

SECTION A - Multiple-choice questions
Instructions to students

Use a **PENCIL** for ALL entries. For each question, shade the box which indicates your answer. All answers must be completed like **THIS** example:



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ONE ANSWER PER LINE

USE PENCIL ONLY

1	A	B	C	D	5	A	B	C	D
2	A	B	C	D	6	A	B	C	D
3	A	B	C	D	7	A	B	C	D
4	A	B	C	D					

Question 1

A typical prokaryotic cell does not have:

- A. nucleic acid.
- B. membrane bound organelles.
- C. ribosomes.
- D. cell membrane.

Question 2

Which of the following shows the correct relationship between a simple organic molecule and a large molecule composed of the smaller units?

- A. Glucose → fat
- B. Amino acid → protein
- C. Glycerol → glycogen
- D. Fatty acids → starch

Question 3

Proteins are manufactured in the

- A. nucleus.
- B. golgi body.
- C. endoplasmic reticulum.
- D. Ribosome.

Question 4

Nuclear DNA (deoxyribonucleic acid) is a double stranded nucleic acid molecule. In a double stranded DNA molecule:

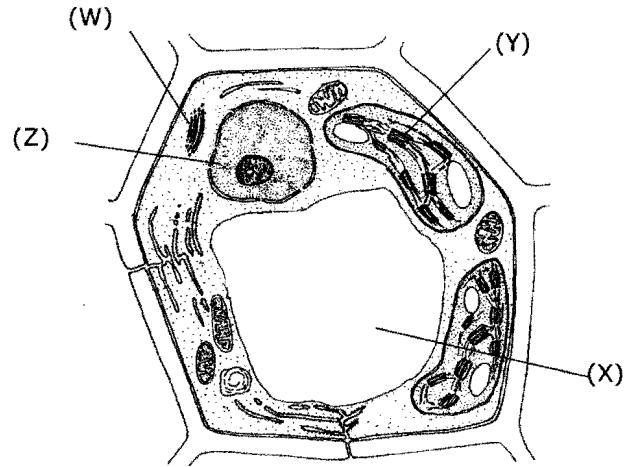
- A. the number of adenine bases is equal to the number of thymine bases.
- B. the number of guanine bases is twice the number of cytosine bases.
- C. the numbers of all four bases (adenine, thymine, guanine and cytosine) are equal.
- D. the number of adenine and uracil bases are the same.

Question 5

Which of the following statements is **not** true of polysaccharides found in living cells?

- A. Starch is an important energy storage molecule in plant cells.
- B. Chitin is found in the cell walls of some fungi.
- C. Cellulose is a component of all plant cell membranes.
- D. They are composed of monosaccharide sub units.

The following is a diagram of a typical plant cell.



Question 6

Which of the following correctly identifies the name and function of the organelle identified?

	Organelle	Name of organelle	Function of organelle
A.	W	Golgi complex	Packages proteins for secretion from cell
B.	X	Vacuole	Stores enzymes packets for digestion of proteins
C.	Y	Nucleus	Production of protein molecules
D.	Z	Chloroplast	Manufacture of glucose molecules

Question 7

The above cell can be called a generalised plant cell because:

- A. it shows the relative size and number of organelles present in a plant cell.
- B. it shows details of organelles often found in plant cells.
- C. it is exactly how a plant cell would appear when viewed with an electron microscope.
- D. it is exactly how a plant cell would appear when viewed with a light microscope.

ANSWER PER LINE

USE PENCIL ONLY

A B C D

11 A B C D

A B C D

12 A B C D

A B C D

Question 8

Unicellular organisms greater than $1000\mu\text{m}$ are rarely seen. This is because:

- A. cells larger than this are visible to predators.
- B. diffusion alone is not adequate for nutrient supply.
- C. they are unable to reproduce.
- D. cell membranes begin to break apart.

Question 9

Steroids are important molecules in intercellular communication. Steroids are:

- A. composed of 4 linked amino acids.
- B. relatively simple 4 ringed carbohydrates.
- C. lipids consisting of linked rings of carbon atoms.
- D. composed of glycerol and fatty acids.

Question 10

An organelle in a cell can only be seen with the aid of the electron microscope. This means that the organelle is:

- A. not living.
- B. very small.
- C. complex.
- D. made of lipid.

Question 11

Liver cells were ground up and then spun in a centrifuge, with the heavier cell organelles collecting at the bottom of the centrifuge tube. Which of the following organelles would fall to the bottom first?

- A. mitochondria.
- B. chloroplasts.
- C. golgi apparatus.
- D. nuclei.

Question 12

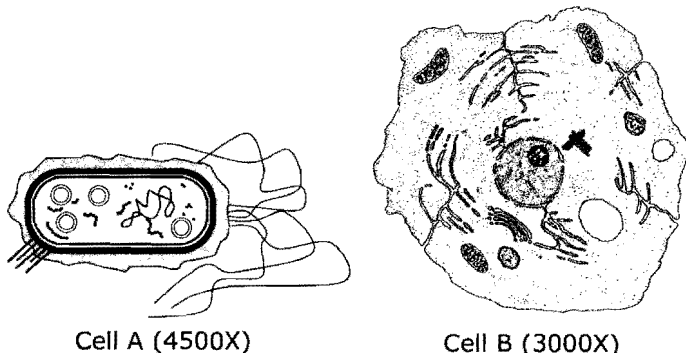
The light microscope is useful for viewing cells of a certain size. Cells of which of the following sizes could be viewed with a light microscope?

- A. 5 millimeter.
- B. 50 micrometer.
- C. 15 nanometer.
- D. 50 nanometer.

SECTION B - Short-answer questions: Instructions to students
 Answer this section in pen. Answer all questions in the spaces provided.

Question 1

The following diagrams are of two cells observed with the electron microscope.



- a. i.** Is cell A prokaryotic or eukaryotic?

- ii.** What are two reasons for your answer to a.i. above.

- 1 + 2 = 3 marks

- b. i.** Is cell B prokaryotic or eukaryotic?

- ii.** What are two reasons for your answer to b.i. above.

- 1 + 2 = 3 marks

- c. i.** What would you expect to be the size range of cell A? (Give your answer in μm .)

- ii.** What would you expect to be the size range of cell B? (Give your answer in μm .)

- 1 + 1 = 2 marks
 Total 8 marks

Question 2

The following table shows the percentage of **different** biological molecules, by mass, in a cell which has had all of its water removed. Also shown is the number of different molecules of each type found in the cell.

	% of total dry mass	Number of different types of molecules
Protein	55	960
RNA	20.5	400
DNA	3.1	1
Lipid	9.1	4
Glycogen	2.5	1

- a.** What evidence is there in this data that the cell was a prokaryotic cell?

- 1 mark
- b.** Protein and glycogen are both large polymers. Why is there just one type of glycogen and many types of protein?

- 2 marks
- c.** Four different types of lipid were found. Name and outline the functions of two types of lipids found in cells.

- 2 marks
 Total 5 marks

Question 3

Part of a nucleic acid molecule extracted from a living cell of a cat, was examined in a laboratory. The sequence of bases in the molecule was determined to be:

TAC ACA GGC GAT AGG CCG

- a. What evidence is there that this base sequence was determined from a molecule of DNA?

1 mark

- b. Where in a cell would this molecule be found?

1 mark

- c. i. DNA is a double stranded molecule. What type of chemical bond holds the two strands of a DNA molecule together?

- ii. What would be the sequence of bases on the corresponding strand of a double stranded DNA molecule?

