;** (some are used as) start / stop / termination **;** *idea that* mutation may **,** not result in change in amino acid / have a neutral effect / result in silent mutation **;**	**2 max**	**Must be clear that base combination is a group of 3 bases** **IGNORE** degenerate **DO NOT CREDIT** makes/ produces/ creates **,** amino acids **DO NOT CREDIT** deletion / insertion (as would create frame shift)
2	(a)	(iv)	adenine / A **and** cytosine / C **and** guanine / G **;**	**1**	**Mark the first 3 answers.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks** **DO NOT CREDIT** adenosine **DO NOT CREDIT** cysteine **DO NOT CREDIT** glycine

Question			Expected Answer	Mark	Additional Guidance
2	(b)		*transcription* **1** DNA / gene , copied / transcribed , into mRNA ; **2** free / activated , (RNA) nucleotides / (RNA) nucleoside triphosphates ; **3** (line up by) complementary base-pairing / described ; **4** (to) one / template / reference / sense , (DNA) strand ; **5** (catalysed by) RNA polymerase ; *translation* **6** (mRNA moves to) ribosomes ; **7** tRNA (molecules) bind to mRNA ; **8** anticodon(s) , match / pair with / bind to , codons ; **9** specific / correct , amino acid attached to tRNA ; **10** formation of peptide bond between amino acids;	**6 max**	**Marks may be awarded from an annotated diagram** **1 IGNORE** 'used to make' **2 DO NOT CREDIT** DNA nucleotides **3 CREDIT** 'A-T, C-G **and** A - U' **4 ACCEPT** 'non-coding' for 'template' **5 DO NOT CREDIT** in context of breaking H bonds **6 CREDIT** translation occurs at ribosomes **Note:** tRNA anticodons bind to mRNA codons **= 2 marks** (mps 7 & 8) **10 DO NOT CREDIT** dipeptide / polypeptide , bond
			QWC ;	**1**	**Award** QWC if **two** mps from **1 – 5** have been awarded **before** **two** mps from **6 – 10** **Place a tick or a cross alongside the pencil icon to indicate whether or not the QWC mark has been awarded.**
			Total	**12**	

Question			Answer	Marks	Guidance
3	(a)	(i)	**X** cytosine / pyrimidine **;** **Y** nucleotide **;**	2	**Mark the first answer on each prompt line.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks** **X ACCEPT** nitrogenous base / organic base **X IGNORE** C
3	(a)	(ii)	at least one line between all opposite bases **;** two lines between A and T **and** three lines between both instances of C and G **;**	2	**IGNORE** bond labels / H / O / δ^+ / δ^- Bases on left strand do not need to be labelled but **CON** this mark if incorrectly labelled
3	(a)	(iii)	polypeptide **;** ribosome **;**	2	**ACCEPT** protein
3	(a)	(iv)	(usually) single stranded / would not have 2 strands **;** uracil / U, instead of thymine / T **;**	2	**Mark the first answer on each prompt line.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks** **IGNORE** shorter **ACCEPT** only one backbone **DO NOT CREDIT** incorrect spelling of thymine with 'a' **IGNORE** difference in sugar as on the diagram ribose and deoxyribose would appear the same
	(b)	(	one strand, from original DNA **and** one strand newly formed **;** an , (original) strand / polynucleotide , acts as template (for new strand) **;**	2	**ACCEPT** one old and one new strand **ACCEPT** each strand is copied

Question			Answer	Marks	Guidance
3	(b)	(i	(DNA) can be replicated without error / same sequence of nucleotides is produced ; reduces occurrence of mutation ; allows (re-)formation of , hydrogen / H , bonds ;	2	**ACCEPT** formation of identical DNA **ACCEPT** same / correct , order / sequence , of bases This mark point is for the correct use of the term 'mutation' and does not imply without error. **ACCEPT** prevents mutation **DO NOT CREDIT** H^+ / H_2 bonds
3	(c)	(i)	horizontal band drawn in tube R1 clearly higher than band in ^{15}N tube and clearly lower than band in ^{14}N tube ;	1	**DO NOT CREDIT** if more than one band drawn **IGNORE** thickness of bands and whether bands are shaded **DO NOT CREDIT** if there is any overlap with a band in another tube 
3	(c)	(ii)	one band (in R2) clearly at the same height as that in tube R1 **and** one band (in R2) clearly at the same height as that in the ^{14}N tube ;	1	**DO NOT CREDIT** if more than two bands drawn **IGNORE** thickness of bands and whether bands are shaded

