VCE BIOLOGY 2015

YEAR 12 UNIT 3

Topic Test 1 – Molecules of Life

Time allowed: 50 minutes
Total marks: 40

14 Multiple Choice Questions
4 Short Answer Questions

An Answer Sheet is provided for Section A.
Answer all questions in Section B in the space provided.

Learning Materials *by Lisachem*
PO Box 2018, Hampton East, Victoria, 3188
Ph: (03) 9598 4564 Fax: (03) 8677 1725
Email: orders@learningmaterials.com.au or orders@lisachem.com.au
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STUDENT NUMBER									Letter
Figures									
Words									

Student Name....…….....

VCE Biology 2015 Year 12 Topic Test 1 Unit 3

Molecules of Life

Student Answer Sheet
There are **14 Multiple Choice** questions to be answered by circling the correct letter in the table below. Use only a 2B pencil. If you make a mistake, erase and enter the correct answer. Marks will not be deducted for incorrect answers.

Question 1	A	B	C	D	*Question 2*	A	B	C	D
Question 3	A	B	C	D	*Question 4*	A	B	C	D
Question 5	A	B	C	D	*Question 6*	A	B	C	D
Question 7	A	B	C	D	*Question 8*	A	B	C	D
Question 9	A	B	C	D	*Question 10*	A	B	C	D
Question 11	A	B	C	D	*Question 12*	A	B	C	D
Question 13	A	B	C	D	*Question 14*	A	B	C	D

VCE Biology 2015 Year 12 Topic Test 1 Unit 3

Molecules of Life

SECTION A – Multiple Choice Questions

Question 1
A large number of lipid molecules are hydrophobic in nature. This means that they are
A. lipophilic and easily dissolved in water.
B. lipophobic and soluble in oils.
C. lipophilic and insoluble in water.
D. lipophobic and insoluble in oils.

Question 2
Starch and cellulose are similar in that they are both
A. polymers of glucose molecules.
B. key components of the cell membrane in plant cells.
C. indigestible by human digestive enzymes.
D. synthesised and stored in the cytoplasm of cells.

Question 3
The monomers used to synthesise protein molecules contain a
A. carboxylic acid functional group, an amine functional group and varying types of R groups, resulting in the differences between these subunits.
B. phosphate group, an amine functional group and varying types of R groups, resulting in the differences between these subunits.
C. R group, a carboxylic acid functional group and varying types of amine groups, resulting in the differences between these subunits.
D. phosphate group, an amine functional group and varying types of carboxylic acid functional groups, resulting in the differences between these subunits.

*Questions 4 and 5 refer to **Figure 1**, which represents a nucleotide.*

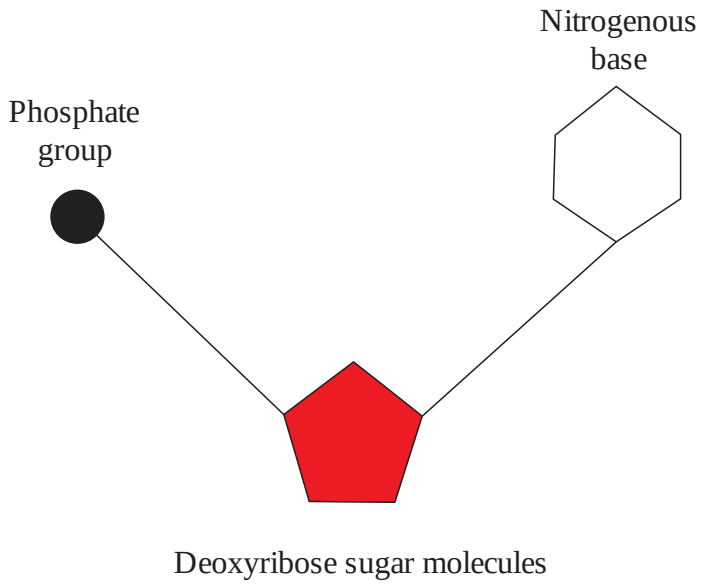


Figure 1

Question 4
The nitrogenous base pictured in **Figure 1** is best classified as a
A. purine.
B. pyrimidine.
C. nucleotide.
D. phospholipid.

