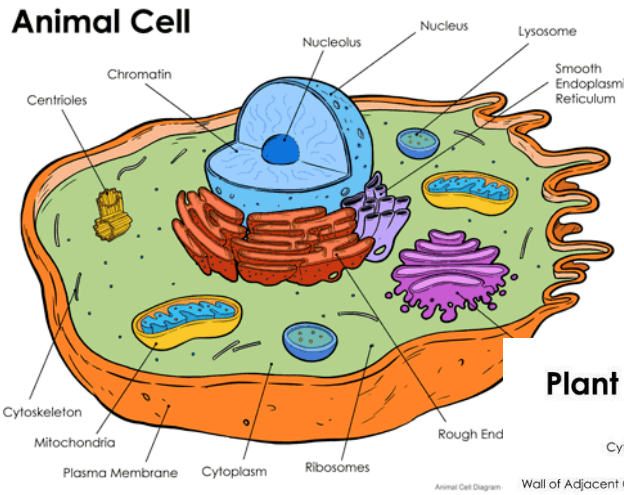
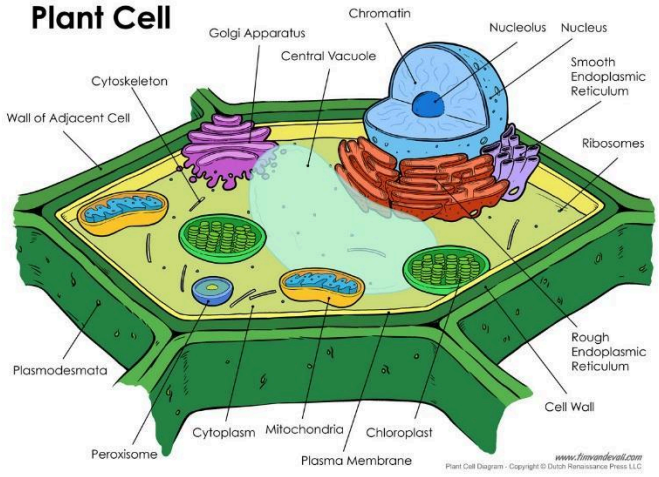
National 5 Biology

Unit 1

Cell Biology



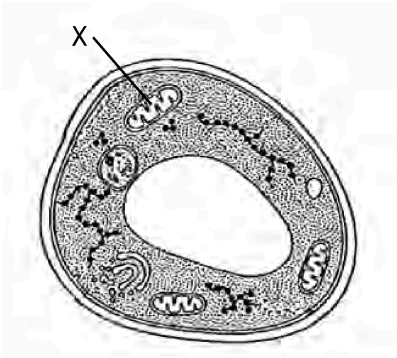


Practise Questions

Key Area one

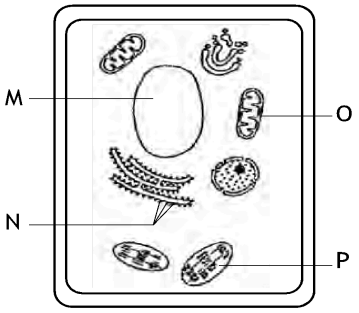
Cell Structure

1. The diagram below shows structures present in a fungal cell.



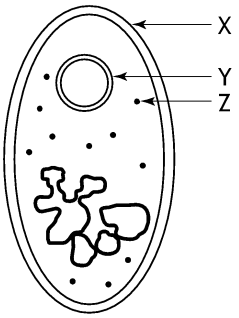
Identify structure X **1**

2. The diagram below represents a plant cell.



Which parts of the cell would also be found in an animal cell? **1**

3. The diagram below represents a bacterial cell.



(a) (i) Name the parts of the cell labelled X and Y **1**

(ii) Give the function of structure Z. **1**

(b) (i) Give one difference and one similarity between the structure of a fungal and a bacterial cell. **2**

(ii) Describe the functions of the cell wall and mitochondria in plant cells. **2**

4. A group of students carried out an investigation into the variety of cell types.

The types of cell they examined are shown in the box below.

Animal	Plant	Bacterial
Fungal		

(a) (i) Identify the type(s) of cell which have a cell wall. **1**

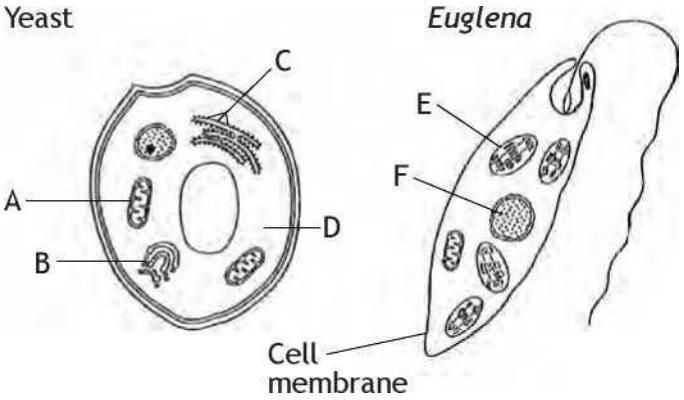
(ii) Identify the type(s) of cell which have a plasmid. **1**

(b) The students then measured a number of cells and calculated the average cell sizes. The results are shown in the table below.