1 + 1 = 2 marks

- d. The sequence of bases TAC in human DNA codes for the amino acid methionine. Explain whether the sequence of bases TAC would code for methionine in the cat's cells.

1 mark
total 5marks

SECTION A - Multiple-choice questions

Instructions to students

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3	A	B	C	D
4	A	B	C	D

5	A	B	C	D
6	A	B	C	D
7	A	B	C	D

Question 1

Which of the following is a protein?

- A. cellulose.
- B. phospholipid.
- C. sucrose.
- D. haemoglobin.

Question 2

The message for a protein under construction is carried from the nucleus to the ribosome by

- A. messenger RNA.
- B. transfer RNA.
- C. DNA.
- D. protein.

Question 3

Chloroplasts and mitochondria:

- A. are both found in eukaryotic and prokaryotic cells.
- B. each have two membranes that are similar to prokaryotic membranes.
- C. probably evolved after a host cell engulfed a prokaryotic cell.
- D. are both involved in the breakdown of glucose molecules.

Question 4

A semi-permeable membrane can best be described as:

- A. allowing molecules to pass into the cell only.
- B. allowing fat soluble molecules to pass through.
- C. allowing some molecules to pass through.
- D. allowing molecules to pass out of the cell only.

Question 5

Glucose is a water soluble molecule. By what route does it pass through the cell membrane?

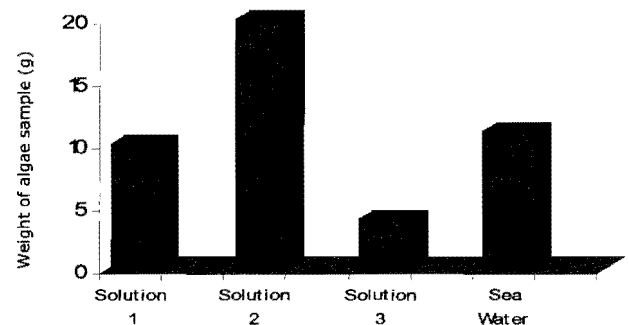
- A. Transferred by the carrier proteins.
- B. Diffuses across the membrane.
- C. Passes between the phospholipid molecules.
- D. Enters in a vesicle.

Question 6

Which of the following is the difference between active transport and facilitated diffusion?

- A. Active transport involves membrane proteins, but facilitated diffusion does not.
- B. Active transport requires energy from the cell, but facilitated diffusion does not.
- C. Facilitated diffusion involves membrane proteins, but active transport uses active proteins.
- D. Facilitated diffusion requires energy from the cell and active transport does not.

The following graph shows the weight of samples of algae after they were suspended in solutions of varying salt concentration for a period of 3 hours. Each sample was weighed prior to the experiment to ensure an equal weight of algae was placed in each solution. This weight is shown as 'Seawater' in the graph.

Weight of algae kept in varying salt concentrations.**Question 7**

Which of the following is the most likely explanation for the increase in weight found in the algae in Solution 2?

- A. Solution 2 had a higher solute concentration than seawater so more water moved into the algal cells.
- B. Solution 2 had a lower solute concentration than seawater so more water moved into the algal cells.
- C. Solution 2 was kept in the dark.
- D. Solution 2 was deprived of carbon dioxide.

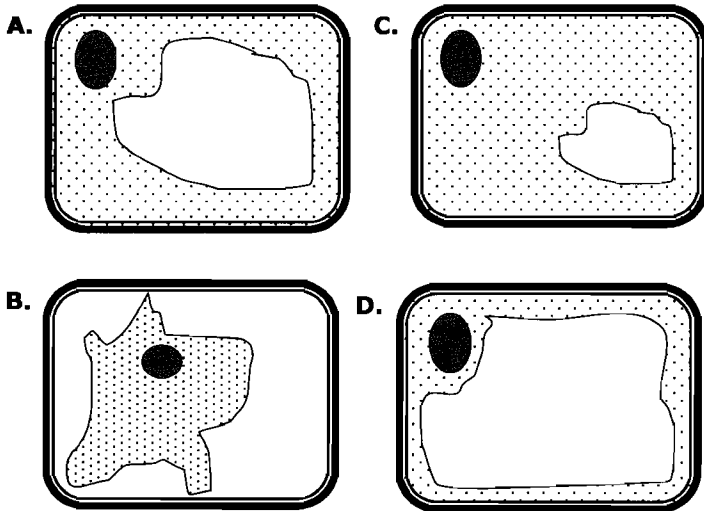
ONE ANSWER PER LINE USE PENCIL ONLY

8 A B C D 10 A B C D

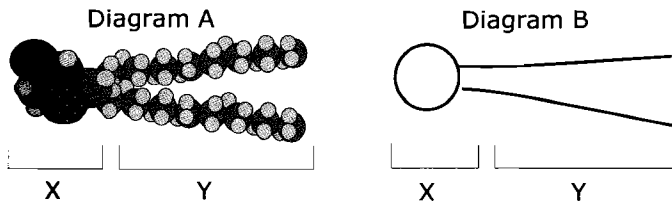
9 A B C D 11 A B C D

Question 8

Cells from the algae kept in Solution 3 were examined at the end of the four-hour period. Which of the following diagrams is most likely to be a cell from the algae kept in Solution 3?



The following two diagrams represent a phospholipid molecule. Diagram B is a very simplified representation.



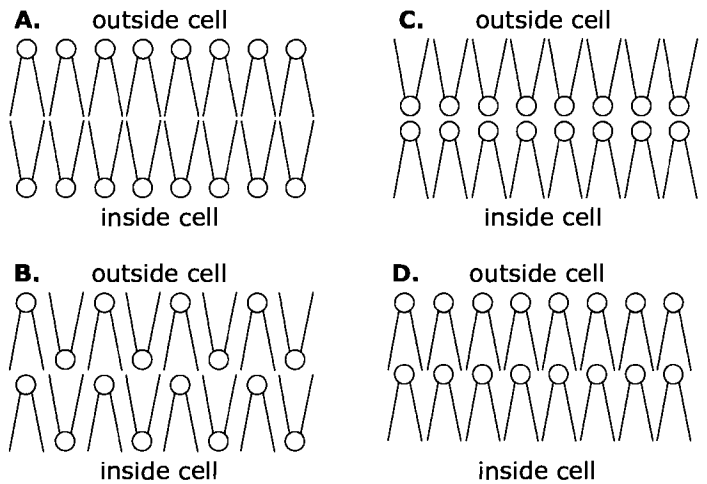
Question 9

Which of the following statements is true of phospholipid molecules?

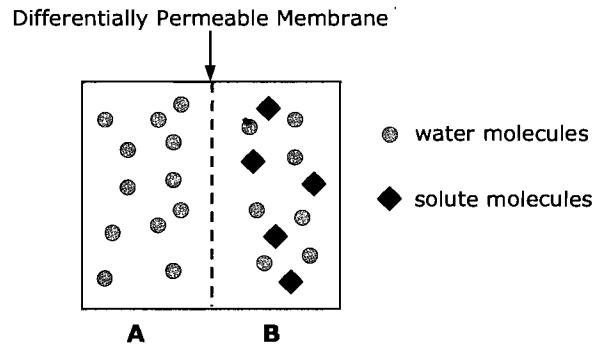
- A. Region X is composed of fatty acids and is hydrophobic.
- B. Region Y is composed of fatty acids and is hydrophobic.
- C. Region X is composed of fatty acids and is hydrophilic.
- D. Region Y is composed of fatty acids and is hydrophilic.

