

## UNIT 3 BIOLOGY

### Revision Booklet 1 - SOLUTIONS

#### 2012 – Question 3

##### Question 3a.

<b>Marks</b>	<b>0</b>	<b>1</b>	<b>Average</b>
<b>%</b>	29	71	<b>0.7</b>

Protein/polypeptide

##### Question 3b.

<b>Marks</b>	<b>0</b>	<b>1</b>	<b>Average</b>
<b>%</b>	37	64	<b>0.7</b>

The sequence of amino acids

##### Question 3c.

<b>Marks</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>Average</b>
<b>%</b>	12	57	31	<b>1.2</b>

Animal: pig

Explanation: the amino acid sequence of the alpha chain is the same as in humans or the beta chain contains only one difference to humans (1 mark) and would therefore be the most similar shape/structure to the human insulin (1 mark).

Most students were unable to explain why the pig insulin would be the best source of insulin.

##### Question 3di.–ii.

<b>Marks</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>Average</b>
<b>%</b>	40	29	32	<b>0.9</b>

##### Question 3di.

The first base of the (triplet in) DNA is different for humans and cows.

Students could have also used the table to give the alternative triplets and indicate that there was a difference.

##### Question 3dii.

There are four different triplets for this amino acid.

Students could also list the four triplets or state that the third position can have four different bases.

## 2011 – Question 1

### Question 1a.

Marks	0	1	2	Average
%	28	45	27	1

Both of:

- the majority of amino acids on the outside of the molecule are hydrophilic
- the groups that are hydrophobic are on the inside.

Some students thought the diagram was of a cell and the cell membrane was hydrophilic, which was incorrect in this situation. Other students incorrectly thought a greater number of hydrophilic parts would make the protein highly soluble, when it is the position that is important.

### Question 1b.

Marks	0	1	2	3	4	Average
%	26	16	21	18	19	1.9

	Type of nucleic acid found in structure	Specific function of the nucleic acid
Structure N	Either of: <ul style="list-style-type: none"> <li>(Chloroplast) DNA</li> <li>RNA.</li> </ul> Or one of: <ul style="list-style-type: none"> <li>rRNA</li> <li>tRNA</li> <li>mRNA</li> </ul>	<ul style="list-style-type: none"> <li>controls production of proteins for photosynthesis OR involved in replication of chloroplasts</li> <li>involved in protein synthesis</li> <li>part of ribosomes</li> <li>carries specific amino acid to ribosomes</li> <li>a copy of DNA carried to ribosomes</li> </ul>

Structure Q	RNA or mRNA	a copy of DNA carried to ribosomes
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Students were required to name a **type of nucleic acid** found in the structure, **not** the name of the structure. Some students could not identify the chloroplast or misidentified it as a mitochondrion. For structure N, many students correctly gave a nucleic acid for Structure N, but could not gain the second mark as the function given referred to a cell, not the chloroplast.

### Question 1c.

Marks	0	1	2	Average
%	51	18	31	0.8

Sally is correct because (both of):

- the subunits are glucose/monosaccharide or nitrogen is not present
- it is therefore a carbohydrate or it is therefore not a protein.

Many students could identify the structure as a carbohydrate and recognise the chemical subunit.

An explanation such as 'the macromolecule contains CH and O' was incorrect and was not awarded a mark as lipids also contain these elements. Students could gain a mark when they stated 'the proportion of elements  $C_x(H_2O)_x$  is for a carbohydrate'.

## 2010 – Question 6

### Question 6a.

Marks	0	1	Average
%	63	37	0.4

All of:

- deoxyribose (sugar)
- nitrogen base
- phosphate (group).

Sugar and pentose were not acceptable as these can also refer to ribose in RNA. Phosphorus was also incorrect; however, phosphorus group was acceptable.

### Question 6b.

Marks	0	1	2	3	Average
%	12	41	29	18	1.6

Amino acid sequence: glu-his-phe

Explanation: The changed primary structure or different bonding leads to a different shape.

Many students did not make the link that the shape would be changed and restated the stem of the question; for example, 'that this would affect the function'.

### Question 6c.

Marks	0	1	2	Average
%	65	23	12	0.5

Hex A-glycolipid fails to form as the substrate can't bind to the enzyme.

### Question 6d.

Marks	0	1	2	Average
%	59	39	3	0.5

Both of:

- the enzyme is blocked and therefore reduces the formation of glycolipid
- there is an alternative pathway/via compound R.

Very few students could identify the alternative pathway. The analysis of pathways would be valuable preparation for this type of question.

## 2009 – Question 1

### Question 1

Questions 1a. and 1b. were generally well answered.

### Question 1a.

Marks	0	1	2	Average
%	37	31	33	1

Chain X alpha helix/coil

Chain Y beta pleated sheet

Both of these structures represent secondary structures. To gain the mark students needed to state that these structures are coiled or pleated. A simple response of 'beta sheet' was not precise enough to gain the mark.

### Questions 1b.

Marks	0	1	2	Average
%	38	15	47	1.1

Suitable examples included:

- glycogen; energy source
- chitin; exoskeleton.