Type of Cell	**Average size of Cell (μm)**
Animal	24
Plant	48
Bacterial	3
Fungal	7

On the graph paper, draw a bar chart to show the average size of the cells shown in the table. **3**

5. The diagrams below show two unicellular organisms.



(a) Name the two chemical components of the cell membrane. **2**

(i) Name the structure that identifies Euglena as a plant cell. **1**

(ii) Most plant cells have a cell wall. Name the structural carbohydrate in the cell wall. **1**

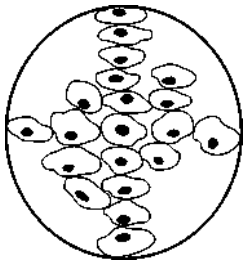
(b) Complete the table below by inserting letters from the diagram to show where each process takes place. **2**

Process	***Letter***
mRNA synthesis	
Protein synthesis	
Photosynthesis	

(c) The diagram below shows a group of human cheek cells as seen under a microscope. The actual diameter of the field of view was 2 mm.

(1 mm = ***1 000*** micrometres)

Calculate the average length of the cells in micrometres. **1**



Key Area Two

Transport across cell membranes

1. Cells from onion tissue were examined under a microscope and then placed in a concentrated sugar solution for 30 minutes. The diagrams below show a cell from the onion before and after being placed in the solution.

before after

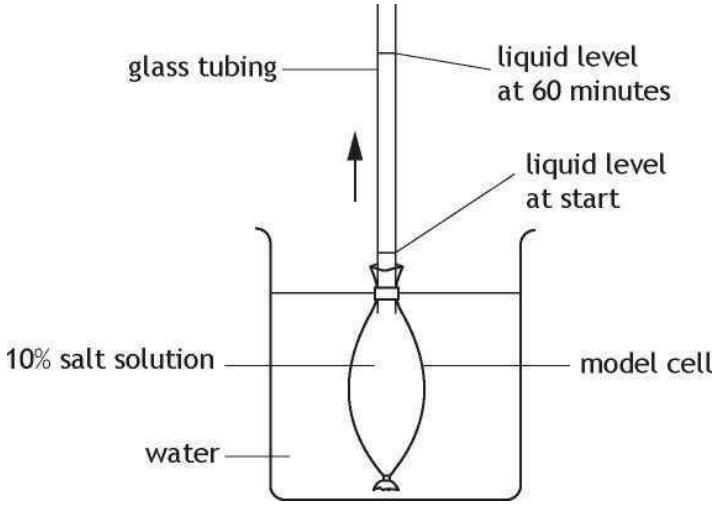
(a) (i) Movement of water caused the change in the appearance of the cell. Name the process responsible for the movement of water. **1**

(b) In terms of water concentration, explain how water movements account for the appearance of the cell after being placed in the solution. **2**

(c) Name one substance, other than water, which must be able to pass into or out of a cell and explain the importance of the substance to the cell. **2**

(d) Give one difference between active transport and passive transport. **1**

2. The apparatus shown below was used to investigate the movement of water into and out of a model cell. The model cell had a selectively permeable membrane.



The liquid level in the glass tubing was measured every 10 minutes for 60 minutes.

The results are shown in the table below.

Time (minutes)	Liquid level (mm)
0	10
10	22
20	32
30	40
40	48
50	56
60	64

(a) Name the process which caused the liquid level to rise. **1**

(b) Explain how this process caused the liquid level to rise. **1**

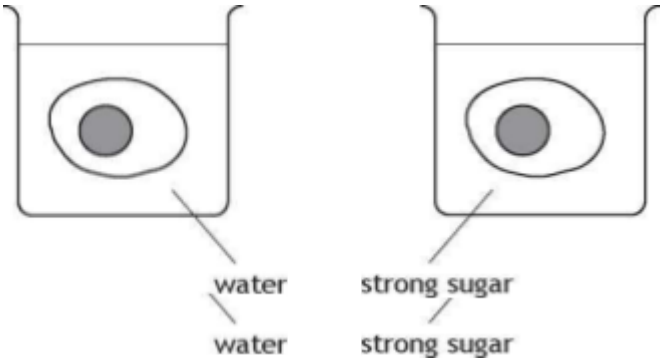
(c) Calculate the average rate of movement of liquid in the glass tubing. (mm per minute). **1**

(d) When the investigation was repeated, the average rate of movement of liquid was slower.

Suggest one difference in the way that the investigation was set up that could have caused this change in results. **1**

3. Shells can be removed from eggs by dissolving them in vinegar for 2–3 days. The egg contents remain inside a thin membrane.

In an investigation, the shells from two eggs were removed. The eggs were then weighed and placed in beakers as shown below.



After 2 hours the eggs were removed from the beakers, blotted dry and reweighed. The results are shown in the following table.