Question 10

Which of the following diagrams best represents the arrangement of phospholipid molecules in a cell membrane?



The following model was used by a group of students to investigate the movement of materials through a membrane. The material used for the membrane was permeable to water and simple ions but not to larger molecules. At the beginning of the experiment side A contained only water; side B contained water and a solute.



Question 11

Which of the following results could the students expect at the conclusion of their experiment?

- A. If the solute was glucose; there would be an increase in volume on side B.
- B. If the solute was NaCl; there would be an increase in volume side A.
- C. If the solute was glucose; it would be detected in both regions A and B.
- D. If the solute was NaCl; it would be detected only in region B.

ONE ANSWER PER LINE

USE PENCIL ONLY

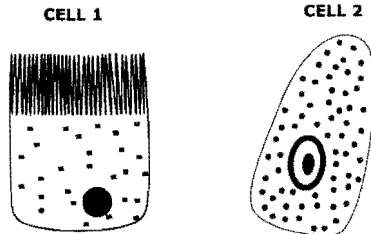
12 A B C D

14 A B C D

13 A B C D

15 A B C D

The following diagrams show two cells from the same animal observed with a light microscope.



Question 12

Both Cell I and Cell II are from an animal because:

- A. both are capable of producing their own food.
- B. both possess a cell wall.
- C. both lack a cell wall.
- D. both have a cell membrane.

Question 13

Cell I is most likely to have which one of the following functions?

- A. Absorption.
- B. Communication.
- C. Reproduction.
- D. Synthesis.

Question 14

Cell I and Cell II would have:

- A. exactly the same number and types of cellular organelles.
- B. would have the same number, but not the same types of cellular organelles.
- C. different numbers and some different types of cellular organelles.
- D. different numbers of cellular organelles only.

Question 15

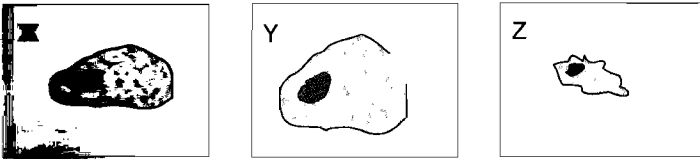
Smooth endoplasmic reticulum:

- A. is studded with ribosomes and transports proteins.
- B. is the site of packaging of proteins for export from the cell.
- C. is the site of lipid synthesis.
- D. is the site of protein synthesis.

SECTION B - Short-answer questions: Instructions to students
 Answer this section in pen. Answer all questions in the spaces provided.

Question 1

A biology student immersed cheek cells in three test tubes containing salt solutions of different concentrations. The relative concentration of the salt solution, compared to the cheek cells, determines the osmotic pressure and thus the direction of water flow. The following cells were observed under the light microscope.



Define osmosis.

1 mark

Unfortunately the student forgot to label her test tubes and the results were confusing for her.

b. i. State which solution, each of the above cells was immersed in.

Test tube X: relative concentration of solution

Test tube Y: relative concentration of solution

Test tube Z: relative concentration of solution

ii. Explain the direction of water flow in each sample.

Test tube X: water flow

Test tube Y: water flow

Test tube Z: water flow

3 marks
 Total 4 marks

Question 2

Cells lining the small intestine absorb the products of digestion which are present in the gut. This absorption takes place through the cells' membranes. The concentrations of a number of substances in the lumen of the gut and in the surrounding cells of the small intestine are outlined in the table below.

Substance	Conc ⁿ in cells (mg/l)	Conc ⁿ in gut lumen (mg/l)
Amino acids	20	10
Glucose	60	40
Fatty acids	2	4
Calcium Ca ²⁺	2	6

a. Complete the following table by stating:

- through what part of the membrane the nutrients will enter the cells of the small intestine.
- the process by which they will enter.

Substance	Membrane part	Process
Glucose		
Fatty acids		
Calcium Ca ²⁺		

3 marks

b. Amino acids are absorbed by the cells of the small intestine despite being in a higher concentration inside the cell than in the lumen of the gut. Explain why cells continue to absorb amino acids.

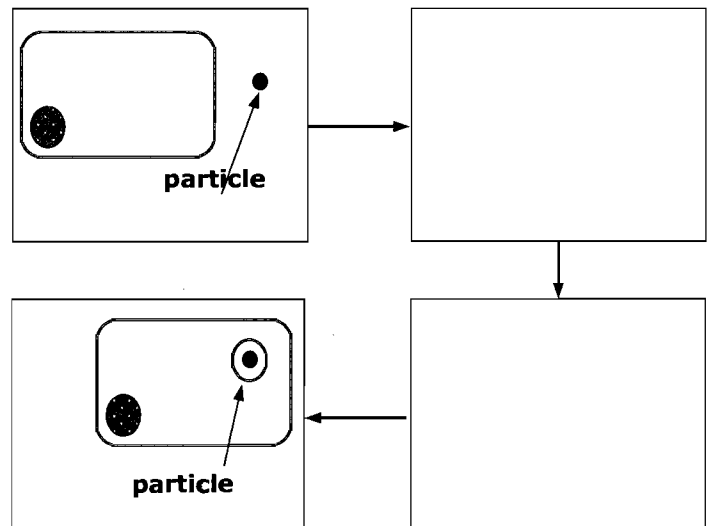
1 mark

Specialized cells of the immune system ingest small particles of solids too large to pass through the cell membrane.

c. By what process do cells absorb particles of solid material?

1 mark

d. The following diagram show a cell before it has ingested a solid particle, and at the end of the process of ingestion. Draw the intermediate steps in the boxes provided.



2 marks
 Total 7 marks

Question 3

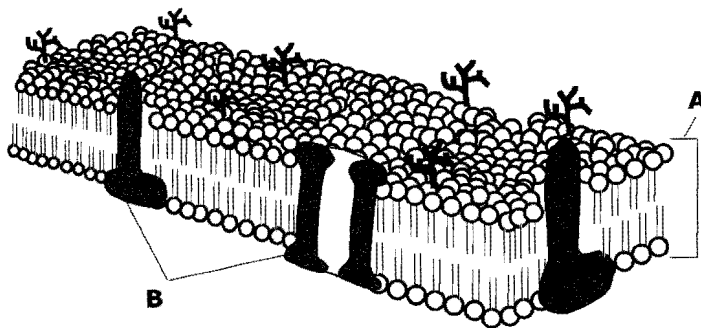
A cell is separated from the external environment by the presence of a plasma membrane. The plasma membrane is one of a number of membranes that form the cell. Membranes play crucial roles in the survival of a cell.

- a. Complete the following table of membrane structures within eukaryotic cells.

Membrane	Location	Function
Plasma	outside cell	
	around nucleus	
	throughout the cytoplasm	Assists in the movement of materials through the cell.
		packaging substances.
Grana	in chloroplasts	site of light reactions of photosynthesis.
	in mitochondria	

6 marks

Structure of a typical membrane



- b. i. What is the name of the compound found in the region labeled **A**?

- ii. What is the name of the compounds labeled **B**?

1 + 1 = 2 marks

- c. Membranes are often described as bilayers. Explain why the compound in region **A** organises itself into a bilayer structure.

2 marks

- d. i. Membranes are said to be differentially or semi-permeable. What is meant by this?

- ii. What types of substances can pass through the region labeled **A**?

- iii. What is the function of the structures labeled **B**?

