

Unit 3 Biology

Revision Booklet 1

Topics

Biomolecules

Plasma Membrane

Transport of substances

&

The Cell and Organelles

Name:

Question 3 (2012)

Human insulin is a macromolecule composed of two amino acid chains. The chains are connected by disulfide bonds.

- a. To what group of macromolecules does insulin belong?

1 mark

Insulin found in other animals varies from human insulin.

The following table compares all the differences seen in the primary structure of human, cow, pig and sheep insulin.

	Amino acid position number within	
	Alpha chain	Beta chain
	-8 - 9 - 10-	-30-
human	-thr - ser - ile-	thr
cow	-ala - ser - val-	ala
pig	-thr - ser - ile-	ala
sheep	-ala - gly - val-	ala

- b. What is meant by the term 'primary structure' of the insulin macromolecule?

1 mark

Humans with diabetes take insulin injections to maintain their health.

- c. If supplies of human insulin were not available, which one of the other three animals listed in the table would be the best source of insulin? Explain your reason for choosing this particular animal.

Animal _____

Explanation _____

2 marks

The table below contains the genetic code for protein production.

		Second letter					
		A	G	T	C		
First letter	A	AAA } phe AAG } AAT } leu AAC }	AGA } AGG } ser AGT } AGC }	ATA } tyr ATG } ATT } Stop ATC } Stop	ACA } cys ACG } ACT } Stop ACC } trp	A G T C	
	G	GAA } GAG } leu GAT } GAC }	GGA } GGG } pro GGT } GGC }	GTA } GTG } his GTT } GTC } gln	GCA } GCG } arg GCT } GCC }	A G T C	
	T	TAA } TAG } ile TAT } TAC } met Start	TGA } TGG } thr TGT } TGC }	TTA } TTG } asn TTT } TTC } lys	TCA } ser TCG } TCT } arg TCC }	A G T C	
	C	CAA } CAG } val CAT } CAC }	CGA } CGG } ala CGT } CGC }	CTA } CTG } asp CTT } CTC } glu	CCA } CCG } gly CCT } CCC }	A G T C	
						Third letter	

d. Use the information in the table to explain

- i. the different sequence of nucleotides in humans and cows with respect to the DNA coding for the amino acid at position 30.

- ii. whether the sequence of nucleotides in DNA coding for the amino acid at position 30 will be identical in cows, pigs and sheep.

1 + 1 = 2 marks

SECTION B – Short answer questions**Instructions for Section B**

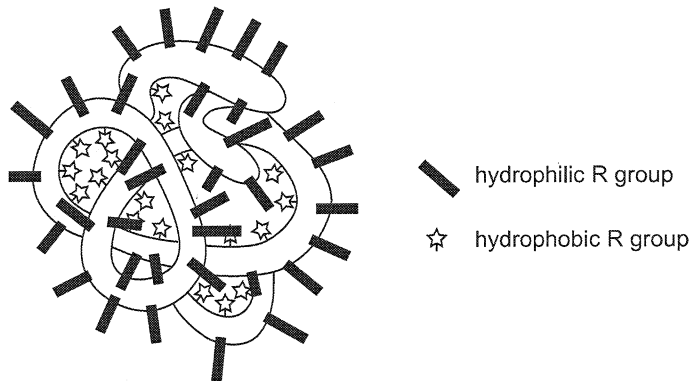
Answer this section in **pen**.

Answer **all** questions in the spaces provided.

Question 1

2041

The following figure represents a globular protein.

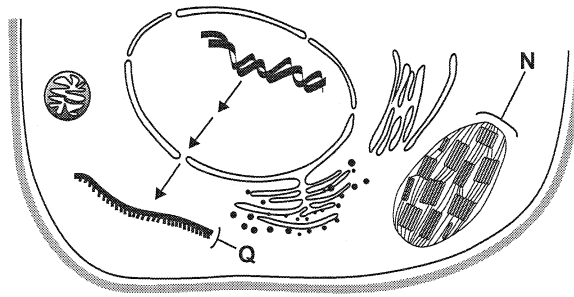


This molecule is likely to be highly soluble in water.

- a. Outline why such a conclusion can be made about this molecule.

2 marks

The following figure represents a portion of a plant cell.