Beaker	Mass at start (g)	Mass after 2 hours (g)	Percentage change in mass
A	54.0	67.5	
B	52.1	47.8	-8.2

(a) Complete the table by calculating the percentage change in mass for beaker A.

1

(b) Suggest why the eggs were blotted dry before being reweighed. **1**

(c) Choose either beaker A or B and explain how osmosis caused the change in mass of the eggs in that beaker. **2**

(d) The movement of molecules in or out of a cell can be passive or active transport. Describe the features of active transport. **3**

4. Osmosis is a process which can occur across the cell membrane.

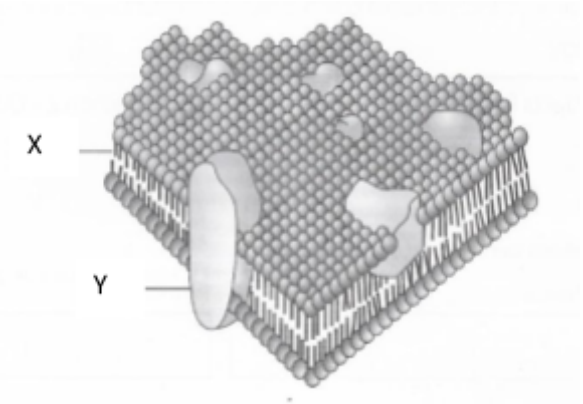
(a) Choose either the leaf cell or red blood cell and describe the effect of osmosis on this type of cell if it was placed in pure water. **2**

(b) Name a process, other than osmosis, which allows molecules to pass through the cell membrane.

1

(c) Give a definition of the process chosen. **1**

5. The diagram below represents molecules present in a magnified fragment of cell membrane.



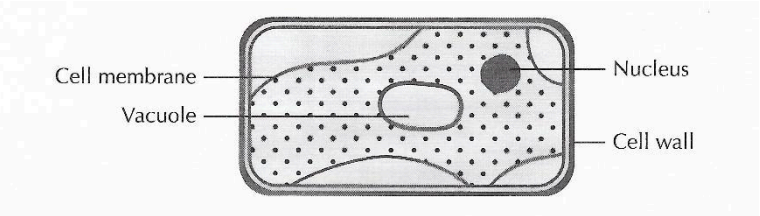
(a) Name molecules X and Y. **2**

(b) Complete the following sentences by choosing the correct options in each choice bracket. **3**

The cell membrane is { selectively / fully } permeable and transports water in and out of the cell by osmosis.

Osmotic movement occurs { down / against } the concentration gradient and { requires / does not require } energy

(c) The diagram below shows a cell from a piece of plant tissue.



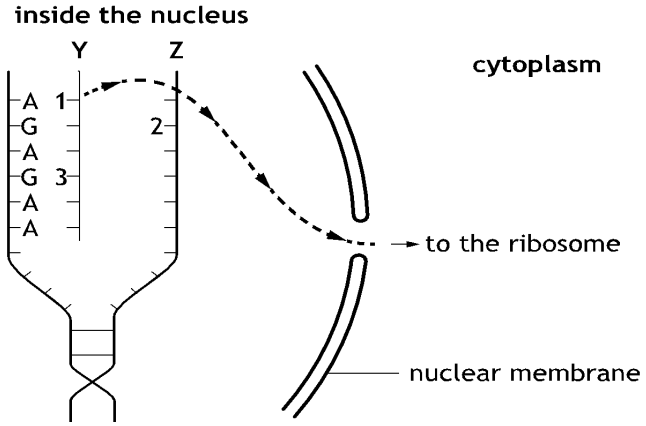
(i) Describe how a piece of plant tissue could be treated so that its cells appeared as shown in the diagram. **1**

(ii) Give the term applied to cells that appear as shown in the diagram. **1**

Key Area Three

DNA and the production of proteins

1. The diagram below shows how genetic information in the nucleus is used in the first stage of making a protein.



(a) (i) Name molecule Y. 1

(ii) Underline one option in sentences correct each bracket to make the following sentences correct.

2

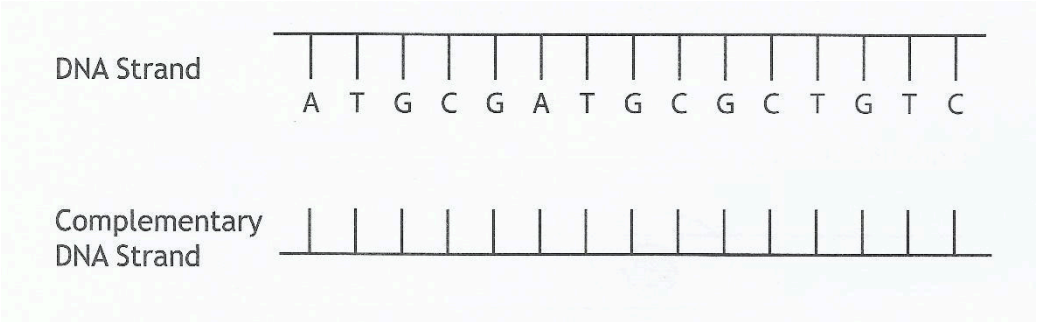
(b) (i) The molecules represented by the letter A are { bases / genes / Proteins }

(ii) The complementary strand Z would have the letter { A / C / G / T } at position 2 in the diagram.