Many students incorrectly gave starch and cellulose as their answers when the question asked for a polysaccharide found in animals. Students occasionally gave examples of monosaccharides and disaccharides, however these answers did not gain any marks.

**Question 1c.**

Marks	0	1	Average
%	73	27	0.3

Cholesterol makes the cell membrane:

- more flexible
- more stable
- more fluid in colder temperatures
- decrease the permeability of the bilayer to create small water-soluble molecules.

Unfortunately, many students made contradictory statements and did not gain the mark.

**2009 – Question 2**

**Question 2a.**

Marks	0	1	Average
%	42	59	0.6

mRNA	G	A	A	U	G	U	A	A	U	G	A	G
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Many students transcribed the DNA correctly, however omitted a base or made one mistake and did not gain the mark. Some students incorrectly transcribed the DNA and gave T (thymine) rather than U (uracil).

**Question 2b.**

Marks	0	1	Average
%	42	58	0.6

20 per cent

**Question 2ci-ii.**

Marks	0	1	2	Average
%	67	27	6	0.4

**Question 2ci.**

Cytosol or cytoplasm

Many students could not correctly identify where tRNA is found. A common incorrect answer was the nucleus.

**Question 2cii.**

tRNA (transfer RNA) carries the correct amino acid to the ribosomes.

Answers to this question were not precise enough to gain the mark.

**Question 2d.**

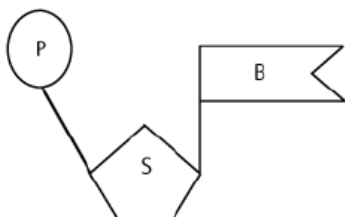
Marks	0	1	Average
%	22	78	0.8

Glutamic acid, cysteine, asparagine, glutamic acid

Students should be aware that if they choose not to write the complete answer and give abbreviations, these abbreviations must be recognisable. For example, 'asp' could represent aspartic acid **or** asparagine, and as a consequence these answers could not gain the mark.

**Question 2e.**

Marks	0	1	Average
%	59	41	0.4



To gain the mark, students needed to join the other two components on either side of the sugar. Most students demonstrated a pleasing level of understanding of the structure, function and role of nucleic acids.

**2008 – Question 1****Question 1**

Marks	0	1	2	Average
%	29	61	10	0.9

**1i.**

Chemical composition (any of):

- phospholipid
- phospholipid bilayer.

Appropriate explanations included:

- the hydrophilic head and the hydrophobic tail allow the passage of lipid soluble molecules
- it is flexible, to form vesicles
- it forms a waterproof barrier.

**1ii.**

Chemical composition (any of):

- protein
- protein channel
- polypeptide.

Appropriate explanations included:

- changeable shape to transport large molecules
- specific shape to transport specific molecules

This question allowed students to draw on their own experience gained through the SAC 'Movement of substances through a membrane'. The chemical composition for both parts was well answered and many students could relate the chemical composition of the phospholipid to its function. Very few students could correctly relate the structure of the protein to its function. The explanations had to be consistent with the composition given.

## 2008 – Question 2

### Question 2

This question mainly required students to recall information and, in part, apply the information given.

#### Question 2a.

Marks	0	1	2	Average
%	18	25	57	1.4

	DNA	RNA
Differences	<ul style="list-style-type: none"><li>• double stranded</li><li>• contains thymine</li><li>• contains deoxyribose sugar</li></ul>	<ul style="list-style-type: none"><li>• single stranded</li><li>• contains uracil</li><li>• contains ribose sugar</li></ul>

#### Question 2b.

Marks	0	1	Average
%	61	39	0.4

Any one of:

- mRNA: to carry information from the nucleus to the ribosome for protein synthesis
- tRNA: to carry specific amino acids to the ribosome for protein synthesis
- rRNA: a structural component of the ribosome.

The specific name of the RNA was not required; a letter was a suitable way to distinguish the type. Students should know that tRNA is transferRNA, **not** transportRNA. Students who used this incorrect term were not awarded a mark. Many students also incorrectly used the terms 'transcription' and 'translation'.

#### Question 2c.

Marks	0	1	Average
%	35	65	0.7

Amino acid

#### Question 2d.

Marks	0	1	Average
%	78	22	0.3

Any one of:

- collagen, to provide strength to skin
- fibrin, required for blood clotting
- myosin, to facilitate muscle contraction.

This question needed to be answered at the cellular level and students who named gross body structures, such as hair, did not gain the mark. A suitable name **and** function were required to gain the mark. 'Chitin' was an incorrect response given by some students.

#### Question 2e.

Marks	0	1	Average
%	71	29	0.3

Property

- strength
- flexibility

Explanation

- due to the arrangement of the polypeptides which enabled them to be stretched and return to the original shape
- parallel arrangement of protein fibres for support

2007 – Question 6

Question 6a.

Marks	0	1	2	Average
%	25	59	16	0.9

Large molecule	Monomers/subunits
Protein (or a specific example such as haemoglobin)	Amino acids
Lipid	Fatty acids OR fatty acids and glycerol OR no monomer
Polysaccharide (or a specific example such as starch)	Monosaccharide
DNA	Nucleotides

Students were awarded two marks for four correct answers; one mark for two or three correct answers; and no marks if only one or no correct responses were given.

