

UNIT 4 BIOLOGY

Revision Booklet 10 - SOLUTIONS

2012 – Question 1

Question 1a.

Marks	0	1	Average
%	17	83	0.9

The two stages of protein synthesis are transcription and translation.

Question 1b.

Marks	0	1	2	3	Average
%	26	12	18	44	1.8

Three of

- DNA template strand copied
- RNA polymerase involved
- (pre)mRNA produced by complementary base pairing
- introns removed, or polyA tail or methyl cap added to (pre)mRNA.

Students gained full marks if they referred to mRNA as the final product via (pre)mRNA, or that the product was mRNA.

Question 1c.

Marks	0	1	2	3	Average
%	26	18	24	32	1.6

Three of the following answers were required for full marks.

Letter representing structure chosen	Role of structure in second stage of amyloid beta-protein synthesis
J	contains the code for protein synthesis, contains rRNA/structural component of ribosomes
K	carries specific amino acid to the ribosome
L	provides energy required for protein synthesis
M	folded to create the protein
R	the site of protein synthesis
S	carries the code for the synthesis of protein

It was important that the organelle's role in the synthesis of amyloid beta-protein was stated.

2012 – Question 4

Question 4a.

Marks	0	1	2	3	4	Average
%	37	12	15	20	16	1.7

The diagram should show four of

- DNA polymerase
- DNA unwinding
- suitably labelled replication fork
- leading/lagging strands, Okazaki fragments or DNA ligase in discontinuous replication
- complementary base pairing
- semi-conservative nature.

Some students took this question to be cell replication, not DNA replication, and therefore incorrectly illustrated mitosis.

Question 4b.

Marks	0	1	2	Average
%	75	19	6	0.3

Binary fission differs from mitosis as (two of)

- the chromosome does not line up on the equator
- the chromosome does not separate at the centromere
- there are no spindle fibres

- there are no phases; for example, prophase
- it is quicker.

It was important that students identified how the two processes differed. Therefore, to state that binary fission occurred in prokaryotes was not relevant and did not gain any marks.

Question 4c.

Marks	0	1	2	Average
%	16	18	66	1.5

Apoptosis is programmed cell death and reduced apoptosis would result in webbing between the fingers.

Question 4d.

Marks	0	1	2	Average
%	23	8	69	1.5

The following is a possible answer.

A: syndactyly, a: non-webbed fingers and toes

Ruby: Aa, Jonah: aa

Offspring: $\frac{1}{2}$ Aa $\frac{1}{2}$ aa

There is a 50 per cent chance that the child of Ruby and Jonah will have syndactyly.

2011 – Question 1**Question 1a.**

Marks	0	1	Average
%	0	100	1

As the nucleus was not labelled as a structure, all students were awarded a mark for this question.

Question 1b.

Marks	0	1	2	Average
%	46	23	32	0.9

Two of:

- involved in transcription
- copies DNA template
- joins nucleotides.

Question 1c.

Marks	0	1	2	Average
%	34	17	49	1.2

Both of:

- pre-mRNA (strand G) is formed
- introns are removed.

Question 1d.

Marks	0	1	2	3	Average
%	30	17	20	33	1.6

Strand H

mRNA: carries instructions to the ribosomes

Structure P

tRNA: carries a specific amino acid to the ribosomes

Structure M

Ribosome: site of protein synthesis production

The description had to relate to protein synthesis. Students were not asked to give information about mRNA, for example, mRNA is single stranded, which was not relevant to the question. Other errors stated by students were that ribosomes package protein or make amino acids.

2010 – Question 2**2ai.**

Transcription

2aii.

All of:

- the DNA template is copied by RNA polymerase
- pre-mRNA is produced. This undergoes post-transcriptional modification, such as introns are removed
- mRNA is produced.

Question 2b.

Marks	0	1	2	3	4	Average
%	15	14	16	22	34	2.5

2bi.

Translation

2bii.

All of:

- ribosomes read the mRNA code
- tRNA anticodons attach to the mRNA codons
- a protein/polypeptide is produced.

This question was generally well answered and most students were able to gain some marks. Contradictory information should be avoided, and students are advised to read their answers carefully and check their content for accuracy.