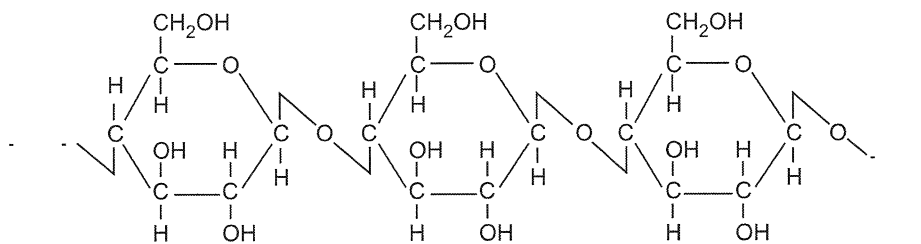


b. Examine the figure above and complete the following table.

	Type of nucleic acid found in structure	Specific function of the nucleic acid
Structure N		
Structure Q		

4 marks

The following diagram shows a portion of an unknown macromolecule found in cells. The remaining portion of the molecule contained the same repeating unit.



Two students were discussing this diagram. Sally suggested it represents cellulose. Toby disagreed. He suggested that the diagram represents the enzyme cellulase.

c. Name the student who is correct and explain why.

2 marks

Total 8 marks

SECTION B – continued
TURN OVER

Question 6

(2010)

- a. List the three components of a DNA nucleotide.

1 mark

In Tay Sachs disease (TSD), the enzyme that breaks down glycolipid is faulty due to a genetic mutation. Examine the following two tables.

Table X – Portion of the genetic code

First letter	Second letter				Third letter
	A	G	T	C	
A	phe	ser	tyr	cys	A
G	leu	pro	his	arg	A
C	val	ala	glu	gly	T

Table Y – Portion of DNA sequences

	DNA nucleotide sequence	Amino acid sequence
Normal individual	-- CTT GCA AAA --	glu - arg - phe
TSD individual	-- CTT GTA AAA --	

The amino acid sequence shown in Table Y for a normal individual forms part of the enzyme hexosaminidase A (Hex A).

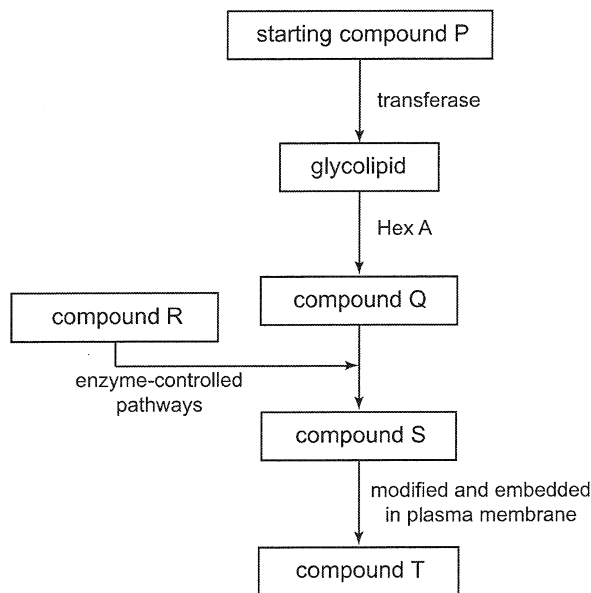
- b. What is the amino acid sequence for the TSD individual in Table Y? Use the information in Table Y to explain how changing one amino acid in a polypeptide may adversely affect the function of a protein of which the amino acid is part.

TSD amino acid sequence _____

Explanation _____

3 marks

Part of the metabolic pathway for the breakdown of glycolipid is shown below.



- c. Explain which enzyme-substrate complex fails to form correctly in sufferers of TSD.

2 marks

A promising form of treatment for TSD is the addition of N-mycin, a chemical which inhibits the action of transferase.

- d. Describe how this treatment may reduce the excessive build-up of brain cell glycolipids without compromising the health of the individual.

2 marks

Total 8 marks

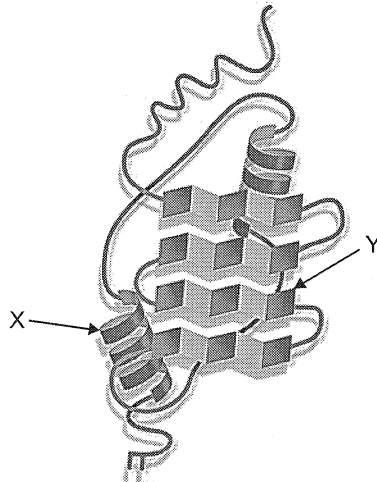
SECTION B – Extended response questions**Instructions for Section B**

Answer this section in **pen**.

