

**Assessment Schedule – 2006****Biology: Describe the role of DNA in relation to gene expression (90715)****Assessment Schedule**

Q	Achievement	Achievement with Merit	Achievement with Excellence
1(a)	<p>Diagram shows:</p> <ul style="list-style-type: none"> <li>base pairing: A-T, G-C</li> <li>A-T with 2 H-bonds, G-C with 3 H-bonds</li> <li>strands running anti-parallel (3' &amp; 5' ends labelled)</li> </ul> <p style="text-align: center;">5'      3'</p>  <p style="text-align: center;">3'      5'</p> <ul style="list-style-type: none"> <li>new nucleotides added to 3' end of strand.</li> </ul> <p><b>3 out of 4 correct.</b></p>		
1(b)	<p>Describes why DNA replication is necessary:</p> <ul style="list-style-type: none"> <li>To make a copy of the genetic material.</li> <li>To allow cell division / mitosis / meiosis to occur.</li> </ul>	<p>Gives a reason as to why DNA replication occurs, eg:</p> <ul style="list-style-type: none"> <li>Copies of DNA are passed on to daughter cells so that these have the same DNA to each other and to parent cell.</li> <li>To make identical copies of DNA so that cell division can occur.</li> </ul>	
1(c)	<p>Describes <b>two</b> aspects of process of DNA replication, eg:</p> <ul style="list-style-type: none"> <li>DNA must unwind to replicate.</li> <li>DNA unzips.</li> <li>Named enzymes are involved and function is correct.</li> <li>The 2 new strands form differently.</li> <li>Free nucleotides join.</li> <li>DNA replication is semi-conservative.</li> </ul>	<p><b>Process complete</b> plus one reason given for aspect of process of DNA replication, eg:</p> <ul style="list-style-type: none"> <li>Explains roles of two enzymes involved e.g. polymerases, ligase, helicase.</li> <li>DNA polymerase requires an RNA primer before it can initiate replication.</li> <li>Okazaki fragments necessary because replication can only proceed in <math>5' \rightarrow 3'</math> direction and so the lagging strand must elongate in sections rather than continuously.</li> </ul>	<p>Process complete, supported by reasons plus why DNA replication is semi-conservative:</p> <ul style="list-style-type: none"> <li>Strand formation semi-conservative: each new molecule will have one of the original DNA strands – the template – and one newly synthesised strand.</li> </ul>

2(a)	<p>Describes how the DNA molecule carries genetic information:</p> <ul style="list-style-type: none"> <li>Information is carried in the <b>order</b> of the bases.</li> <li>Codes for the amino acids which make up the protein.</li> <li>Codes for the amino acid sequence.</li> </ul>	<p>Explains how base order carries information:</p> <ul style="list-style-type: none"> <li>Sequence of bases determines the sequence of amino acids in a protein.</li> <li>Each group of 3 bases specifies an amino acid in the finished protein.</li> </ul>	
2(b)	<p>Provides a basic description of transcription and/or translation. Must cover <b>THREE</b> of place / purpose / associated molecules / nucleic acid structure, eg:</p> <ul style="list-style-type: none"> <li>Transcription involves making an RNA copy of a section of DNA.</li> <li>Translation is the production of a polypeptide / protein using the RNA as a template.</li> </ul>	<p>Clearly distinguishes, giving reasons for, the differences between the two processes. Must cover <b>TWO</b> of place / purpose / associated molecules / nucleic acid structure, eg:</p> <ul style="list-style-type: none"> <li>Transcription occurs in the nucleus of the cell because DNA is the template for the production of mRNA, and it cannot leave the nucleus.</li> <li>Translation occurs in the cytoplasm, as the ribosomes are found there and they mediate the process.</li> </ul>	
2(c)	<p>Describes how enhancers work to improve efficiency of transcription, eg:</p> <ul style="list-style-type: none"> <li>enhancers may increase rate of transcription.</li> <li>binds to transcription factors to initiate transcription.</li> </ul>	<p>Gives reasons how or why enhancers may have this effect, eg:</p> <ul style="list-style-type: none"> <li>binding to transcription factors, so that promoter sequence is properly positioned to initiate transcription.</li> <li>regulates the process of transcription so that the cell can respond efficiently to changes in the environment.</li> </ul>	
2(d)	<p>Describes role of inducer <b>OR</b> repressor, eg:</p> <ul style="list-style-type: none"> <li>Repressor binds to the operator / DNA to prevent transcription.</li> <li>Inducer binds to repressor so it cannot attach to operator / DNA.</li> <li>To prevent the cell synthesising a protein when it is not needed.</li> </ul>	<p>Gives reason for the roles of inducer <b>AND</b> repressor in gene expression, eg:</p> <ul style="list-style-type: none"> <li>repressor occupies part of promoter, prevents polymerase from beginning transcription.</li> <li>Inducer removes repressor, allows polymerase to bind and begin transcription.</li> </ul>	<p>Discusses the significance of these interactions, eg:</p> <ul style="list-style-type: none"> <li>Transcription will occur only when necessary substrate is present.</li> <li><b>OR</b> when substrates that can be used more efficiently are absent.</li> <li>Thus <b>maximising energy efficiency</b> in cell.</li> </ul>