(c) (i) Name the basic units which are joined together to make a protein at the ribosome. 1

(ii) The diagram above shows a section of the code to make a protein such as amylase. Describe how the code to make the protein insulin would differ from this. 1

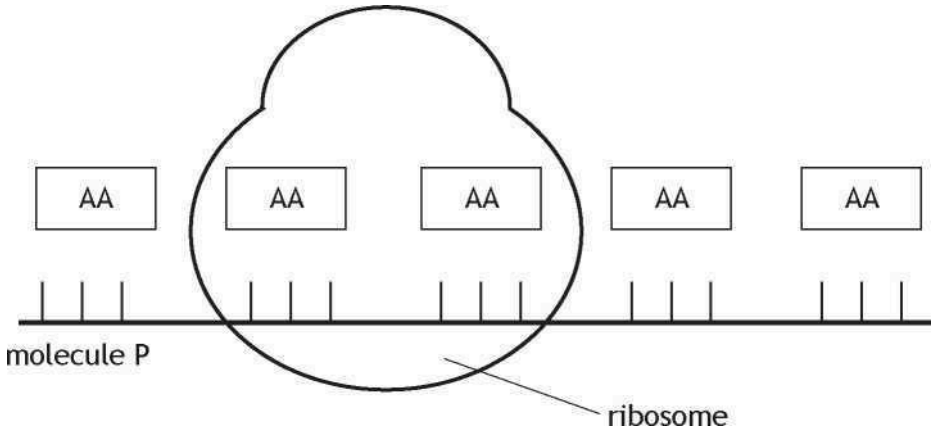
2. (a) DNA is a double stranded molecule. The following diagram shows part of one strand. Complete the diagram to show the complementary strand. 1



(b) (i) DNA contains genetic material which controls the synthesis of chemicals made from amino acids.

Name the type of chemicals synthesised. **1**

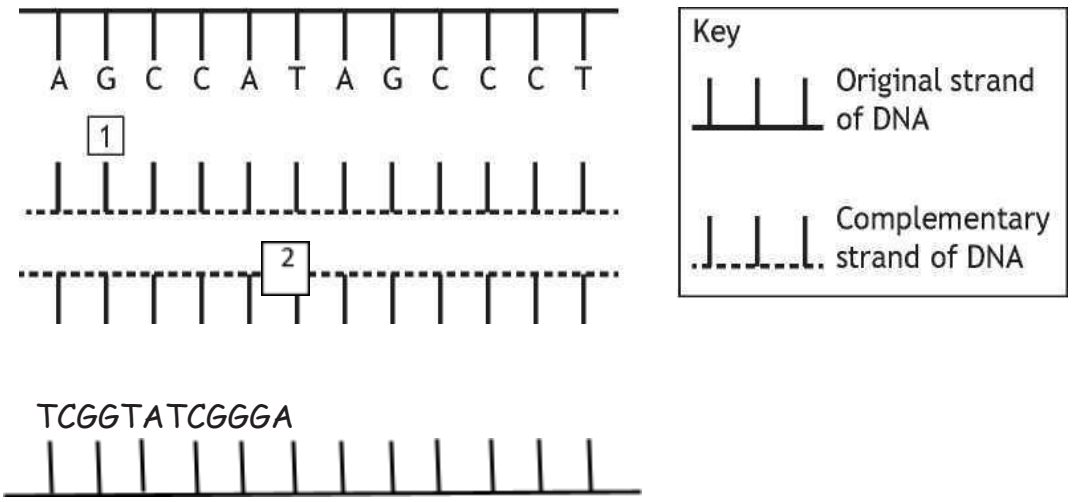
(ii) The diagram below shows an example of one of these chemicals being synthesised.



Name molecule P and describe how it determines the sequence of amino acids, represented by AA, as shown in the diagram. **2**

(iii) Name the part of the cell where molecule P was made. **1**

3. (a) Forensic scientists can take small quantities of DNA and use a process to make large quantities. Each DNA molecule is separated and used to make two complementary strands as shown below.



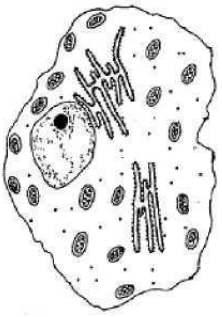
Give the full names of bases labelled 1 and 2 in the diagram above. **2**

(b) The bases in a strand of DNA make up the code for the production of proteins. The DNA for every individual person varies.