1 + 1 + 1 = 3 mark
 Total 13 mark

Question 4

A group of Biology students wished to investigate the effects of the deficiency of various elements on the growth of the aquatic plant, *spirogyra*.

They set up four similar flasks as shown right. Each contained a nutrient solution and an equal quantity of the plant.



Each of the four flasks was deprived of one nutrient - iron, potassium, magnesium or nitrate. The nutrient solution contained all other plant nutrients. The plants were placed in a well lit part of the laboratory and their growth observed after two weeks.

- a. What hypothesis may the students have been testing?

1 mark

- b. What results would support this hypothesis?

1 mark

Whilst being impressed with the students' initiative, their Biology teacher criticised the experiment's design as it did not include a control.

- d. i. What is meant by the term control?

- ii. How would you improve the design of the experiment to include a control?

1 + 1 = 2 marks
 Total 4 marks

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Question 1

Which of the following statements is true of polysaccharides found in living cells?

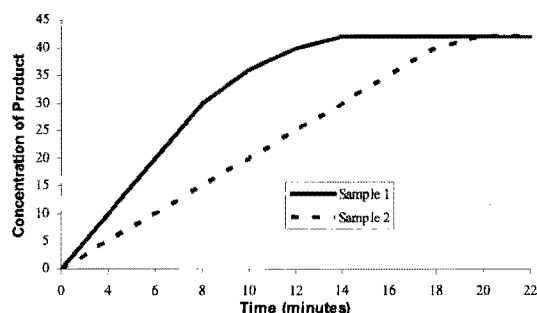
- A. Starch is an important energy storage molecule in animal cells.
- B. Chitin is a structural component of cell membranes.
- C. Cellulose is an important energy storage molecule in plant cells.
- D. Both glycogen and starch are composed of chains of glucose molecules.

Question 2

Enzymes are composed of:

- A. carbohydrate.
- B. lipid.
- C. protein.
- D. nucleic acids.

The following information is relevant to **Questions 3-4**. This graph shows the progress of a biological reaction under two different conditions.



Question 3

The variable being investigated in these two samples was most probably:

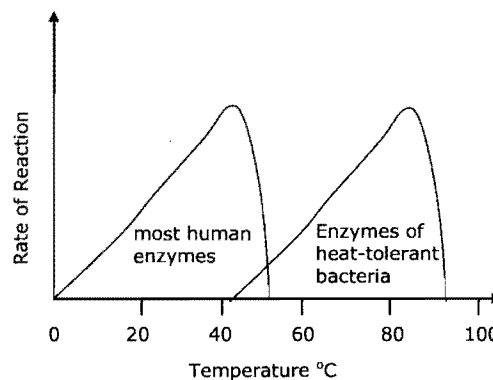
- A. amount of substrate.
- B. amount of reactant.
- C. concentration of enzyme.
- D. pH.

Question 4

The amount of product stopped increasing after 14 minutes in sample 1. The most likely explanation for this is:

- A. After 14 minutes all of the enzyme was consumed.
- B. After 14 minutes all of the substrate was consumed.
- C. The enzyme began to break down the product.
- D. All of the enzyme was irreversibly bound to substrate molecules.

The following graph shows the reaction rates for typical human enzymes and the enzymes of heat tolerant bacteria.



Question 5

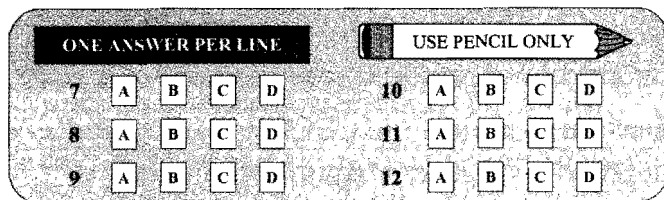
It is reasonable to conclude that:

- A. most human enzymes are partially denatured at 20°C.
- B. enzymes of heat tolerant bacteria will function well at normal human body temperature.
- C. a human enzyme which has been denatured at 65°C, will again function normally if cooled to 35°C.
- D. the heat-tolerant bacteria are unlikely to survive in water at 100°C.

Question 6

The correct order of molecules involved in the production of a polypeptide chain is:

- A. RNA-DNA-amino acid-polypeptide.
- B. DNA-RNA-polypeptide-amino acid.
- C. DNA-amino acid-RNA-polypeptide.
- D. DNA-RNA-amino acid-polypeptide.

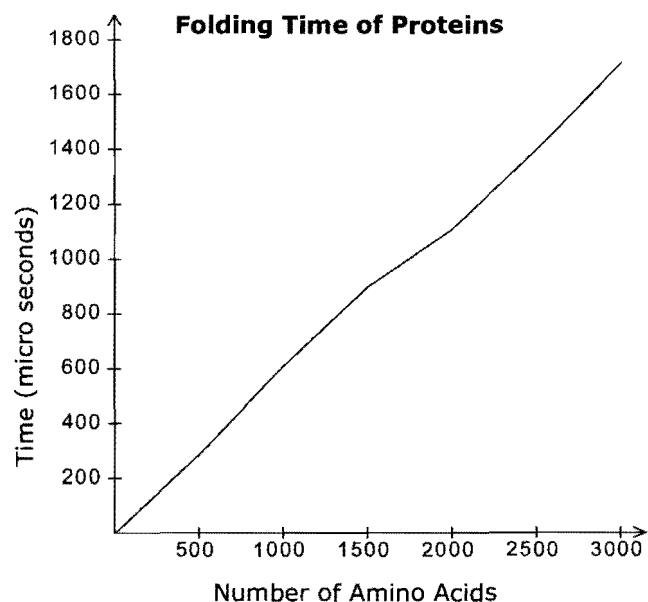


Question 7

The efficient folding of a protein molecule is ensured by the presence of other proteins known as protein chaperones in a cell. A likely result of defective chaperones is:

- A. the production of a protein with a faulty primary structure.
- B. the production of proteins with incomplete tertiary structure.
- C. the production of a protein with a faulty secondary structure.
- D. the overproduction of the protein.

The graph below shows the folding time of proteins with differing numbers of amino acids.



Question 8

Which of the following statements is correct?

- A. The folding time decreases as the number of amino acids decreases.
- B. The folding time increases as the number of amino acids decrease.
- C. The folding time depends on the type of amino acids present.
- D. There is no relationship between the folding time and the number of amino acids.

Question 9

Which of the following structures contribute to the production of proteins by a cell?

- A. nucleus.
- B. endoplasmic reticulum.
- C. ribosomes.
- D. all of the above.

Question 10

Which statement about amino acids is **correct**?

- A. They always have one amino group and one carboxyl group.
- B. In the formation of proteins, a bond links the amino group of one amino acid to the variable side chain of the adjacent amino acid.
- C. The variable side chains of all of the amino acids carry a charge.
- D. The peptide bond that links amino acids together in a protein is a type of hydrogen bond.

Question 11

Enzyme activity in cells may be inhibited by the presence of molecules which bind temporarily with the active site of the enzyme. These molecules:

- A. have a chemical structure similar to the enzyme's active site.
- B. have a chemical structure similar to the enzyme's usual substrate molecule.
- C. affect the primary structure of the enzyme.
- D. alter the enzymes' secondary structure.

Question 12

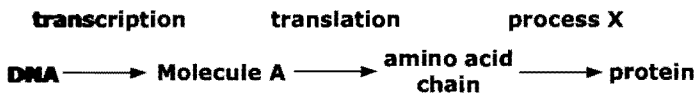
The peptide bond, which is found between adjacent amino acids, is an example of:

- A. an ionic bond.
- B. an hydrogen bond.
- C. a weak bond.
- D. a covalent bond.