Question 5
In **Figure 1**, the nitrogenous base could be
A. adenine.
B. guanine.
C. uracil.
D. cytosine.

***Figure 2** relates to Questions 6 and 7.*

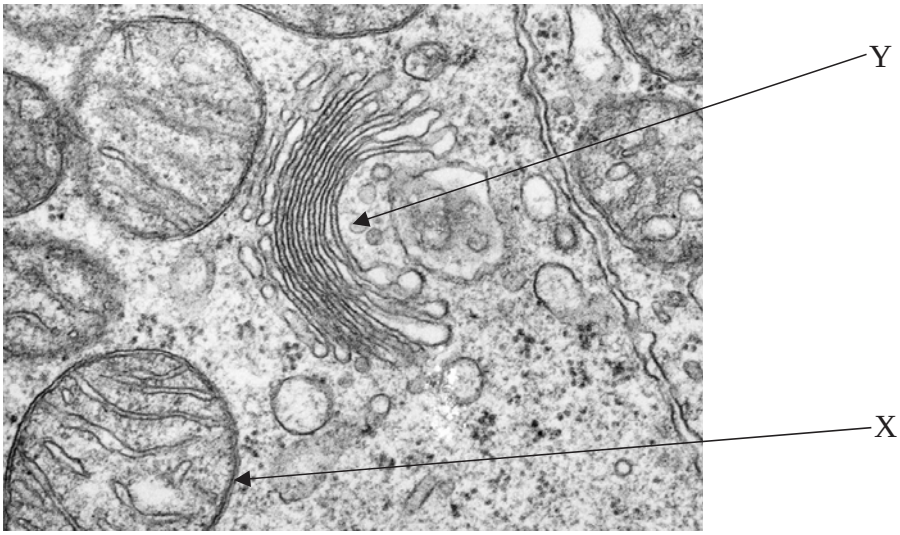


Figure 2: Electron micrograph of a eukaryotic cell.

Question 6
Referring to the electron micrograph shown in **Figure 2**, which of the following statements is correct about structure Y?

A. This structure packages proteins and other materials for both intracellular and extracellular transport.
B. Found in plants, this structure traps light energy and is involved in the photosynthetic process.
C. This structure is involved in the synthesis of proteins and glycolipids.
D. ATP is produced in this structure, which serves to power the cell's metabolic pathways.

Question 7
In **Figure 2**, structure X is a cellular organelle, which serves as the site of

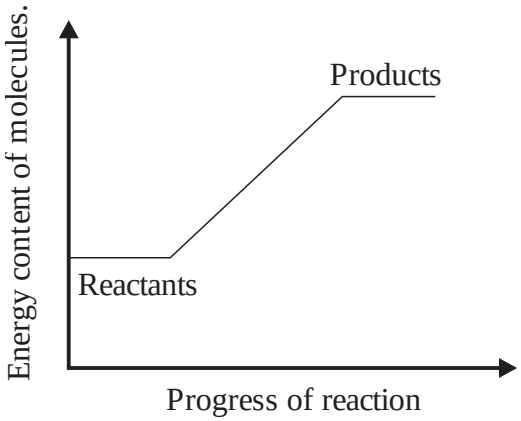
A. aerobic cellular respiration.
B. photosynthesis.
C. protein synthesis.
D. hydrolysis of lipids.

Question 8
During the light dependent phase of photosynthesis,

A. oxygen is converted to carbon dioxide in the grana of chloroplasts.
B. high energy electrons move through the electron transport chain in the stroma.
C. a water molecule is split and oxygen, ATP and NADPH are produced as products.
D. the Calvin cycle occurs, resulting in the production of a glucose molecule.

Question 9
During photosynthesis, the conversion of NADPH to NADP occurs in the
A. Calvin cycle.
B. light dependent phase of photosynthesis.
C. grana.
D. cristae.

The following information relates to Questions 10-12.