3(a)	Diagram clearly identifies allele pairs as AA, Bb, rr. <b>NB</b> <i>order</i> of the gene loci is not important.											
3(b)	i) $X^M X^M$ , $X^M X^m$ ii) $X^m X^m$ iii) $X^m Y$ iv) $X^M Y$ <b>All correct.</b>											
3(c)(i)	<table border="1" style="display: inline-table; vertical-align: middle;"> <tr> <td></td><td><math>X^m</math></td><td>Y</td></tr> <tr> <td><math>X^M</math></td><td><math>X^M X^m</math></td><td><math>X^M Y</math></td></tr> <tr> <td><math>X^m</math></td><td><math>X^m X^m</math></td><td><math>X^m Y</math></td></tr> </table> All genotypes given.		$X^m$	Y	$X^M$	$X^M X^m$	$X^M Y$	$X^m$	$X^m X^m$	$X^m Y$		
	$X^m$	Y										
$X^M$	$X^M X^m$	$X^M Y$										
$X^m$	$X^m X^m$	$X^m Y$										
3(c)(ii)	Phenotypic proportions: Male 1:1 normal:affected Female 1:1 normal:affected  Genotypic proportions: Male 1:1 $X^M Y$ : $X^m Y$ Female 1:1 $X^M X^m$ (carrier): $X^m X^m$  Ratios can be expressed in any form but must include descriptions of phenotype and genotype.											
3(d)	Describes male or female difference: <ul style="list-style-type: none"> <li>Absence of normal DMD allele on Y chromosome.</li> <li>Females would need to have both recessive alleles.</li> </ul>	Uses these differences: <ul style="list-style-type: none"> <li>Because females have 2 copies of the gene, a recessive mutant allele on one chromosome may be masked by the presence of a normal allele on the other chromosome.</li> <li>Because males have only a single copy of the gene, a recessive mutant allele will be expressed.</li> </ul>										
3(e)	Recognises that a disabling mutation in one gene will disrupt function of other genes further down the <b>pathway</b> .  <b>OR:</b> Recognises that the absence of a disabling mutation will allow the <b>pathway</b> to proceed as each step can be completed.	Explains that different individuals may have mutations in different genes in the skin pigment <b>pathway</b> .  <b>OR:</b> Recognises that if the mutation occurs in the same gene in the <b>pathway</b> , it must be a dominant mutation.	Discusses the significance of this information, eg: <ul style="list-style-type: none"> <li>If the mutation for albinism is recessive, albino parents are affected at different genes on the pathway. The child inherits a normal (dominant) allele at each gene, and therefore the <b>pathway</b> is able to be complete and pigment produced.</li> <li>If the mutation for albinism is dominant AND each parent is heterozygous for that mutation, a child of this pair may inherit a normal (recessive) allele from each parent. Provided the other genes are normal, the <b>pathway</b> is able to be complete and the child will have normal pigmentation.</li> </ul>									

**Judgement Statement**

**Biology: Describe the role of DNA in relation to gene expression (90715)**

<b>Achievement</b>	<b>Achievement with Merit</b>	<b>Achievement with Excellence</b>
SIX questions answered correctly. Minimum of $6 \times A$	EIGHT questions answered correctly, including at least FOUR at Merit level. Minimum of $4 \times M + 4 \times A$	EIGHT questions answered correctly, including at least ONE at Excellence level and at least FOUR at Merit level. Minimum of $1 \times E + 4 \times M + 3 \times A$