SECTION B - Short-answer questions: Instructions to students
 Answer this section in pen. Answer all questions in the spaces provided.

Question 1

The following diagram refers to the steps involved in the manufacture of a biological molecule in living cells.



- a. What name is given to the molecule represented by molecule A?

 1 mark
- b. State two ways in which this molecule is different from DNA.

 2 marks
- c. Briefly describe the events which occur at translation to produce a polypeptide chain.

 1 mark
- d. What name is given to process X?

 1 mark
- e. In what part/s of the cell is DNA transcribed to molecule A?

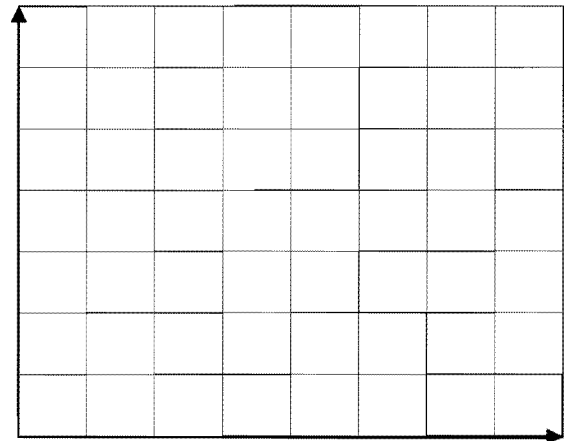
 1 mark
 Total 6 marks

Question 2

A group of students carried out an experiment to investigate the rate of breakdown of glucose by an enzyme extracted from yeast cells. All of the tubes contained the same amount of the enzyme. The tubes contained the same volume of glucose solution (in H₂O), but the glucose concentration varied. All of the tubes were kept at the same temperature and pH. The results are given in the table below.

Tube No.	Glucose Concentration (mM)	Rate of glucose breakdown (µmol/min)
1	0	0
2	0.5	30
3	1.0	55
4	1.5	75
5	2.0	90
6	2.5	100
7	3.0	105
8	3.5	105

- a. On the axes provided sketch a graph of the results of this experiment. Label both axes clearly.



- b. i. List the contents of tube 1.

- ii. Explain the purpose of tube 1 in this experiment.

 1 + 1 = 2 marks
- c. The rate of breakdown of glucose in tubes 7 and 8 was the same (105 µmol/min). Explain why this has occurred.

 1 mark

In a second experiment a new variable was investigated. In this experiment the amount of enzyme and the glucose concentration in each tube were kept constant. The other variable was increased in tubes 1-4. The results which the students recorded are shown in the table below.

Tube No.	Rate of glucose breakdown (µmol/min)
1	5
2	20
3	80
4	5

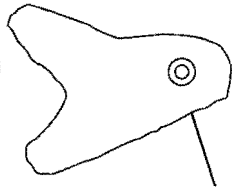
- d. i. Name one variable which may have been being investigated in this experiment?

ii. For the variable you suggested in d. i., explain how the results support your conclusion.

1 + 2 = 3 marks
Total 8 marks

Question 3

A Biology student was investigating the effects of different kinds of solutions on a freshwater protist, *amoeba*. *Amoeba* has a contractile vacuole, which is able to expel excess water from the cell to the external environment.



Contractile vacuole

Three different environments were set up. These were:

- distilled water
- dilute sugar solution
- concentrated sugar solution

The number of contractions was counted over a period of 10 minutes.

a. What hypothesis may the student have been testing?

1 mark

b. What results would support this hypothesis?

1 mark

c. What would be an appropriate control for this experiment?

1 mark

d. State two ways in which this experiment could be improved?

2 marks
Total 5 marks

Question 4

A hierarchy of structure determines the shape of a protein molecule. The four levels of structure are found in the following table.

a. Match each of the levels of protein structure with the factor which determines that level of structure. Write the correct **letter** in the empty box.

Structure of protein (levels)	Correct letter	Determined by
1. Primary		A. Interactions between polypeptide chains
2. Secondary		B. Base sequence in DNA
3. Tertiary		C. Interactions between atoms in the variable regions of the amino acids in a peptide chain.
4. Quaternary		D. Hydrogen bonding which causes a peptide chain to form an α helix or β pleated sheet.

4 marks

b. Many proteins do not exhibit quaternary structure. Explain why.

1 mark

c. Chemical studies have shown that an abnormal haemoglobin molecule differs from a normal haemoglobin molecule in only a single amino acid.

i. Which of the above levels is definitely affected by this change?

ii. Which of the above levels may be affected?

iii. Explain your answer to c. ii.

1 + 1 + 1 = 3 marks

d. How would this change in the amino acid sequence of a protein occur?

1 mark
Total 9 marks

SECTION A - Multiple-choice questions**Instructions to students**

Use a **PENCIL** for ALL entries. For each question, shade the box which indicates your answer. All answers must be completed like **THIS** example:

A	B	C	<input checked="" type="checkbox"/>
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Marks will **NOT** be deducted for incorrect answers. **NO MARK** will be given if more than **ONE** answer is completed for any question. If you make a mistake, **ERASE** this incorrect answer - **DO NOT** cross it out. A correct answer scores 1, an incorrect answer scores 0.

ONE ANSWER PER LINE**USE PENCIL ONLY**

1	A	B	C	D
2	A	B	C	D
3	A	B	C	D
4	A	B	C	D
5	A	B	C	D

6	A	B	C	D
7	A	B	C	D
8	A	B	C	D
9	A	B	C	D
10	A	B	C	D

Question 1

Proteins are secreted from a cell in structures known as:

- A. vacuoles.
- B. vesicles.
- C. lysosomes.
- D. protein channels.

Question 2

Many proteins are unable to be secreted directly across the plasma membrane because:

- A. they are small non-polar molecules.
- B. they are soluble in the plasma membrane.
- C. they are large polar molecules.
- D. they are insoluble in the cytoplasm.

Question 3

A basic difference between animal and plant cells is that animal cells do *not* have:

- A. a cell membrane.
- B. ribosomes.
- C. a cell wall.
- D. vacuoles.

Question 4

What is the best description of transcription ?

- A. The process in which RNA is changed into protein.
- B. The process in which DNA is copied into RNA.
- C. The process in which DNA is changed into protein.
- D. The process in which RNA is copied into DNA.

Question 5

What is the name of the process in which each peptide is actually assembled, and where does this process take place?

- A. transcription, on ribosomes.
- B. translation, in the nucleus.
- C. translation, on ribosomes.
- D. transcription, in the nucleus.

Question 6

Chloroplasts are found in:

- A. some prokaryotic cells.
- B. all plant cells.
- C. all leaf cells.
- D. some leaf cells.

Question 7

What molecule is produced in the light reactions of photosynthesis and used in the light-independent reactions of photosynthesis?

- A. CO₂
- B. ATP
- C. H₂O
- D. O₂

Question 8

The light-independent reactions of photosynthesis do not normally take place at night because:

- A. it is too dark.
- B. they rely on the products of the light-dependent reactions.
- C. it is too cold.
- D. plants are unable to obtain water at night.

Question 9

Radioactive oxygen (¹⁸O) is introduced into the environment of an experimental plant. After a short period of exposure to sunlight, the radioactive oxygen is detected in sugars in the leaf cells of the plant. The ¹⁸O was most likely introduced to the plant's environment in the molecule:

- A. CO₂
- B. H₂O
- C. ATP
- D. O₃

Question 10

The electron transport stage of cellular respiration involves the production of the waste product:

- A. oxygen.
- B. carbon dioxide.
- C. water.
- D. lactic acid.

