

# A Level AQA Biology

## 23 Gene expression – answers

Question	Answers	Extra information	Mark	AO Spec reference										
01.1	<table border="1"> <thead> <tr> <th>Mutation</th> <th>Number of triplet codes that are changed</th> </tr> </thead> <tbody> <tr> <td>substitution of guanine</td> <td>1</td> </tr> <tr> <td>deletion of the initial cytosine base</td> <td>3</td> </tr> <tr> <td>insertion of cytosine after the first adenine base</td> <td>3</td> </tr> <tr> <td>insertion of three cytosine bases before guanine</td> <td>1</td> </tr> </tbody> </table>	Mutation	Number of triplet codes that are changed	substitution of guanine	1	deletion of the initial cytosine base	3	insertion of cytosine after the first adenine base	3	insertion of three cytosine bases before guanine	1	<p>One mark per correct box</p> <p>The 2<sup>nd</sup> triplet (CCC) and the 4<sup>th</sup> triplet (AAA) remain the same The 1<sup>st</sup> triplet and 2<sup>nd</sup> triplet (CCC) remain the same</p> <p>Only CTG is changed (to CTC and CCG). Although the sequence of triplets will change, AAA and ATT remain the same.</p>	4	AO2 3.8.1
	Mutation	Number of triplet codes that are changed												
	substitution of guanine	1												
	deletion of the initial cytosine base	3												
	insertion of cytosine after the first adenine base	3												
insertion of three cytosine bases before guanine	1													
01.2	C to T on (original) 22 <sup>nd</sup> base; A to T on 12 <sup>th</sup> base; A to T on 10 <sup>th</sup> base;	3	AO2 3.8.1											
01.3	deletion of the eight nucleotides GATTATGG (originally bases 14 to 21);	1	AO2 3.8.1											
01.4	change in DNA triplet code / mRNA codon (sequence); different primary structure of protein / order of amino acids in polypeptide; different tertiary protein structure;	3	AO1 3.1.4.1 3.4.2 3.8.1											
01.5	(mutation in) non-coding / junk DNA; point / substitution mutation <b>AND</b> same amino acid produced (by a different triplet); idea that new primary structure / change in an amino acid has little / no effect on tertiary structure;	3	AO1 3.8.1											

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01.6	<b>Name of DNA mutation</b>	<b>Description</b>	<i>One mark per correct box</i>	3	AO1 3.8.1
	inversion	nucleotides are rotated 180° and positioned in a nucleotide sequence in the reverse order			
	duplication	one or more extra copies of a gene or region of chromosome are produced			
	translocation	a section of DNA reattaches to a different chromosome			
			<i>Or words to this effect</i>		
02.1	U / uracil instead of A / adenine (in mRNA);			1	AO2 3.1.5.1 3.4.2
02.2	(valine and glutamic acid have) different R groups; (which can) form different hydrogen bonds / hydrophobic interactions / ionic bonds (with other polypeptide chains);			2	AO2 3.1.4.1
02.3	epigenetic change / modification / gene silencing; RNA polymerase cannot bind; to promoter;			2 max	AO2 3.8.2.2
02.4	more DNA triplets affected / changed; <i>idea of greater change to protein structure;</i>			2	AO1 3.8.1
02.5	homozygous recessive <b>AND</b> heterozygous;		<b>ACCEPT</b> letters to represent alleles (e.g., cc and Cc)	1	AO2 3.7.1

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Question	Answers			Extra information	Mark	AO Spec reference
03.1	<b>Level</b>	<b>Control mechanism</b>	<b>Description</b>	<i>Or words to this effect</i>	4	AO1 3.8.2.2
	transcription	transcription factors	<i>idea of molecules bind to DNA to either increase or decrease transcription;</i>			
		epigenetic control / epigenetics;	acetylation of histones			
	post-transcription	RNA interference	<u>mRNA disabled;</u> <u>translation prevented;</u>	<i>Or words to this effect</i>		
03.2	methylation prevents RNA polymerase binding to the promoter; no transcription of tumour suppressor genes; control of cell cycle is lost; acetylation increases transcription of oncogenes; (oncogenes cause) increased cell survival / proliferation;			<i>Or words to this effect</i>	4 max	AO2 AO3 3.8.2.2 3.8.2.3
04.1	undifferentiated / unspecialised; able to differentiate to form any cell type; able to divide to form a whole organism;				2 max	AO1 3.8.2.1
04.2	multipotent; unipotent; pluripotent;				3	AO1 3.8.2.1