Answer **all** questions in the spaces provided.

Question 1

The diagram below shows the structure of a particular protein molecule.



- a. The protein contains two distinctive types of polypeptide chains labelled X and Y. What are the names of these two types?

Chain X _____

Chain Y _____

2 marks

- b. Name a polysaccharide found in animals and describe its function.

Name _____

Function _____

2 marks

- c. What is the function of cholesterol in cell membranes?

1 mark

Total 5 marks

Question 2

- a. A section of one of the strands of a DNA molecule has the sequence of bases shown.

DNA: C T T A C A T T A C T C

In the spaces below, enter the sequence of bases in the corresponding mRNA which is complementary to this DNA.

mRNA											
------	--	--	--	--	--	--	--	--	--	--	--

1 mark

- b. The percentage of base T in a molecule of DNA is 30%. What is the percentage of G bases in the same DNA molecule?

1 mark

Another type of nucleic acid is tRNA.

- c. i. Where is tRNA found in a cell?

- ii. Describe the role of tRNA.

1 + 1 = 2 marks

- d. The table shows the names of six amino acids together with some of their DNA codes.

Amino acids	DNA triplet(s)
cysteine	ACA, ACG
glutamic acid	CTT, CTC
aspartic acid	CTA, CTG
asparagine	TTA, TTG
leucine	GAA, GAG, GAT, GAC
methionine	TAC

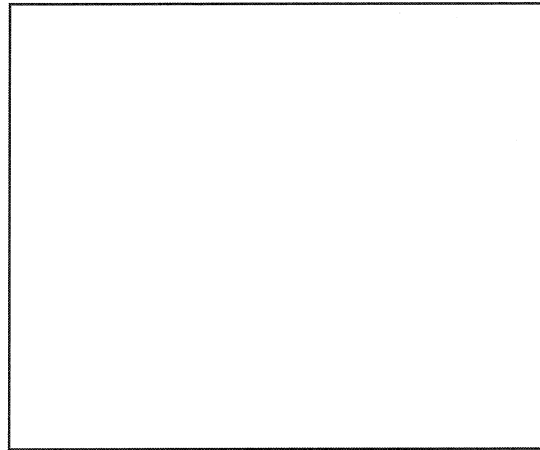
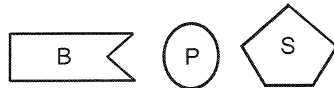
Use the information in the table and write the order of amino acids coded for by the DNA sequence given in part a.

1 mark

Nucleic acids are made up of nucleotides. Each nucleotide consists of three components, sugar (S), phosphate (P) and nitrogen base (B), linked together in a particular way.

- e. In the empty box, draw a diagram to show the way the three components are joined to make a nucleotide.

Use the following symbols in your diagram.



1 mark

Total 6 marks

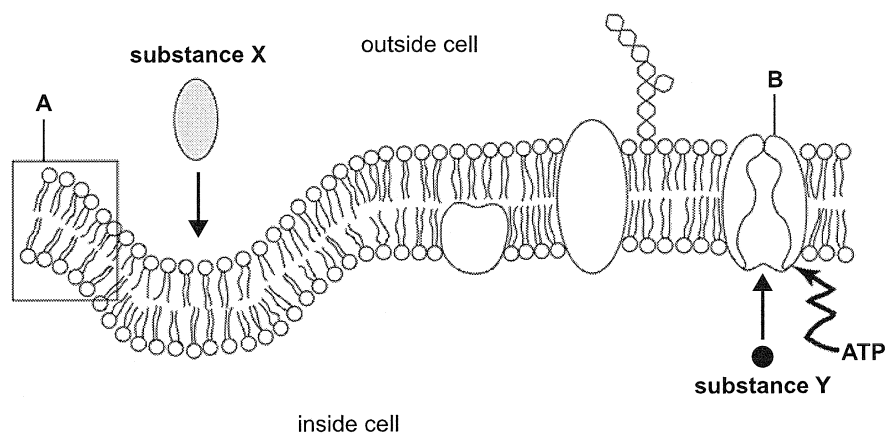
SECTION B – Extended response questions**Instructions for Section B**

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Answer all questions in the spaces provided.