Describe the way in which this code differs from person to person. **1**

(c) Name the single stranded molecule which carries a complementary copy of the code from the DNA in the nucleus to the ribosome for protein synthesis. **1**

4. The diagram below shows features of the ultrastructure of an animal cell.



(a) Name the structure, shown in the diagram, which contains the cell's genetic information. **1**

(b) The genetic information is encoded in DNA molecules. Describe the structure of a DNA molecule. **1**

(c) DNA codes for the amino sequences in protein. Give two functions of proteins in cells other than enzymes. **2**

(d) Describe the features of mRNA molecule. **2**

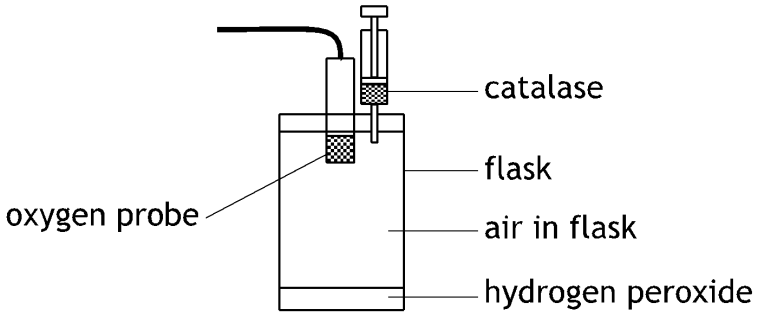
Key Area Four

Proteins and Enzymes

1. (a) A reaction takes place because the active site of an enzyme is complementary to. 1

(b) Enzymes act as catalysts because they are 1

2. The enzyme catalase breaks down hydrogen peroxide into water and oxygen in living cells. The apparatus shown below was used to study the effect of temperature on the activity of the enzyme catalase.



Catalase was added to the flask and the increase in oxygen in the air in the flask was measured by the oxygen probe and recorded as percentage increases. The procedure was repeated at five different temperatures and the results are shown in the table below.

Temperature (^{0}C)	Increase in oxygen (%)
5	0.5
20	0.8
35	1.4
40	1.1
50	0.1

(a) On the grid below, use the results in the table to complete the line graph of temperature against percentage increase in oxygen. **3**

(b) Identify the temperature at which catalase was most active? **1**

(c) The catalase and the hydrogen peroxide were both at the required temperature before they were added together.

Explain why this improves the validity of the results. **1**

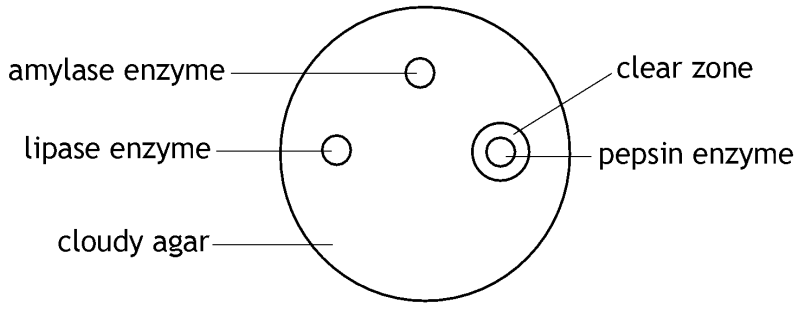
(d) Explain why no oxygen was produced when the investigation was repeated using a different enzyme. **1**

(e) Describe how the experiment could be modified to investigate the effect of pH on the activity of catalase.

1

3. An investigation was carried out into digestion of a protein. Protein was mixed with agar gel in a Petri dish. Three wells were cut in the gel. A solution of the enzyme pepsin was placed in one of the wells and solutions of the enzymes amylase and lipase into the remaining wells. The dishes were then left for two days at 20°C.

The experiment was repeated five times. The diagram below shows the appearance of one of the Petri dishes after two days.



The clear zone in the gel around the pepsin well shows that digestion of protein has occurred. The widths of the clear zones in each dish were measured.

(a) The table below shows the results for each dish.

Petri dish	Width of clear Zone around well containing pepsin (mm)
1	4.5
2	4.1
3	4.0
4	4.6
5	3.8
Average	

Complete the table by calculating the average width of the clear areas. **1**

(b) Describe one precaution, not already mentioned, that would have to be taken for each dish to ensure the validity of the results. **1**

(c) Identify the feature of enzyme activity shown by the results. **1**

(d) Give one condition which could cause an enzyme to become denatured. **1**

4. Hydrogen peroxide can damage cells and lead to cell death. Catalase is an enzyme which breaks down hydrogen peroxide into oxygen and water. Scientists in New Zealand investigated the link between the level of catalase in sheep livers and the fat in their meat.

The hypothesis was that the higher the level of liver catalase, the greater the fat content of the meat.

In the investigation, they examined 9 sheep with a high percentage of fat and 15 sheep with a low percentage of fat. The sheep with the high percentage of fat had an average catalase level of 4800 K/g and those with the lower percentage of fat had an average catalase level of 3600 K/g.

The scientists concluded that their hypothesis was correct.

(a) (i) Name the substrate of catalase. **1**

(ii) Identify an aspect in the planning of the investigation that would suggest that the hypothesis might not be proven correct.

1

(b) A further investigation proved that the hypothesis was correct.