ONE ANSWER PER LINE					USE PENCIL ONLY				
11	A	B	C	D	14	A	B	C	D
12	A	B	C	D	15	A	B	C	D
13	A	B	C	D					

Question 11

Glycolysis occurs:

- A. in the cytosol of cells.
- B. within the mitochondrial matrix.
- C. on the surface of mitochondrial cristae.
- D. in the stroma of chloroplasts.

Question 12

The products of the process of glycolysis are:

- A. carbon dioxide, water and ATP.
- B. pyruvate and ATP.
- C. alcohol and ATP.
- D. ATP only.

Question 13

Sliders are small fresh-water turtles common in North America. They are able to remain under water for days at a time, not breathing at all. During a long period of being submerged you would expect the slider to:

- A. have high concentrations of O₂ in blood vessels.
- B. have high concentrations of lactic acid in its muscle cells.
- C. remain very active during its time under water.
- D. store large quantities of ATP in its muscle cells.

The following photograph is of a cell organelle.



Question 14

This organelle is:

- A. called a mitochondrion and is the site of aerobic respiration.
- B. called a mitochondrion and is the site of anaerobic respiration.
- C. called a chloroplast and is the site of photosynthesis.
- D. called a chloroplast and is the site of glycolysis.

Question 15

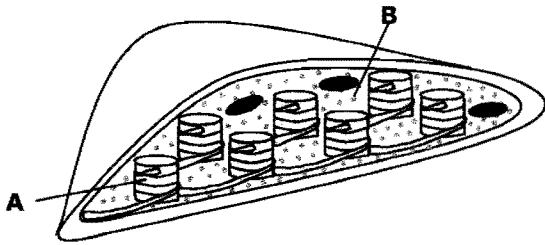
Endergonic (anabolic) reactions in cells include:

- A. the production of glucose in photosynthesis.
- B. the breakdown of ATP to ADP + phosphate.
- C. the production of pyruvate in glycolysis.
- D. intracellular digestion of proteins to amino acids.

SECTION B - Short-answer questions: Instructions to students
 Answer this section in pen. Answer all questions in the spaces provided.

Question 1

The following diagram shows a section of a chloroplast.



a. Name the regions labeled:

i. A

ii. B

1 + 1 = 2marks

b. Chloroplasts are the site of photosynthesis. Write a balanced equation for photosynthesis.

1 mark

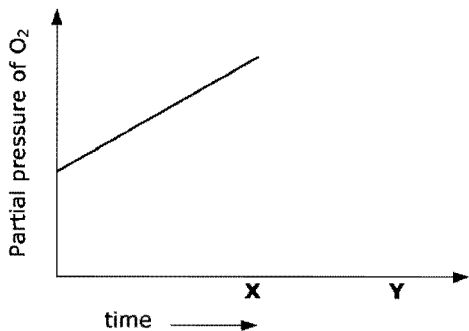
c. Photosynthesis involves two sets of reactions in the chloroplasts, the light-dependent and light-independent reactions. What are the products of these reactions?

i. Light-dependent reactions.

ii. Light-independent reactions.

1 + 1 = 2marks

The graph below shows the change in the partial pressure (concentration) of oxygen in the air surrounding an experimental plant kept in bright light.



d. Explain why the partial pressure of O₂ has increased.

1 mark

The same plant was kept in the dark for the period of time X - Y.

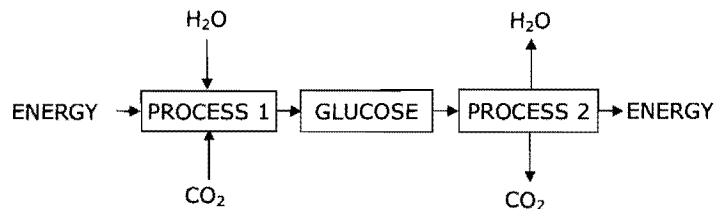
e. i. On the axes above, show what will happen to the partial pressure of O₂ in the time period X - Y.

ii. Explain why you have drawn the graph the way you have.

1 + 2 = 3 marks
 Total 9 marks

Question 2

A student who was asked to present his understanding of energy transfer in plant cells produced the following diagram.



a. i. What process is represented as PROCESS 1?

ii. What is the source of energy for this process?

1 + 1 = 2 marks

b. i. What process is represented as PROCESS 2?

ii. In what organelle would this process occur?

1 + 1 = 2 marks

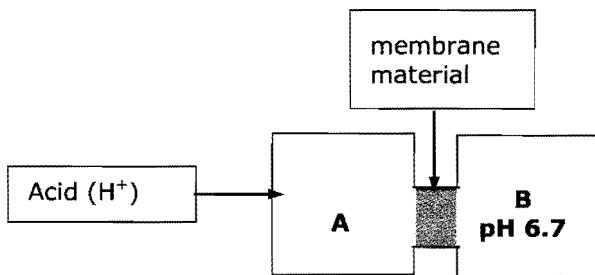
The student's diagram does not present a complete picture of matter and energy transfers within a plant cell.

- c. Improve on the diagram by showing:
- the pathway of oxygen
 - the fate of the energy produced in PROCESS 2
 - two other uses of the glucose produced in PROCESS 1.

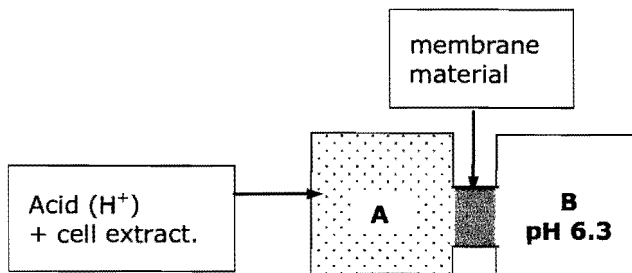
1 + 1 + 1 = 3 marks
Total 7 marks

Question 3

A scientist separated pieces of plasma membrane from an animal cell and put them in equipment so that the membrane separated two reservoirs, one of distilled water (A) and the other acid (B). When she added a dilute solution of acid to one side (side A) of the membrane, the acidity of the solution on the other side (side B) did not change. (Experiment 1)



She then ground up a culture of animal cells and added this cell extract to side A. The pH of the solution in side B then dropped. (Experiment 2)



- a. Why did the acidity of solution B in experiment 1 not change?

1 mark

- b. Explain what was present in the cell extract that enabled the passage of H^+ ions across the membrane.

1 mark

- c. What name is given to the type of transport that occurs in experiment 2?

1 mark

The parietal cells of the stomach are able to use this mechanism to pump and concentrate hydrochloric acid in the stomach.

- d. i. What organelle is likely to be present in increased numbers in parietal cells to facilitate this process?

- ii. Explain your answer to d. i.

1 + 1 = 2 marks
Total 5 marks

Question 4

ATP has been called the energy currency of the cell. It is a portable molecule able to move to the parts of the cell where energy is required.

- a. Outline the process by which ATP provides energy for cellular processes.

1 mark

- b. Name two cellular functions which use the energy provided by ATP.

2 marks

Eukaryotic cells generally manufacture ATP by aerobic cellular respiration, but are able to produce ATP by the anaerobic breakdown of glucose molecules. This reaction is less efficient than aerobic respiration.