Question 1 2008

The diagram below shows a cross section of part of the plasma membrane of a typical mammalian cell. The substances labelled X and Y are about to be transported across the membrane in the directions shown by the arrows (→).

**i. Structure A**

Chemical composition _____

Explain how the chemical composition of structure A facilitates its role.

ii. Structure B

Chemical composition _____

Explain how the chemical composition of structure B facilitates its role.

1 + 1 = 2 marks

Question 2 2008

There are structural differences between molecules of DNA and RNA.

- a. Outline two of these differences by completing the following table.

	DNA	RNA
Difference 1		
Difference 2		

2 marks

- b. Name one kind of RNA and state its function.

Type of RNA _____

Function _____

1 mark

Proteins may be classified as fibrous or globular depending on their 3-dimensional shape.

In fibrous proteins, the polypeptide chains are arranged in parallel to form long fibres or sheets. In globular proteins, the polypeptide chains are folded into compact spherical or globular shapes.

- c. Name the subunit of a polypeptide.

1 mark

Keratin, found in fingernails and claws, is an example of a fibrous protein.

- d. Name another example of a fibrous protein and briefly outline its function.

1 mark

- e. Describe a distinctive property of a fibrous protein and explain how this property is due to the arrangement of its polypeptides.

1 mark

Total 6 marks

Question 6 2007

During digestion, large molecules are broken down into their constituent monomers (subunits).

- a. Complete the table below.

Large molecules	Monomers (subunits)
	Amino acids
Lipid	
	Monosaccharide
DNA	

2 marks

- b. Explain how a monosaccharide enters an epithelial cell.

1 mark

- c. For what purpose would a cell use a lipid monomer?

1 mark

- d. Part of the sequence of a DNA strand responsible for the production of an amino-acid chain is shown. Below it, write the complementary DNA base sequence.

ATG	AAC	AGC	GGC

1 mark

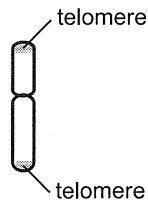
- e. What does G in AGC stand for?

1 mark

Total 6 marks

Question 7 2007

Chromosomes are DNA structures in the nucleus of a cell. The ends of chromosomes are called telomeres.



Some changes in the DNA of these telomeres can trigger the development of cancer.

Scientists are working to detect these changes in telomeres at an early stage of their development.

- a. Outline one advantage of being able to detect early changes in telomere DNA.

1 mark

One normal sequence of DNA in a particular telomere was AATCGTCCAGGG. On examination of the telomeres of one patient this sequence was found to have changed to AACCGTCCTGGG.

The doctor examined the relationship between a DNA sequence and amino acids that could be expected. He used the following table to obtain information.

DNA sequence	Amino acid
AAT or AAC	leucine
CGT or CGG	alanine
CCA or CCT	glycine
GGG or GGT	proline

- b. Is the doctor likely to be concerned or not concerned about the change in the telomere DNA of this patient? Explain your answer.

1 mark

- c. Name one application of molecular biology in medicine that you have studied this year and outline the significance of its use.

Name of application _____

Significance _____

2 marks

Total 4 marks

SECTION B – Short-answer questions

Instructions for Section B

Answer this section in **pen**.

Answer all questions in the spaces provided.

Question 1 2006

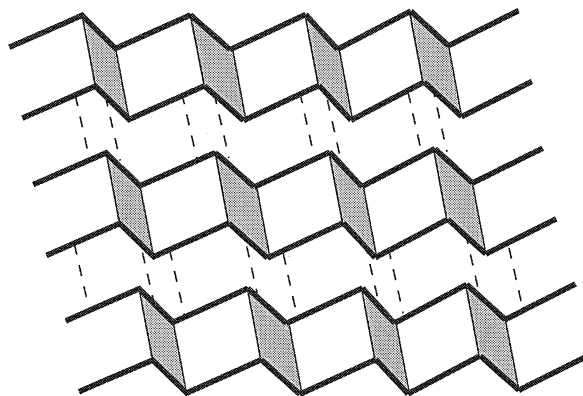
Scientists are now turning to the study of the proteome (all of the proteins) of an organism rather than the study of single proteins.

- a. Briefly outline **one** reason why the emphasis is now on the study of all the proteins of an organism rather than on one protein at a time.

1 mark

Protein molecules come in many shapes and forms that can be classified into primary, secondary, tertiary and quaternary. The secondary, tertiary and quaternary shapes arise as a result of different kinds of folding of a primary structure.