Graph 1: A biological reaction

Question 10
The reaction in **Graph 1** represents
A. a catabolic reaction.
B. an exergonic reaction.
C. an anabolic reaction.
D. cellular respiration.

Question 11
It would be reasonable to conclude that the biological reaction depicted in **Graph 1** involves the
A. production of ADP, P_i and NADPH.
B. breakdown of a complex molecule into simpler molecules.
C. cell expending energy and losing some of this energy as heat to the environment.
D. synthesis of a complex molecule from simpler molecules.

Question 12
A biological example of a reaction that would be representative of the reaction depicted in **Graph 1** would be
A. cellular respiration.
B. the hydrolysis of a protein molecule.
C. lipid digestion.
D. the synthesis of ATP.

Question 13
Which of the following molecules would pass through the phospholipids of a cell membrane at the fastest rate?

A. Amino acids.
B. Glucose.
C. Starch.
D. Carbon dioxide.

Question 14
A plant cell is placed into a hypertonic solution. When viewed under a light microscope, the

A. cell becomes turgid, but the cell wall maintains the shape of the cell.
B. cell becomes less turgid, but the cell wall maintains the shape of the cell.
C. cell wall bursts, liberating the cell contents.
D. vacuole increases in size and the plant cell becomes plasmolysed.

End of Section A

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Molecules of Life

SECTION B – Short Answer Questions

Question 1 (8 marks)
Enzymes are an essential part of metabolism; however some individuals with mucopolysaccharidosis II (MPS II) have a non-functional lysosomal enzyme, while other MPS II sufferers lack the enzyme completely. The lysosomal enzyme involved in MPS II normally breaks down long chained sugar molecules called glycosaminoglycans.

a. What is an enzyme? **1 mark**

_____

_____

b. It is possible that in people with MPS II, the lysosomal enzyme involved is denatured. Explain what it means if an enzyme is denatured and provide one example of a substance or condition that might cause an enzyme to denature. **2 marks**

_____

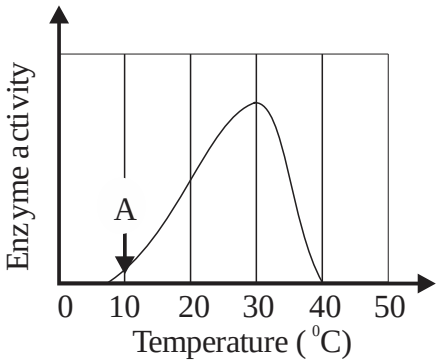
_____

_____

_____

_____

c.



Graph 2: The temperature tolerance range for the lysosomal enzyme in non-MPS II sufferers.

i. According to the information in **Graph 2**, what is the optimum temperature for the lysosomal enzyme shown? **1 mark**

_____

_____

ii. Account for the level of enzyme activity at point A in **Graph 2**. **1 mark**

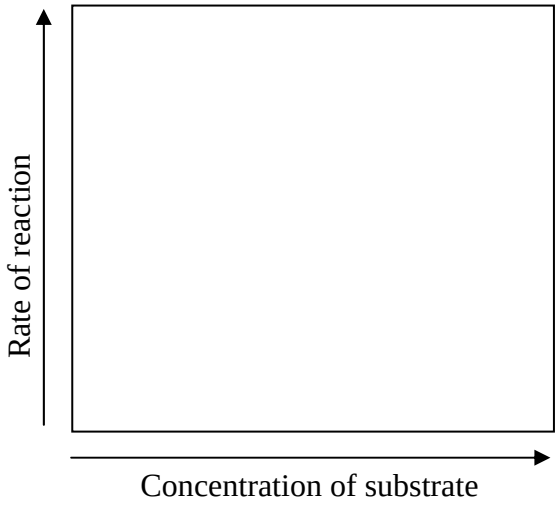
_____

_____

_____

_____

d. Sketch a graph in the space below, showing enzyme activity, when there is a fixed amount of enzyme present, but an increasing concentration of substrate being added. Explain what happens to the rate of the reaction as the concentration of the substrate increases. **3 marks**