- c. i. Under what conditions will animal cells produce ATP by anaerobic breakdown of glucose?

- ii. What are the products of anaerobic breakdown of glucose in animal cells.

- iii. In what ways is this reaction less efficient than aerobic respiration.

2 + 1 + 2 = 5 marks

SECTION A - Multiple-choice questions

Instructions to students

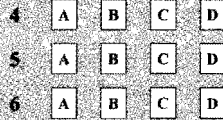
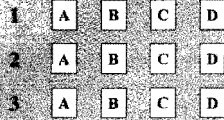
Use a **PENCIL** for ALL entries. For each question, shade the box which indicates your answer. All answers must be completed like **THIS** example:



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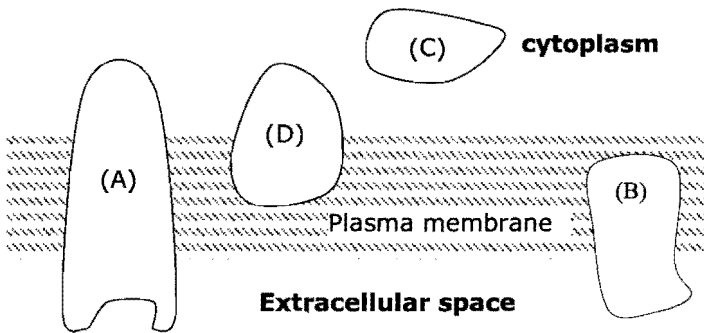
ONE ANSWER PER LINE

USE PENCIL ONLY



Question 1

A hormone can cause a change in the function of its target cell by binding to a protein in the cell membrane. To which of the proteins depicted in the figure, does it bind?



- A. (A)
- B. (B)
- C. (C)
- D. (D)

The following diagrams are of three human nerve cells.

Cell I	
Cell II	
Cell III	

Question 2

You would expect to find cell II associated with:

- A. skeletal muscle.
- B. an endocrine gland.
- C. a pressure receptor.
- D. smooth muscle.

Question 3

Which of the following correctly describes the direction of nerve impulses in a reflex arc?

- A. From Cell II to Cell I to Cell III.
- B. From Cell I to Cell II to Cell III.
- C. From Cell II to Cell III to Cell I.
- D. From Cell III to Cell I to Cell II.

Question 4

The seeds of desert plants can remain in the soil for many years without germinating. These seeds are said to be in a state of:

- A. hibernation.
- B. dormancy.
- C. abscission.
- D. senescence.

Question 5

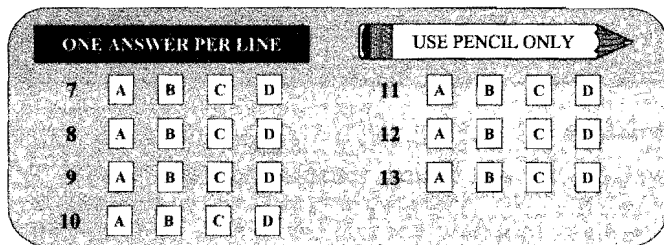
To encourage plants to grow "bushy" rather than tall and thin, gardeners sometimes remove the apical tip of the plant. The resultant bushy growth is due to the absence of:

- A. auxin.
- B. cytokinin.
- C. ethylene.
- D. gibberellin.

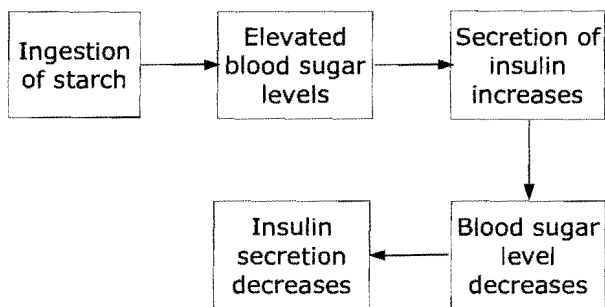
Question 6

Calcitonin is a protein hormone which regulates blood calcium levels. It is secreted by the thyroid gland. Which of the following correctly represents the pathway of molecules of calcitonin before they leave a thyroid cell?

- A. nucleus → mitochondrion → golgi body → vesicle
- B. ribosome → golgi body → endoplasmic reticulum → membrane
- C. ribosome → endoplasmic reticulum → golgi body → vesicle
- D. nucleus → ribosome → golgi body → endoplasmic reticulum



The following diagram shows a feedback system which occurs in the body.



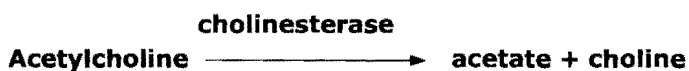
Question 7

The stimulus in this system is:

- A. the release of insulin.
- B. the decrease in blood sugar levels.
- C. the increase in blood sugar levels.
- D. the ingestion of starch.

The following information is relevant to questions 8 and 9

Acetylcholine is the neurotransmitter most often involved in signaling between a neuron and a muscle cell. Muscle contraction is stimulated when acetylcholine binds with receptor molecules on the surface of muscle cells. Acetylcholine is rapidly broken down by the action of an enzyme, cholinesterase, ensuring the muscle cell's response is brief.



Muscle function is affected by a number of poisons which affect the action of acetylcholine:

- Curare is a competitive inhibitor of acetylcholine. It blocks muscle cells' membrane receptors.
- Serin gas (nerve gas) blocks the action of cholinesterase.
- Botulism toxin prevents the release of acetylcholine.

Question 8

Which of the following would you expect to be associated with serin gas poisoning?

- A. general muscle paralysis.
- B. uncontrolled muscle contraction.
- C. toxicity due to a build up of acetate in the synaptic gap.
- D. increased production of acetylcholine by neurons.

Question 9

From the above information it would be reasonable to conclude that:

- A. curare has a chemical structure similar to acetylcholine.
- B. curare has a chemical structure similar to the muscle cell's acetylcholine receptors.
- C. botulism toxin will cause an increase in muscle cell activity.
- D. botulism toxin has a chemical structure similar to acetylcholine.

Question 10

Nerve cells are essential to an animal because they directly provide:

- A. communication between cells.
- B. transport of nutrients to various organs.
- C. regulation of reproductive rates within other cells.
- D. exchange of gases within the body.

Question 11

During training, the body temperature of a runner increases. The runner responds by perspiring, which lowers body temperature. This process is an example of:

- A. an enzyme and substrate reaction.
- B. homeostasis.
- C. an acquired characteristic.
- D. positive feedback.

Question 12

Which row in the chart contains the words that best complete this statement? The (I) glands produce (II), which are transported by the (III) system.

Row	I	II	III
A.	digestive	hormones	circulatory
B.	endocrine	enzymes	lymphatic
C.	endocrine	hormones	circulatory
D.	digestive	enzymes	lymphatic

Question 13

All hormones bind to recognition sites in order to exert their effect on the target cell. Where is the receptor site for a steroid hormone?

- A. on the cell membrane only.
- B. in the nucleus or cytoplasm.
- C. on the cell membrane or nucleus.
- D. on the mitochondria.

SECTION B - Short-answer questions: Instructions to students
 Answer this section in pen. Answer all questions in the spaces provided.

Question 1

Cells are the simplest structural units into which multicellular organisms can be separated. There are about 200 different kinds of cells identified in the human body in terms of detailed differences in structure and function. These cells are specialised for their role in the body.

- a. Complete the following table of the cellular structures in an eukaryotic cell by:
- filling in the name of the structure or its function in the first two columns.
 - indicating with a cross (X) whether the organelle is membrane bound, made of membrane or has no membrane.