One kind of secondary structure is a pleated sheet where the primary molecule extends along the folded sheet. The primary structures in the layers are held together by hydrogen bonding.



- b. Explain why such a structure may be important in the function of a particular protein.

1 mark

Proteins can also be classified on the basis of their general function. Three of these functions are shown in the table below.

- c. Complete the table by giving an example of a protein for each of the functions listed.

Function of protein	Example
structural	
transport	
regulatory	

3 marks

Total 5 marks

2006

SECTION B – Short answer questions**Instructions for Section B**

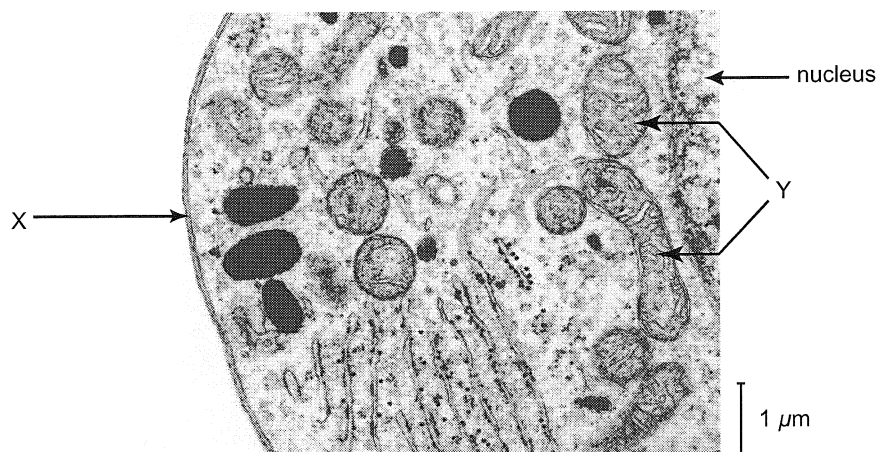
Answer this section in **pen**.

Answer **all** questions in the spaces provided.

Question 1

6202

The electromicrograph below shows a portion of a cell.



- a. Name and describe the structure of X.

Name _____

Description _____

2 marks

- b. What would you look for to determine whether a cell is from an animal or a plant?

2 marks

It has been suggested that as humans age the structures labelled Y become less efficient.

- c. Explain the consequence of this for an elderly person.

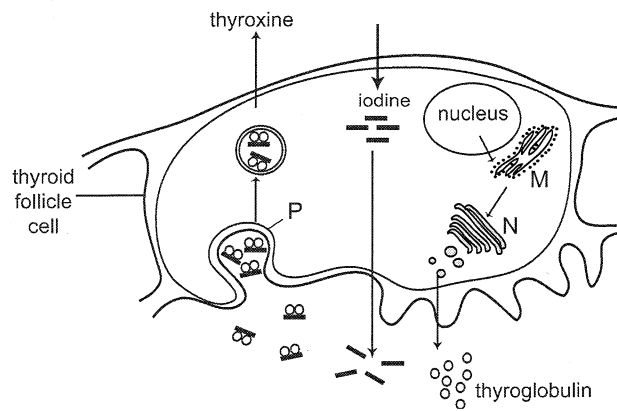
2 marks

- d. What is the difference between the cytosol and the cytoplasm of a cell?

2 marks

The following diagram shows some detail of a cell from a thyroid gland.

2009 Q 5



e. Name structure M.

1 mark

f. Name structure N.

1 mark

g. Name the process occurring at site P.

1 mark

Total 8 marks

SECTION B – Short-answer questions**Instructions for Section B**

Answer this section in **pen**.

Answer all questions in the spaces provided.

Question 1 2005

The table below contains the names of six cellular structures found in a plant cell.

In the list below the table, a number of functions of cellular structures are given. Complete the table by matching **the letter of a function** to the appropriate cellular structure in the plant cell. You are not required to use every function given.

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

Functions of various cellular structures of the plant cell

- A. site where ATP is generated
- B. digestion of macromolecules
- C. site of protein synthesis
- D. proteins modified and packaged for transport
- E. selective barrier that limits movement in or out of cell
- F. solar energy is converted to chemical energy
- G. contains DNA, a template for mRNA synthesis
- H. storage of wastes and other materials

Total 3 marks