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Question 2 (6 marks)
Aerobic cellular respiration in eukaryotic cells is a complex process which can be summarised as occurring in four main stages:

Stage I. glycolysis
Stage II. oxidation of pyruvate to acetyl – CoA
Stage III. Krebs Cycle
Stage IV. Electron Transport Chain

a. **i.** Which stage of aerobic cellular respiration occurs in the mitochondrial matrix? **1 mark**

_____

ii. Which stage of aerobic cellular respiration produces the most ATP? **1 mark**

_____

iii. Which stage of aerobic cellular respiration requires ATP to reach completion? **1 mark**

_____

b. What would the presence of lactic acid in muscle cells indicate? **1 mark**

_____

_____

_____

_____

_____

c. **i.** If fungal cells, like yeast, were exposed to similar conditions to those experienced by the muscle cells described in part **b)**, what process would occur? **1 mark**

_____

ii. What products would be formed? **1 mark**

_____

_____

Question 3 (6 marks)
In a recent study of proteomics, links between the muscle mass of individuals and the intake of dietary proteins were found. It was also established that the human proteome is homologous with 61% of the fruit fly proteome. Proteomics is defined as being the large scale study of proteins, particularly their structure and function.

a. The proteome is the entire set of proteins expressed by a cell at a certain time and under certain conditions. What term describes the genetic material that controls the proteome's expression? **1 mark**

_____

_____

_____

Figure 3 shows a level of protein organisation.