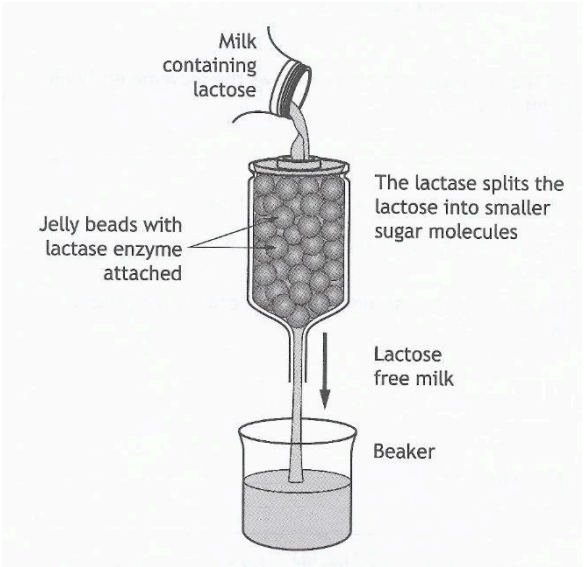
Describe how this investigation could help farmers to select only sheep with a low percentage of fat, to provide meat for consumers following a low-fat diet.

1

(c) The optimum temperature for the activity of catalase is 37°C.

Predict what would happen to the activity of catalase if the temperature was lowered to 34°C. **1**

5. The diagram below shows how the enzyme lactase is used in the production of lactose-free milk.



(a) (i) Underline one option in each of the brackets to make the following sentences correct. **2**

This process is an example of a {degradation / synthesis} reaction.

(ii) In this reaction, lactose is the { product / substrate } of lactase.

(b) A fault in the production resulted in boiling water running over the lactase enzyme.

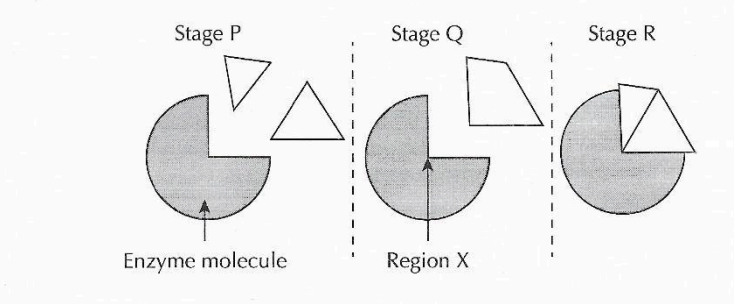
Using your knowledge of enzymes, predict how the milk produced would differ from the expected product. Explain your answer. **2**

(c) Enzymes such as lactase are biological catalysts. Explain the role of enzymes in living cells.

1

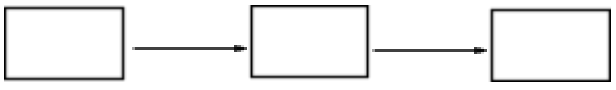
(d) Name the substance of which enzymes are made. **1**

6. The diagrams below represent stages in a synthesis (building up) reaction catalysed by a human enzyme molecule at 37^0C.



(a) Complete the flow chart below by adding letters to show the correct order of these stages as they would occur during the reaction.

1



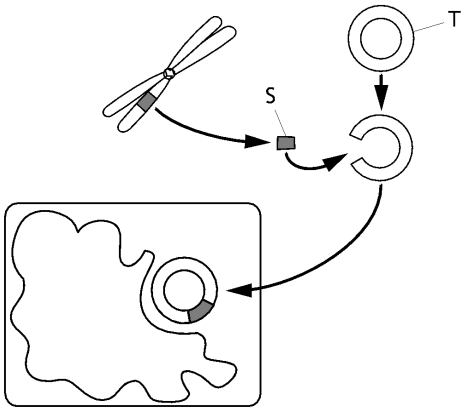
(b) Identify the part of the enzyme molecule labelled region X in the diagram.**1**

(c) Explain why the cellular reaction above would not occur if the temperature were increased to 60^0C. **1**

