

# A Level AQA Biology

## 12 DNA and protein synthesis – answers

Question	Answers					Extra information	Mark	AO Spec reference
01.1	<b>Species</b>	<b>A /%</b>	<b>G /%</b>	<b>C /%</b>	<b>T /%</b>	<i>One mark per correct row</i>	3	AO2 3.1.5.1 MS 0.3
	<i>G. gallus</i>	28.0	22.0	22.0	28.0			
	<i>H. sapiens</i>	30.0	20.0	20.0	30.0			
	<i>A. aberrans</i>	29.3	20.7	20.7	29.3			
01.2	<p>Three from:  <i>prokaryotic DNA is shorter;</i>  <i>lacking introns;</i>  <i>not associated with proteins/histones;</i>  <i>circular;</i>  <i>not found in a nucleus;</i></p>					Accept reverse arguments throughout	3 max	AO1 3.4.1
01.3	<p><i>translation in prokaryotic cells</i>  <i>(occurs in) smaller ribosomes;</i></p> <p>does not use rough ER / occurs on free ribosomes;</p>					Accept reverse arguments throughout <b>ACCEPT</b> 70S ribosomes in prokaryotes and 80S ribosomes in eukaryotes	2	AO1 3.2.1.2 3.4.2
01.4	<p>(ATP) hydrolysis provides energy;            (to) activate tRNA / bond amino acid to tRNA;            peptide bond formation (between amino acids);  <i>idea of to move mRNA through ribosome;</i></p>						2 max	AO1 3.4.2
02.1	<b>U G C C C A U U C G A A ;</b>						1	AO2 3.4.1 3.4.2
02.2	<b>A C G G G U A A G C U U ;</b>						1	AO2 3.4.1 3.4.2

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02.3	<i>idea that</i> an amino acid can be coded for by more than one triplet / codon;		1	AO1 3.4.1
02.4	<i>idea that</i> the same base is not used in different codons / triplets;		1	AO1 3.4.1
03.1	introns; (are) removed after transcription / removed from pre-mRNA; ref. alternative splicing / retained introns;  promoters / regulatory sequences; ref. transcription regulation / binding of transcription factors;  ref. junk DNA / pseudogenes / telomeres / multiple repeats (between genes);		4 max	AO1 3.4.1 3.4.2 3.8.2.2 3.8.4.1
03.2	(a gene is) a section of DNA; coding for (the amino acid sequence of) a polypeptide;	Allow 'coding for rRNA / tRNA / miRNA'	2	AO1 3.4.1
03.3	the (fixed) position of a gene on a DNA molecule;		1	AO1 3.4.1
03.4	(a cell that contains) a single (complete) set of (unpaired) chromosomes;		1	AO1 3.4.3
03.5	any whole number in the range 826 to 870;		1	AO2 3.4.1 MS 0.4 MS 1.1
03.6	<i>idea that</i> most gene products are not needed; genes transcribed only when needed; genes switched off / epigenetic control; (because) cells are differentiated / specialised;		3 max	AO2 3.4.2

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04.1	contains genes for respiration / photosynthesis; no need to import (particular) proteins/enzymes from the cytoplasm;		2	AO2 3.4.1															
04.2	bacteria also divide using binary fission; mitochondria and bacteria have circular DNA; mitochondria and bacteria have DNA that is not associated with proteins / histones; mitochondria and (some) bacteria have double membranes;  but bacteria have a cell wall and mitochondria do not; <i>idea that the theory is difficult to prove;</i>		3 max	AO3 3.2.2 3.4.1															
04.3	transmembrane / intrinsic / membrane-spanning / channel protein; <i>idea of connects matrix and intermembrane space;</i> channel (specific) for H <sup>+</sup> ions; active site for ADP and P <sub>i</sub> ; <i>idea of able to rotate to catalyse ATP production;</i>		3 max	AO2 3.5.2															
04.4	few mitochondria present in sperm cells / male gametes (compared to egg cells/ oocytes); <i>idea that no mitochondria in sperm cells enter the egg during fertilisation;</i> <i>idea that mitochondria from sperm are destroyed during fertilisation;</i>		1 max	AO2 3.4.1 3.4.3															
05.1	<table border="1"> <thead> <tr> <th>Feature</th> <th>mRNA</th> <th>tRNA</th> </tr> </thead> <tbody> <tr> <td>contains uracil</td> <td>✓</td> <td>✓</td> </tr> <tr> <td>folded into a loop structure</td> <td></td> <td>✓</td> </tr> <tr> <td>has anticodons</td> <td></td> <td>✓</td> </tr> <tr> <td>involved in translation</td> <td>✓</td> <td>✓</td> </tr> </tbody> </table>	Feature	mRNA	tRNA	contains uracil	✓	✓	folded into a loop structure		✓	has anticodons		✓	involved in translation	✓	✓	One mark per correct row	4	AO1 3.4.2
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05.2	both contain C, G, T, and U; both have complementary base pairing; both are looped;  rRNA lacks anticodons; rRNA has more loops;	Accept reverse argument Accept reverse argument	4 max	AO2 3.4.2
06.1	<b>F B H D E G A C I</b> ;;;;	If the order is incorrect, award one mark each for: <ul style="list-style-type: none"> <li>• F first and I last</li> <li>• G before A</li> <li>• B before H</li> </ul>	4	AO1 3.4.2
06.2	no pre-mRNA formed in prokaryotes; transcription does not occur in a nucleus in prokaryotes;	Accept reverse arguments	2	AO1 3.4.2
06.3	many genes not expressed; ref. epigenetics / genes switched off; introns removed from the DNA base sequences of genes;		3	AO1 3.4.2

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07	<p>The following are suitable topic areas from the specification that could be used to describe the role of nucleotides and nucleic acids.</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>3.1.5.1</td> <td>Structure of DNA and RNA</td> </tr> <tr> <td>3.1.5.2</td> <td>DNA replication</td> </tr> <tr> <td>3.1.6</td> <td>ATP</td> </tr> <tr> <td>3.2.3</td> <td>Transport across cells</td> </tr> <tr> <td>3.4.1</td> <td>DNA, genes and chromosomes</td> </tr> <tr> <td>3.4.2</td> <td>DNA and protein synthesis</td> </tr> <tr> <td>3.5.1</td> <td>Photosynthesis</td> </tr> <tr> <td>3.5.2</td> <td>Respiration</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	3.1.5.1	Structure of DNA and RNA	3.1.5.2	DNA replication	3.1.6	ATP	3.2.3	Transport across cells	3.4.1	DNA, genes and chromosomes	3.4.2	DNA and protein synthesis	3.5.1	Photosynthesis	3.5.2	Respiration		25	AO1 3.1.5.1 3.1.5.2 3.1.6 3.2.3 3.4.1 3.4.2 3.5.1 3.5.2
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### Skills box answers

Question	Answer
1	5
2	<b>UGACAGAGUCUCCUC</b>
3	<b>ACU, GUC, UCA, GAG, GAG</b>
4	Introns are removed from strands of pre-RNA
5	$51 \times 3 = 153$ $2 \times 3 = 6$ = 159 bases