2009 – Question 1d**Question 1d.**

Marks	0	1	2	3	Average
%	39	15	16	30	1.4

All of:

- mRNA travels to the ribosomes where its codons are read
- tRNA carries specific amino acids to the ribosomes **or** complementary base pairing occurs between the codons and anticodons
- product; protein/polypeptide.

This question was well answered by many students. However, some students failed to name the final product, which was specifically asked for in the question. Other students used many irrelevant terms, enzymes and structures which detracted from their answers.

2007 – Question 3

Question 3

Question 3a.

Marks	0	1	Average
%	72	28	0.3

Either of:

- genes are only activated/transcribed when required
- required genes are expressed, which can save energy.

To gain the mark the purpose of gene regulation was required. A common answer that lacked sufficient information was 'genes are turned on and off'.

Question 3b.

Marks	0	1	Average
%	82	18	0.2

The transcription of all genes is stopped or suppressed.

Question 3c.

Marks	0	1	Average
%	83	17	0.2

Either of:

- enzyme 1 is inhibited
- compound 1 is not produced.

Question 3d.

Marks	0	1	2	Average
%	74	13	13	0.4

Both of:

- when tryptophan is available, its presence prevents further tryptophan being produced
- therefore the cell does not waste energy or resources producing tryptophan.

In parts b., c. and d. students were not awarded the mark if they stated that the gene/enzyme was repressed, as the stem of the question stated that tryptophan acts as a repressor. However, students could gain the mark if they indicated in their response that they understood the term; for example, for part c. 'tryptophan represses enzyme 1 and stops production of compound 1'.

It was evident that many students did not understand the term repressor. They found it difficult to **apply** their knowledge to this question, which was essentially a feedback system.

2006 – Question 2

Questions 2a–c.

Marks	0	1	2	3	4	Average
%	24	13	23	19	21	2.0

Question 2a.

Transcription

Question 2b.

2bi.

Either of:

- Pre-mRNA
- primary RNA.

mRNA was not an acceptable answer.

2bii.

Either of:

- introns are removed
- any other post transcriptional modification.

Question 2c.

One of:

- translation
- polypeptide synthesis
- protein synthesis.

Question 2d.

Marks	0	1	2	Average
%	47	15	38	0.9

2di.

Transfer RNA (tRNA)

2dii.

Transfer RNA brings a specific amino acid to the ribosome. The anticodons of the tRNA are complementary to the codons of the mRNA.

Many students incorrectly called tRNA, transport RNA. An incorrect answer was that 'tRNA is involved in making an amino acid'.

2006 – Question 7**Question 7a.**

Marks	0	1	Average
%	58	42	0.4

Genes are only expressed when required to conserve energy or time.

Question 7b.

Marks	0	1	Average
%	83	17	0.2

RNA polymerase

This part was poorly answered as students did not relate their answer to gene expression and the enzyme needed to bind to allow this process to occur. The most common incorrect answer was enzyme X.

Questions 7c–d.

Marks	0	1	2	Average
%	39	29	33	1.0

Question 7c.

Production of enzyme X will occur.

Question 7d.

The binding of the tryptophan to the repressor protein changes its shape (from the diagram) and this complex can no longer bind to the operator gene (therefore transcription can occur).

2005 – Question 5**Question 5a.**

Marks	0	1	Average
%	35	65	0.7

Tubes 1 and 2 are the control group to which other tubes can be compared.

Parts a. was generally well answered by students.

Question 5b.

Marks	0	1	2	Average
%	59	26	14	0.6

The conclusions which can be drawn are:

- the abnormal fungus cannot produce histidine
- the abnormal fungus can produce the other 19 amino acids.

Question 5c.

Marks	0	1	2	3	Average
%	47	27	8	18	1.0

ci.

The sequence codings for 'his' in RNA are CAU and CAC, which are GTA and GTG respectively in DNA.

5cii.

sequence 3

5ciii.

This sequence does not have the DNA triplet for histidine (GTA or GTG) whereas sequences 1 and 2 do, so the polypeptide could be made without interruption.

Many students gave the code for RNA in part ci.

Question 5d.

Marks	0	1	Average
%	77	23	0.3

Watson and Crick would have concluded that Adenine pairs with Thymine and Guanine pairs with Cytosine because these pairs are in approximately equal numbers.

To gain the mark, specific reference had to be made to the pairing of the bases.