Key Area Five

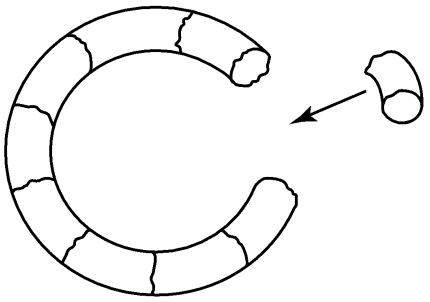
Genetic Engineering

1. The diagram below shows stages in the production of a substance, such as insulin, by genetic engineering.



Identify S and T. **1**

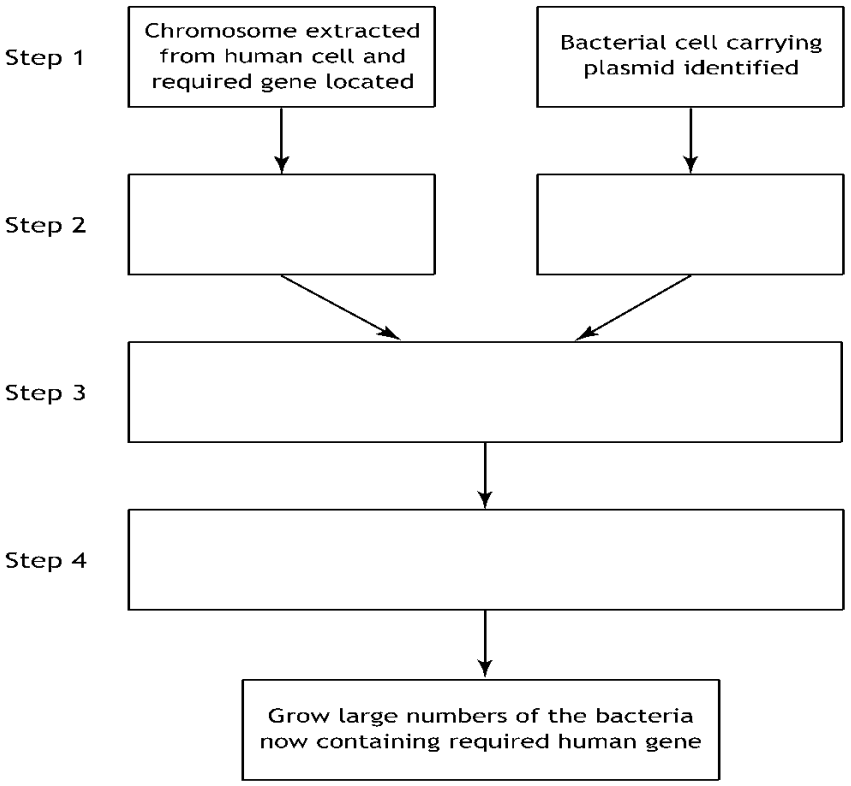
2. The diagram below shows a stage in the genetic engineering of a bacterium to allow it to produce human insulin.



Which stage of the genetic engineering process is represented in the diagram? **1**

3. Genetic engineering can be used to transfer human genes to bacteria artificially.

(a) Complete the boxes below to describe each of the steps carried out to transfer a human gene to a bacterial cell. **3**



(b) Name a human hormone which has been produced by genetically engineered bacteria. **1**

(c) Describe how genetic information can be transferred naturally between species. **1**

4. The following steps are involved in the process of genetic engineering.

1 Insertion of a plasmid into a bacteria host cell
2 use of an enzyme to cut out a piece of chromosome containing a desired gene
3 insertion of the desired gene into the bacterial plasmid
4 Use of an enzyme to open a bacterial plasmid

Write the correct sequence of these steps. **1**

5. Choose from the list of words below, to complete the following sentence.

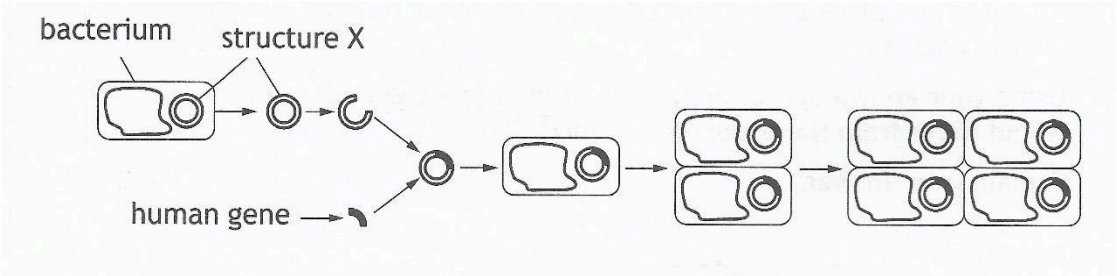
In genetic engineering, a …….from one organism is introduced into the …… of an unrelated organism. **1**

chromosome, nucleus, gene, protein, genome

6. Name three useful products in medicine that can be obtained by genetic engineering. **2**

7. Give three examples of genetic engineering that are intended to improve crop plants. **2**

8. The diagram below represents part of the process of genetic engineering.



(a) Structure X is removed from the bacterium and modified during this process. Name structure X. **1**

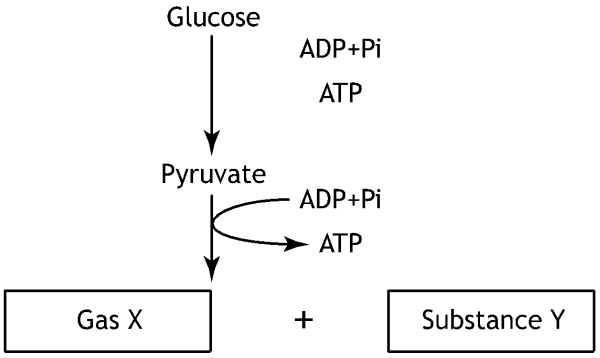
(b) The bacteria have an initial concentration of 1000 cells/cm^3. Each cell divides once every 30 minutes.