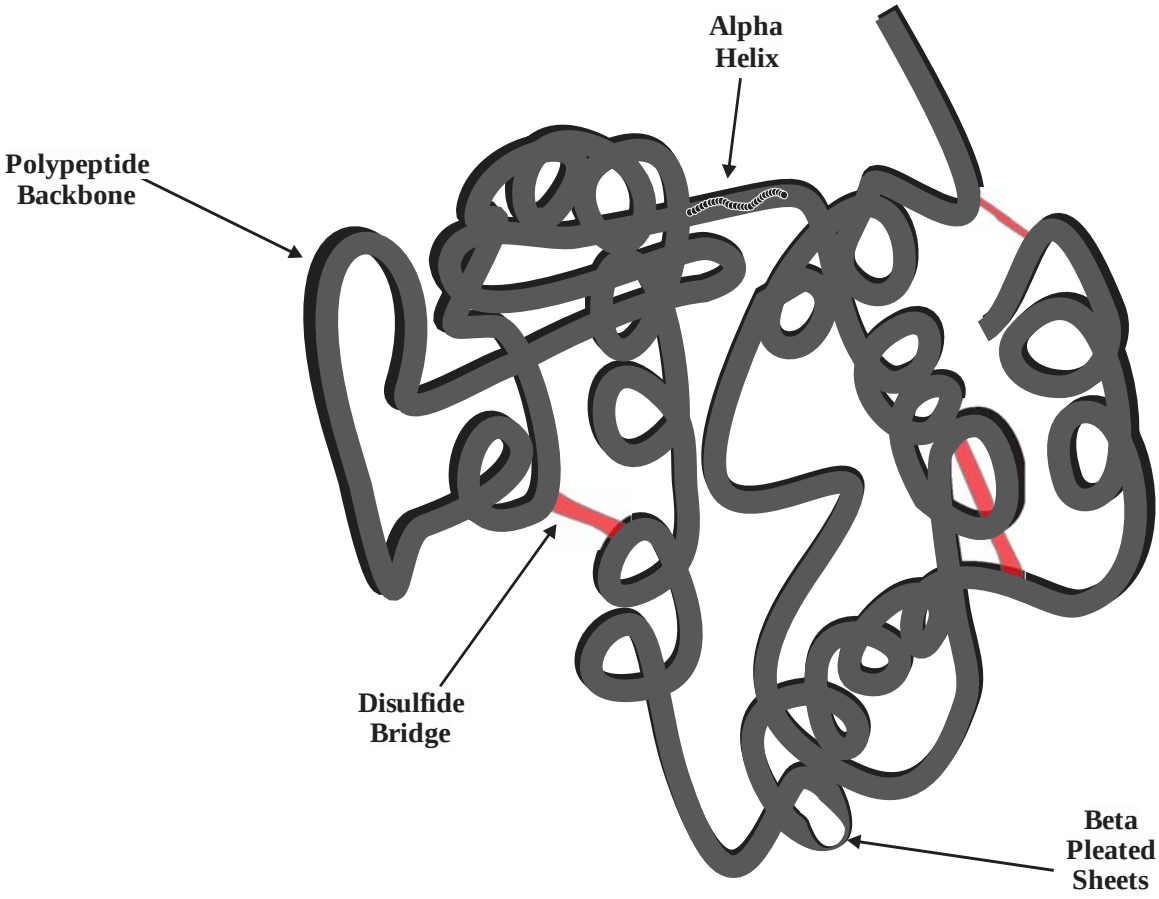


Figure 3

b. What level of protein organisation is being shown in **Figure 3**? **1 mark**

_____

_____

c. What is meant by the polypeptide backbone shown in **Figure 3**? **1 mark**

_____

d. Explain what is meant by the quaternary structure of a protein and give an example of a protein that has a quaternary structure? **2 marks**

_____

_____

_____

_____

e. What level of protein organisation is not affected by denaturation and clearly explain why it is not? **1 mark**

_____

_____

_____

Question 4 (6 marks)
Lipids are a type of biomolecule that are very important for cellular processes and structures.

a. What are the **three** main chemical elements typically found in lipid molecules? **1 mark**

_____

_____

b. Explain how the cytosol of a cell is kept separate from the extracellular fluid surrounding the cell. In your answer, refer to the properties of the biomolecules involved in the structure described. **2 marks**

_____

_____

_____

_____

c. Draw a generalised labelled diagram of a phospholipid molecule, in the space provided below. Identify the hydrophobic and hydrophilic components of the molecule drawn. **2 marks**

d. How does a phospholipid molecule differ from a triglyceride molecule? **1 mark**

_____

_____

_____

End of Section B

End of Topic Test 1

Suggested Answers

VCE Biology 2015 Year 12 Topic Test 1 Unit 3

Molecules of Life

SECTION A – Multiple Choice Answers

1. C	**2.** A	**3.** A	**4.** B	**5.** D	**6.** A	**7.** A
8. C	**9.** A	**10.** C	**11.** D	**12.** D	**13.** D	**14.** B

SECTION B – Short Answer (Answers)

Question 1 (8 marks)

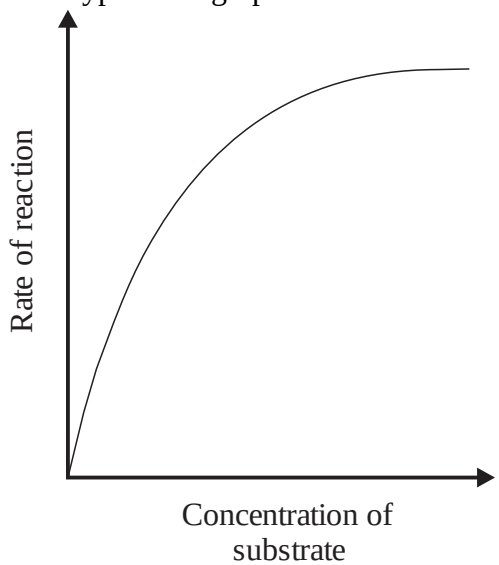
a. An enzyme is a protein which catalyses a specific biochemical reaction **(1 mark)**.

b. An enzyme that is denatured has both its secondary and its tertiary structure disrupted, leading to a loss of function **(1 mark)**. Students only need one of the following: Extremes of temperatures or pH levels outside the enzyme's tolerance range or the presence of poisons, heavy metal salts or alcohol can all lead to the denaturation of proteins **(1 mark)**.

c. **i.** 30°C **(1 mark)**.

ii. At point A, the temperature is too cold for the enzyme to optimally function. At a colder temperature, reacting molecules have lower kinetic energy therefore collide less frequently and thus the reaction rate is lowered **(1 mark)**.

d. Students should draw a hyperbolic graph similar to the one below **(1 mark)**.