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Question	Answers	Extra information	Mark	AO Spec reference
04.3	(induced pluripotent stem cells are) pluripotent stem cells produced from , adult / somatic , cells ; can be used to produce replacement cells or tissues; avoids ethical issues associated with the use of embryonic stem cells; cells taken from the patient; (therefore) avoids , tissue rejection / immune response;	<i>Or words to this effect</i> <i>Or words to this effect</i>	4 max	AO1 AO2 3.8.2.1
05.	<i>idea that we do not yet fully understand which parts of the genome are genetic, regulatory and non-coding;</i>  <i>idea that we can (eventually) know which genes code for which proteins;</i>  (but) not all genes are transcribed / translated; some / many genes are switched off; reference to transcription factors / epigenetics;  post-transcriptional control changes protein production; reference to RNA interference / splicing / post-translational protein modifications;		5 max	AO3 3.8.2.1 3.8.2.2 3.8.3
06.1	<b>E A C B D ;;</b>	<b>ALLOW</b> A before E If the order is not correct, allow one mark for E being first <b>AND</b> D being last.	2	AO1 3.8.2.2
06.2	gene expression is reduced/stopped; (but) gene is still present/transcribed;		2	AO2 3.8.2.2
06.3	reduce/stop gene expression; of oncogenes;		2	AO2 3.8.2.2 3.8.2.3

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07	<p>The following are suitable topic areas from the specification that could be used to describe how advances in the understanding of genetics has improved preventative measures and treatments for infectious diseases, genetic diseases, and cancer.</p> <p>In order to fully address the question and reach the highest mark bands students must also include at least five topics in their answer, to demonstrate a synoptic approach to the essay.</p> <table border="1"> <thead> <tr> <th>Specification reference</th> <th>Topic area</th> </tr> </thead> <tbody> <tr> <td>3.2.4</td> <td>... the immune system</td> </tr> <tr> <td>3.6.4.2</td> <td>Control of blood glucose ...</td> </tr> <tr> <td>3.7.1</td> <td>Inheritance</td> </tr> <tr> <td>3.8.1</td> <td>Alteration of the sequence of bases ...</td> </tr> <tr> <td>3.8.2.1</td> <td>Most of the cell's DNA is not translated</td> </tr> <tr> <td>3.8.2.2</td> <td>Regulation of transcription and translation</td> </tr> <tr> <td>3.8.2.3</td> <td>Gene expression and cancer</td> </tr> <tr> <td>3.8.3</td> <td>Using genome projects</td> </tr> <tr> <td>3.8.4.1</td> <td>Recombinant DNA technology</td> </tr> <tr> <td>3.8.4.2</td> <td>... diagnosis of heritable conditions</td> </tr> </tbody> </table> <p>Students may be able to show the relevance of other topics from the specification.</p> <p><b>Note:</b> other topics from beyond the specification can be used, providing they relate to the title and contain factually correct material of at least an A-level standard. Credit should not be given for topics beyond the specification which are below A-level standard.</p>	Specification reference	Topic area	3.2.4	... the immune system	3.6.4.2	Control of blood glucose ...	3.7.1	Inheritance	3.8.1	Alteration of the sequence of bases ...	3.8.2.1	Most of the cell's DNA is not translated	3.8.2.2	Regulation of transcription and translation	3.8.2.3	Gene expression and cancer	3.8.3	Using genome projects	3.8.4.1	Recombinant DNA technology	3.8.4.2	... diagnosis of heritable conditions		25	AO1 AO2 3.2.4 3.6.4.2 3.7.1 3.8.1 3.8.2.1 3.8.2.2 3.8.2.3 3.8.3 3.8.4.1 3.8.4.2
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### Skills box answers:

Question	Answers
1a	1.5 mmol dm <sup>-3</sup>
1b	5.3 mmol dm <sup>-3</sup>
1c	3.4 mmol dm <sup>-3</sup>
2a	0.099
2b	0.28
2c	0.61
3	no, it would be invalid to predict the curve so far beyond the known values.