Question			Answer	Marks	Guidance
3	(d)		same concentration of sugar (solution in each tube) **;** same volume of, mixture / solution / sugar solution (in each tube) **;** spin (all tubes) at same , speed / acceleration **;** spin (all tubes) for same (length of) time **;**	3	**IGNORE** prompt lines - mark as prose I**GNORE** amount throughout **IGNORE** mass **IGNORE** mass **IGNORE** volume , of sugar / DNA extract **ACCEPT** tubes spun at constant speed **IGNORE** temperature / pH **IGNORE** mass of DNA
			Total	**17**	

Question			Answer	Marks	Guidance
4	(a)		monosaccharide(s) **;**	1	**ACCEPT** phonetic spelling
4	(b)	(i)	*identical to diagram of β-glucose with* inversion of OH and H on any **one** carbon atom **;** correct inversion of OH and H on 1st C **;**	2	A correct diagram as shown below = 2 marks  **ACCEPT** displayed formula for CH_2OH etc If the candidate has drawn α-glucose upside down = 0 marks

Question				Answer	Marks	Guidance
4	(b)	(ii)			2	*Answers need a feature plus an explanation of how the feature helps the function*
			1	soluble so can be (easily) , transported / carried (around organism) **;**		**1 ACCEPT** soluble so is able to , react / AW **1 ACCEPT** description of solubility in terms of chemical properties linked to transport or reactivity
			2	small (molecule) so can , be transported / diffuse , across (cell) membranes **;**		
			3	easily / quickly , respired / oxidised / broken down , to , release energy / produce ATP **;**		**3 DO NOT CREDIT** 'hydrolysed' **3 DO NOT CREDIT** 'easily broken down to provide energy for respiration' **3 DO NOT CREDIT** 'easily broken down to produce energy'
			4	molecules can , join / AW , to produce , (named) disaccharides / (named) polysaccharides **;**		**4 IGNORE** 'used to form glycogen' without idea of molecules , bonding / joining / condensation
4	(c)				3	**AWARD** making points from suitably labelled diagram
			1	part of nucleotide **;**		
			2	bonded / joined / attached , to (named) base **and** phosphate **;**		**2 IGNORE** 'made up of' **2 DO NOT CREDIT** answers which state incorrect bond **2 IGNORE** 'phosphate molecule'
			3	phosphate (joined) to C5 (and C3) / base (joined) to C1 **;**		
			4	(deoxyribose is part of) backbone (of DNA) **;**		
			5	*idea of* linking with (second) phosphate on adjacent nucleotide **;**		
			6	nucleotide is , monomer / repeating unit , of DNA / polynucleotide **;**		**6 ACCEPT** 'DNA formed from a chain of nucleotides'

Question			Answer		Marks	Guidance
4	(d)	(i)			3	**Mark the first answer on each prompt line.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks** *Candidates may **identify** the error or **correct** the error* **If nothing is written on the answer lines, ACCEPT** a clear indication on the boxed list of which statements are incorrect
			1	α-glucose / β-glucose **;**		**1 ACCEPT** b / B for 'β'
			2	some / no , 1–6 bonds **or** only 1 –4 bonds **;**		
			3	condensation / hydrolysis **;**		
			4	branches / straight chain **;**		
4	(d)	(ii)		glycogen / amylopectin **;**	1	**Mark the first answer.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks** **IGNORE** starch **DO NOT CREDIT** if spelling could be confused with another molecule, e.g. glucagon
				Total	**12**	