Cell structure	Function	Membrane bound	Made of membrane	No membrane
Mitochondria				
	Transporting of proteins			
Nucleus				
	Packaging of proteins prior to their distribution			
Ribosome				
	Contains enzymes responsible for intracellular digestion			

3 + 1 = 4 marks

- b. Draw and label a diagram of a typical cell membrane.

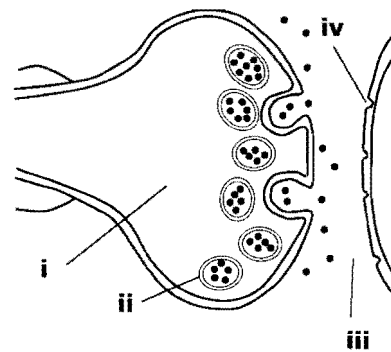
2 marks

- c. What are the functions of membranes in eukaryotic cells?

2 marks
Total 8 marks

Question 2

The following diagram shows the junction where two neurons meet.



- a. Name the structures labeled on the diagram above.
- _____
 - _____
 - _____
 - _____

1 + 1 + 1 + 1 = 4 marks

- b. What is the function of structure iv?

1 mark

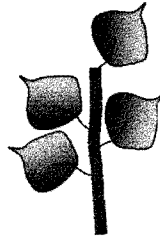
- c. Compare the nervous and endocrine systems by completing the following table

	Nervous system	Endocrine system
Speed of transmission	fast	
Mode of transmission		chemicals
Target	specific muscle or gland	

3 marks
Total 8 marks

Question 3

A student wanted to test the hypothesis that plants dipped in rooting hormone will produce new roots at a faster rate than those without the hormone. Two stem cuttings of equal length, like the one shown were taken from a rose, a hydrangea and a rosemary plant.



The cut end of one cutting from each plant was dipped into the rooting hormone and the other was dipped in water. Both were planted in wet sand and identical environmental conditions were maintained throughout the experiment. At the end of five weeks, the lengths of the roots were measured. The results are shown below.

Plant	Total Length of Roots (cm)	
	Hormone treatment	Water treatment
Rose	0.00	0.00
Hydrangea	2.80	0.55
Rosemary	3.60	1.10

a. What cellular process is the rooting hormone likely to have stimulated?

1 mark

b. Why did the student use three different plants?

1 mark

c. i. What conclusion can be drawn from the results of this experiment?

ii. State *one* way that the student could make the results more valid.

1 + 1 = 2 marks

d. Why were identical conditions maintained throughout the experiment?

1 mark

e. What purpose did the cuttings dipped in water serve in this experiment?

1 mark
Total 6 marks

Question 4

A student studied the effect of gibberellin on the growth of maize seedlings. The seedlings were all the same height. A different concentration of gibberellin, in a fixed volume of water, was applied to seven groups containing 10 plants each. The plants were grown under identical environmental conditions for 30 days. At the end of the experiment, the height of each plant was measured. The data are shown below.

Gibberellin Concentration Micrograms/l	Average Height (cm)
0.00	15
0.05	35
0.10	55
0.25	65
0.50	70
1.00	75
2.00	75

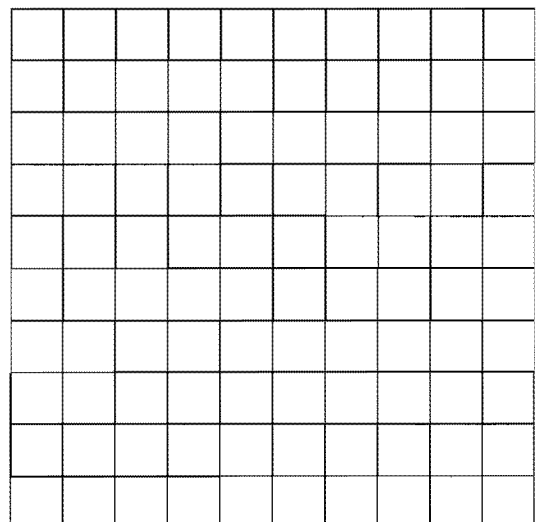
a. i. What is gibberellin?

ii. How does gibberellin act to increase the height of the seedlings?

iii. Outline one other role of gibberellin in plants.

1 + 1 + 1 = 3 marks

b. Plot the data on the grid, using a line graph. Label axes clearly.



2 marks

c. Summarize the effect of varying concentrations of gibberellin on the growth of the seedlings.

2 marks

d. If a farmer wanted advice about how to maximize the growth of maize seedlings, what would you tell him?

1 mark
Total 8 marks

c. Why do the hormones attach to the target cell and not other cells in the diagram?

1 mark

d. A patient presented at a clinic complaining of low energy, weight gain and feeling cold. He was found to be suffering from under-secretion of the thyroid hormones.

i. How would doctors have established this condition?

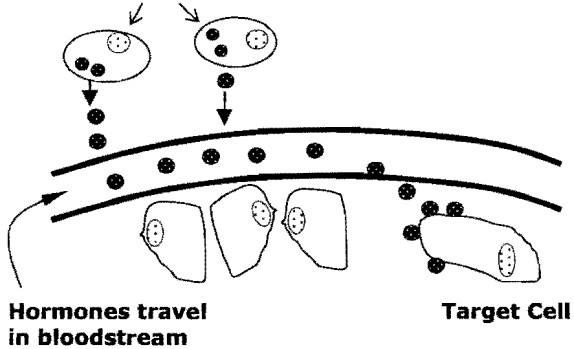
ii. What possible treatment could be used to correct this condition?

1 + 1 = 2 marks
Total 6 marks

Question 5

The diagram below shows a biological process.

Endocrine cells release hormones



a. What is a hormone?

1 mark

b. Many hormones that influence cell function are steroids.

i. What type of biological molecule is a steroid?

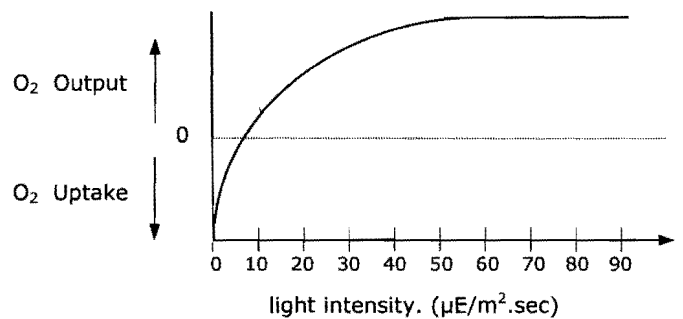
ii. Explain whether the above diagram shows a steroid hormone or a peptide hormone.

1 + 1 = 2 marks

Question 6

The following graph shows the rate of oxygen exchange between a leaf and the external environment in varying light intensities.

Rate of oxygen exchange



a. What process is responsible for the output of oxygen to the environment?

1 mark

b. Write a balanced equation for this process.

1 mark

c. A student concluded that as the leaf did not release oxygen at light intensities of less than 10 μE/m².sec, that respiration was the only process occurring in the leaf cells at these light intensities.

i. Do you agree or disagree with this conclusion?

ii. Use the information contained in the graph and your knowledge of cellular processes to explain why you agree or disagree.

1 + 2 = 3 marks

d. How could you account for the fact that the rate of O₂ output remained constant between light intensities of 50 and 80 $\mu\text{E}/\text{m}^2\cdot\text{sec}$?

1 mark
Total 6 marks