There is initially a dramatic increase in the rate of the reaction, due to the lower concentration of substrate but high availability of the enzyme **(1 mark)**. The graph then plateaus because the enzyme becomes saturated with substrate, due to the increase in substrate concentration, making the reaction dependent on the availability of the enzyme rather than on the concentration of the substrate **(1 mark)**.

Question 2 (6 marks)

a. **i.** Stage III **(1 mark)**.

ii. Stage IV **(1 mark)**.

iii. Stage I **(1 mark)**.

b. Lactic acid build up in muscle cells indicates oxygen deficiency and the cells are accessing additional energy through anaerobic respiration **(1 mark)**.

c. **i.** Fermentation **(1 mark)**.

ii. Ethanol **(1 mark)**.

Question 3 (6 marks)

a. The genome of a cell **(1 mark)**.

b. Tertiary structure **(1 mark)**.

c. The polypeptide backbone refers to the sequence of amino acids that are bonded together to form the primary structure of the protein **(1 mark)**.

d. Proteins have quaternary structure when more than one polypeptide chain is joined together to make a protein. These polypeptide chains are held together by R group interactions **(1 mark)**. Haemoglobin or other suitable answer **(1 mark)**.

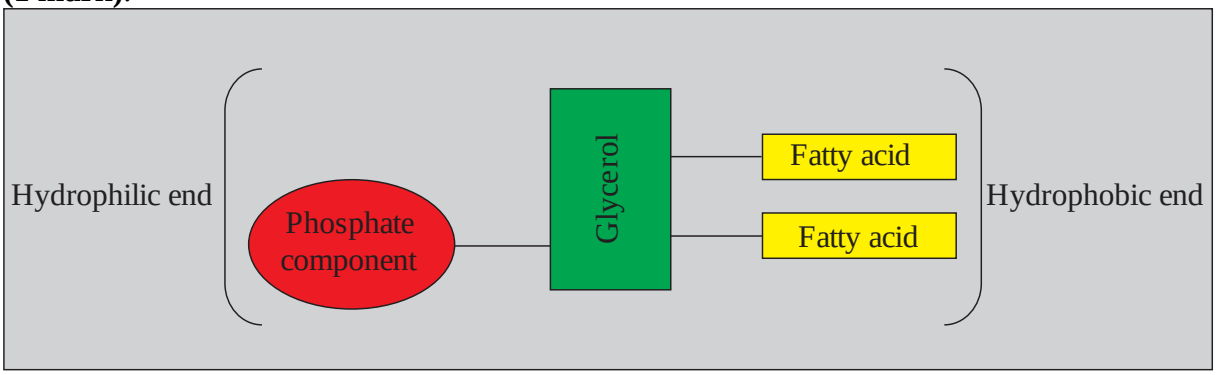
e. The primary structure of a protein is unaffected by denaturation, because the covalent peptide bonds between the amino acid molecules are too strong and remain unaffected by agents of denaturation **(1 mark)**.

Question 4 (6 marks)

a. Carbon, hydrogen and oxygen **(1 mark)**.

b. The phospholipid bilayer is responsible for the boundary created between the cytosol of a cell and the extracellular fluid surrounding the cell **(1 mark)**. The hydrophobic section of the phospholipids align towards the cell membrane, whilst the hydrophilic components face both the cytosol and extracellular fluid. These properties create a boundary between the cytosol and extracellular fluid **(1 mark)**.

c. Students should draw a labelled diagram similar to the one below.
Correctly drawing and labelling a phosphate group, glycerol molecules and two fatty acid chains **(1 mark)**. Correctly labelling the hydrophobic and hydrophilic ends **(1 mark)**.



d. Both molecules have a glycerol component but a triglyceride molecule possesses three fatty acid chains, whereas a phospholipid has a phosphate group and two fatty acid chains **(1 mark)**.

End of Suggested Answers