Calculate how long it will take for the concentration to become greater than 15000 cells/cm^3. **1**

Key Area Six

Respiration

1. The diagram below shows stages in the breakdown of glucose in the presence of oxygen to form the final products, gas X and substance Y.



(a) Identify gas X and substance Y. **1**

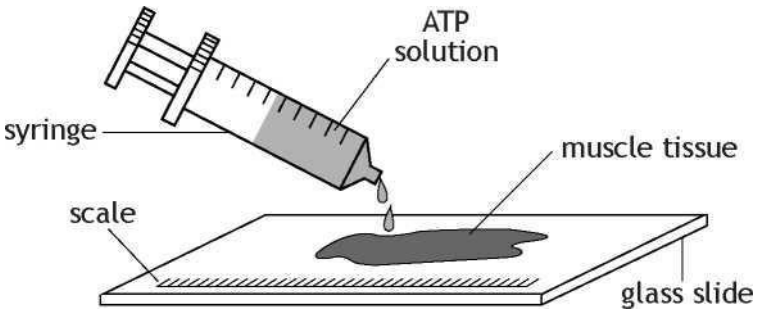
(b) State the number of molecules of ATP which are produced per glucose molecule during each of the following pathways. **2**

(i) Aerobic respiration

(ii) Fermentation

(c) State the location of the fermentation pathway in a cell. **1**

2. The diagram below shows part of an investigation into the effect of adding two different concentrations of ATP solution to two pieces of muscle tissue.



The results of the investigation are given in the table below.

Muscle tissue	*Concentration of ATP solution added (%)*	*Length of muscle tissue (mm)*			
		At start	*After 5 minutes*	*Decrease in length*	*Percentage decrease (%)*
1	0.5	48	45.6	2.4	5
2	*1.0*	45	40.5	4.5	

(a) (i) Calculate the percentage decrease in length of muscle tissue 2. **2**

(ii) Give a conclusion that can be drawn from the results. 1

(b) The list below contains some features of respiration in germinating peas.

List	
W	Does not require oxygen
X	Releases CO_2
Y	Produces 38 molecules of ATP per glucose molecule
Z	Produces ethanol

(i) Complete the table below by entering the letters from the list in the correct box to match the features with the type of respiration occurring. Each letter may be used once or more than once. **2**

Aerobic respiration in germinating peas	*Fermentation in germinating peas*

3. If a tissue was heated to 65°C for 10 minutes, respiration would cease even if oxygen and food were supplied. Why is this?

1

4. Muscle tissue can be dark or light in colour. Dark tissue cells use oxygen to release energy. Light tissue cells do not use oxygen to release energy.

(a) Name the process by which energy is released in the dark tissue cells. **1**

(b) (i) Name the substance which muscle cells break down to produce pyruvate. **1**

(ii) When pyruvate is being formed, enough energy is released to form two molecules of a high-energy compound.

Write the word equation to show how this compound is generated. **1**

5. The table below shows the average percentage of dark and light tissue cells. These cells were found in the muscles of athletes training for different events at the 2014 Commonwealth games in Scotland.

Type of Athlete	*Average percentage of dark tissue cells* (%)	*Average percentage of light tissue cells* (%)
cyclist	60	40
swimmer	75	25
shot putter	40	60
marathon runner	82	18
sprinter	38	62

(a) Using information in the table, identify which type of athlete would be likely to produce the most lactic acid in their muscle cells. Justify your answer. **2**

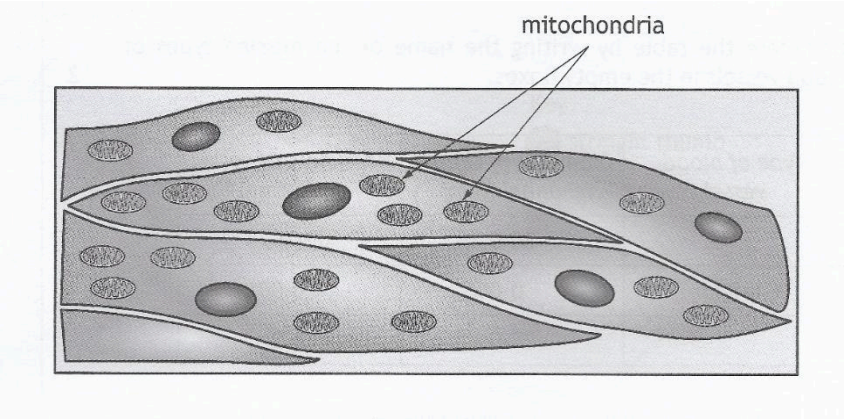
(i)Type of athlete

(ii) Justification

(b) A sample of muscle tissue from an athlete was examined and found to contain a total of 360 cells. 90 of these cells were light tissue cells. Identify

which type of athlete the sample was taken from. **1**

6. The diagram below shows muscle cells.



(a) (i) Explain why muscle cells require many mitochondria. **1**

(ii) Name one substance produced by a cell carrying out aerobic respiration. **1**

(b) A muscle cell will carry out fermentation when oxygen is not available.

Describe the fermentation pathway in muscle cells. **2**