Carbohydrate was not an accepted answer for a polymer of monosaccharides, as a **large** molecule was asked for. Many students incorrectly gave ‘nucleic acid’ as the monomer of DNA.

Question 6b.

Marks	0	1	Average
%	77	23	0.3

- A monosaccharide moves by facilitated diffusion **or** active transport.
- This occurs via protein channels **or** by protein carrier molecules.

The process and structure were required to gain the mark. Many students incorrectly stated the process was endocytosis or that the passage occurred through the phospholipid bilayer.

Question 6c.

Marks	0	1	Average
%	44	56	0.6

Any one of:

- as a component of plasma membrane
- as an energy source
- for energy storage.

Answers which suggested that there are ‘no monomers of lipids’ were also awarded the mark.

Question 6d.

Marks	0	1	Average
%	21	79	0.8

ATG	AAC	AGC	GGC
TAC	TTG	TCG	CCG

Many careless mistakes were made in this question, such as leaving out one base or making an error in the use of complementary base pairing rules.

Question 6e.

Marks	0	1	Average
%	34	66	0.7

Guanine

## 2007 – Question 7

### Question 7

Imprecise answers to this question cost many students marks.

#### Question 7a.

Marks	0	1	Average
%	65	35	0.4

The detection of changes in the DNA could lead to:

- the cancer being treated **earlier**
- members of the family receiving advice to be tested
- a lifestyle change.

Any of the above answers was accepted. Too many students stated the cancer could be detected and made no mention why this was an advantage. The knowledge gained by the change in the DNA had to be used to advantage.

#### Question 7b.

Marks	0	1	Average
%	52	48	0.5

The doctor is not likely to be concerned as the change in the DNA produces the **same** amino acid sequence.

#### Question 7c.

Marks	0	1	2	Average
%	61	17	23	0.6

Suitable applications of **molecular** biology in medicine included:

- design of a drug or vaccine which is specific to the target cell or which does not cause harm to healthy body cells or natural flora

## 2006 – Question 1

### Question 1

#### Question 1a.

Marks	0	1	Average
%	60	40	0.4

The emphasis is on the study of all proteins because of the interaction between proteins, and the reliance that some have on others.

Although this question was well answered by many students, others failed to identify either of the points above.

#### Questions 1b.

Marks	0	1	Average
%	70	30	0.3

Structures may be important because:

- of the ability of the protein to stretch or contract (elongate or shorten) in particular situations
- pleating may strengthen the molecule and that may be important for its function
- particular structures may provide an active or binding site for an enzyme or other molecule.

Few students appeared to understand that secondary-structure proteins may have a particular function in that state, with many writing only about them being part of a tertiary-structure protein. Answers that gave general comments, such as 'the protein could be an enzyme', without explaining the relevance of structure received no credit.



**Question 1c.**

Marks	0	1	2	3	Average
%	36	22	22	19	1.3

Function of protein	Example
structural	collagen, keratin, silk, cytoskeleton, cilia, fibrin, fingernails
transport	haemoglobin, protein carrier, serum albumin
regulatory	hormone (or specific example), enzyme (or specific example), major histocompatibility complex (MHC)

This question was generally well answered. Incorrect answers generally referred to compounds such as carbohydrates and other non-protein compounds.

**2012 – Question 1****Question 1a.**

Marks	0	1	2	Average
%	18	47	35	1.2

Name: cell membrane or plasma membrane

Description: a phospholipid bi-layer

A common incorrect answer was cell wall. Many students described a function of the cell membrane rather than describing its structure.

**Question 1b.**

Marks	0	1	2	Average
%	14	20	66	1.5

Plants have a cell wall and animal cells do not.

Any other suitable organelle unique to plant and animal cells such as chloroplasts, centrioles, etc. was acceptable. Comparative statements such as 'Only plant cells have cell walls' were also accepted.

**Question 1c.**

Marks	0	1	2	Average
%	18	30	52	1.4

A lack of mitochondria would mean a lower rate of cellular respiration and the person would tire more readily.

**Question 1d.**

Marks	0	1	2	Average
%	46	21	33	0.9

Cytosol is the fluid part of the cell. Cytoplasm is the fluid part and organelles excluding the nucleus (the area between the nucleus and plasma membrane).

**2009 – Question 5****Question 5e**

Marks	0	1	Average
%	23	77	0.8

Rough endoplasmic reticulum

Abbreviations were not acceptable.

**Question 5f.**

Marks	0	1	Average
%	14	86	0.9

Golgi (body, apparatus, complex)

**Question 5g.**

Marks	0	1	Average
%	49	51	0.5

Endocytosis

2005 – Question 1

**Question 1**

Marks	0	1	2	3	Average
%	3	9	26	61	2.5

Cellular structure in the plant cell	Matching function choose one from (A–H)
Golgi apparatus	D
mitochondria	A
chloroplast	F
lysosome	B
vacuole	H
cell membrane	E