

Assessment Schedule – 2007**Biology: Describe the role of DNA in relation to gene expression (90715)****Evidence Statement**

Q	Achievement	Achievement with Merit	Achievement with Excellence
1(a)	A: (deoxyribose) sugar B: phosphate C: base D: nucleotide All FOUR correct.		
1(b)	(i) Polymerase: using base pairing to synthesize new complementary DNA strand. (ii) Helicase: winds / unwinds double helix (iii) Ligase: joins (the phosphate / sugar bonds to) connect the Okazaki fragments. Any THREE correctly described.		
1(c)	Describes transcription and translation <ul style="list-style-type: none"> Transcription – DNA is used to make mRNA Translation – mRNA is used to make amino acid sequence / polypeptide chain / protein. 	Describes both , and explains the need for one , eg: <ul style="list-style-type: none"> Transcription is necessary as there is only one copy of DNA in the cell and it needs to be kept protected in the nucleus. Transcription is necessary to deliver the instructions for one specific gene / protein from the nucleus to the ribosome / cytoplasm. Translation is necessary to accurately match a codon to an amino acid by using tRNA. Ribosomes move along the mRNA 'reading' the codons. Each codon is matched with a complementary anticodon (tRNA) carrying a specific amino acid which join to form the protein. Translation is necessary because the ribosome needs to read the instructions on the mRNA to know how to start and finish the protein and in what order to connect the amino acids. 	Explains the need for both transcription and translation, eg: <ul style="list-style-type: none"> Transcription is where DNA is used to make mRNA. Translation is where the mRNA is used to make amino acid sequence / polypeptide chain / protein. Transcription is necessary as there is only one copy of DNA in the cell and it needs to be kept protected in the nucleus. Translation is necessary to accurately match a codon to an amino acid by using tRNA. Ribosomes move along the mRNA 'reading' the codons. Each codon is matched with a complementary anticodon (tRNA) carrying a specific amino acid which join to form the protein.
2(a)	GUG CAC CUG ACU CCU GAG GAG AAG ALL correct.		

2(b)	DNA change – middle base changed from a T changed to an A mRNA change - second (middle) nucleotide base of the codon has been changed from an A to a U BOTH needed.											
2(c)	Describes the effect on structure and function, eg: <ul style="list-style-type: none">Produces a different mRNA codon, changing the shape of the protein by substituting a different amino acid. This may change the protein’s function by changing how it interacts with other molecules.Changes in protein shape results in a change in shape of the red blood cell so it cannot carry oxygen as well.	Describes effect on both and explains how shape or function is affected, eg. <ul style="list-style-type: none">Substituting a different amino acid may change the shape of the protein by influencing how it folds into its tertiary structure. OR <ul style="list-style-type: none">The protein’s function may be altered by changing its active site (if an enzyme) or altering the way it interacts (hydrogen bonds) with other structures.	Links explanations of how structure AND function are affected <ul style="list-style-type: none">Changing the amino acid may change folding of the peptide chain by (i) changing bonding between side chains or (ii) replacing a hydrophobic side chain with a hydrophilic one. This will affect the oxygen carrying ability of the final haemoglobin / red blood cell.Changes in folding may result in a change in the shape of the active site (if an enzyme), or in the way the folded peptide interacts with other polypeptides (eg in forming functional haemoglobin). Changes in protein shape and/ or function results in a change in shape of the red blood cell.									
2(d)	Defines co-dominance as a gene interaction where both alleles are expressed equally in the phenotype.	Compares this with incomplete dominance, where a reduced amount of the dominant allele’s product is present / an intermediate phenotype is formed; and explains that normal and sickle cell alleles are codominant because both types of haemoglobin / red blood cell are present.										
2(e)	<table border="1"><tr><td></td><td>Hb^S</td><td>Hb^S</td></tr><tr><td>Hb^A</td><td>Hb^AHb^S</td><td>Hb^AHb^S</td></tr><tr><td>Hb^S</td><td>Hb^SHb^S</td><td>Hb^SHb^S</td></tr></table> <p>Punnet square correct.</p>		Hb ^S	Hb ^S	Hb ^A	Hb ^A Hb ^S	Hb ^A Hb ^S	Hb ^S	Hb ^S Hb ^S	Hb ^S Hb ^S		
	Hb ^S	Hb ^S										
Hb ^A	Hb ^A Hb ^S	Hb ^A Hb ^S										
Hb ^S	Hb ^S Hb ^S	Hb ^S Hb ^S										
2(f)	(i) 50% are likely to have sickle cell anaemia. (ii) 0% will be homozygous normal. Correct odds for both (i) and (ii).											
2(g)	Pleiotropy: a single gene can have multiple / many phenotypic effects.											

3(a)	Phenotypic ratio in F2: 9 black : 7 white																											
	<table><tr><td></td><td>AB</td><td>Ab</td><td>aB</td><td>ab</td></tr><tr><td>AB</td><td>AABB</td><td>AABb</td><td>AaBB</td><td>AaBb</td></tr><tr><td>Ab</td><td>AABb</td><td>AAbb</td><td>AaBb</td><td>Aabb</td></tr><tr><td>aB</td><td>AaBB</td><td>AaBb</td><td>aaBB</td><td>aaBb</td></tr><tr><td>ab</td><td>AaBb</td><td>Aabb</td><td>aaBb</td><td>aabb</td></tr></table>		AB	Ab	aB	ab	AB	AABB	AABb	AaBB	AaBb	Ab	AABb	AAbb	AaBb	Aabb	aB	AaBB	AaBb	aaBB	aaBb	ab	AaBb	Aabb	aaBb	aabb		
	AB	Ab	aB	ab																								
AB	AABB	AABb	AaBB	AaBb																								
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aB	AaBB	AaBb	aaBB	aaBb																								
ab	AaBb	Aabb	aaBb	aabb																								
3(b)	Epistasis / complementary genes: coat colour is controlled by the interaction of 2 different gene loci. Must name AND describe.																											
3(c)	States that <ul style="list-style-type: none">Each gene codes for a different enzyme. or <ul style="list-style-type: none">Both genes need a dominant allele (A_B_) to produce black coat colour. or <ul style="list-style-type: none">The absence of either dominant alleles (aa__ , __bb) results in white / no coat colour)	Explains coat colour from either the genetics of control OR metabolic control / enzymes, eg <ul style="list-style-type: none">Homozygous recessive for gene A or homozygous recessive for gene B → white coat colour AND black coat colour requires at least one dominant allele for each gene. OR: <ul style="list-style-type: none">Both genes produce different <u>enzymes / gene product</u>, and both are needed to produce the black pigment. If either of these enzymes is faulty / not made then the pathway cannot be completed and the poodle will be white.	Genes act in sequence on a colourless precursor and intermediate: to give a coloured product (black hair colour). If there is a homozygous recessive at either gene locus, then a white hair coat is produced.																									

Judgement Statement

Achievement	Achievement with Merit	Achievement with Excellence
SEVEN questions answered at Achievement level or higher. 7 × A	SEVEN questions answered, including at least THREE at Merit level or higher. 3 × M + 4 × A	SEVEN questions answered including at least TWO at Excellence level and TWO at Merit level. 2 × E + 2 × M + 3 × A