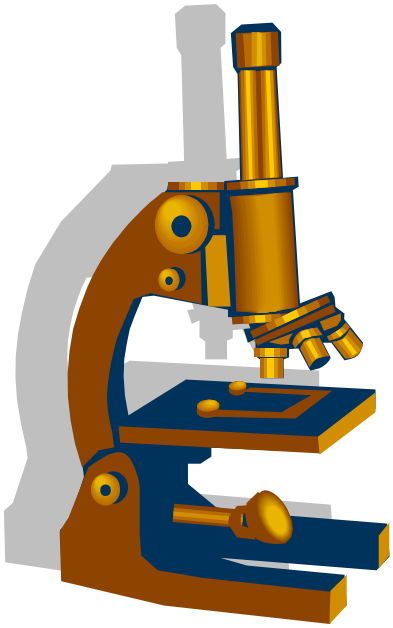
National 5

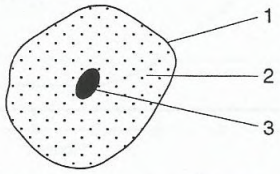
Biology



Unit 1
Homework booklet

Homework 1

1. The diagram shows a typical animal cell with some structures labelled.



Which line in the table correctly identifies each structure?

	1	2	3
A	nucleus	cytoplasm	membrane
B	membrane	cytoplasm	nucleus
C	nucleus	membrane	cytoplasm
D	cytoplasm	membrane	nucleus

2. The following is a list of cell functions.

1. site of chemical reactions
2. control of all activities
3. control of entry and exit

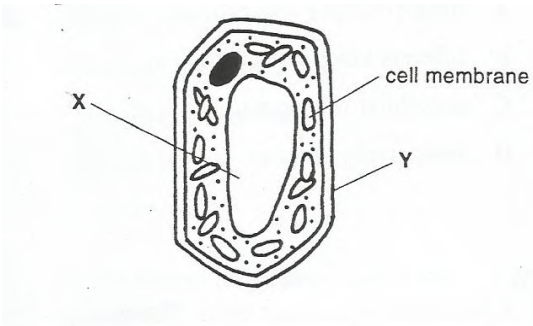
Which line in the table correctly matches cell structures to these functions?

	Nucleus	*Cytoplasm*	*Membrane*
A	1	2	3
B	2	3	1
C	3	1	2
D	2	1	3

1

1

Questions 3 and 4 refer to this diagram of a plant cell.



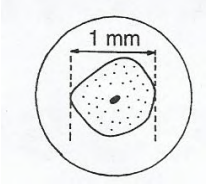
3. Structure X is the
A cell wall
B. cell membrane
C. cytoplasm
D. Vacuole

4. Structure Y is the
A. vacuole
B. cell membrane
C. nucleus
D. cell wall.

1

1

5. The diagram shows a human cheek cell magnified 100 times. At this magnification the cell appears to 1 mm across. What is the actual size of the cell

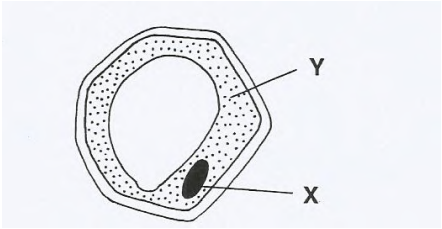


1

6. A bacterium reproduces every 30 mins. How many cells could arise from one bacterium cell after 6 hours?

1

7. The diagram shows a stained plant cell viewed by a high powered microscope.

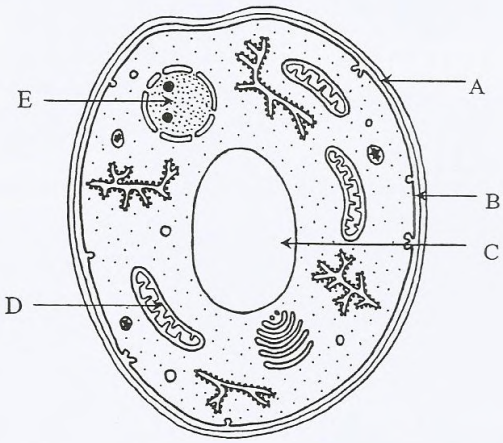


a) Name structures X and Y. 1

b) Name a structure visible in the drawing which would not be found in an animal cell. 1

c) Predict the effect on the appearance of the cell if the stain had not been used in preparing the cell for viewing by microscope. 1

8. The following diagram represents a section through a yeast cell.



(a) The table below records descriptions which refer to structures shown in the diagram.

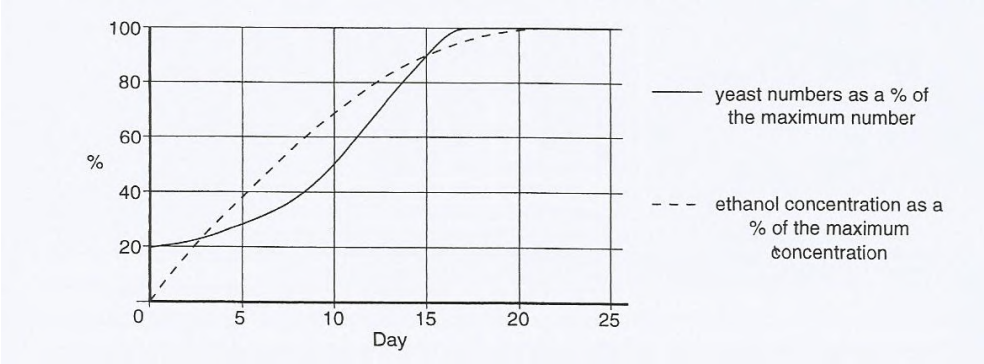
Complete the table by inserting the appropriate letters and function.

Letter of Structure	*Function*
	Prevents bursting of cell caused by water intake
B	
	Controls cell metabolism

3

b) Yeast is **not** a producer. What feature of the yeast cell demonstrated by the above diagram supports this statement. 1

10. Yeast cells are used in industrial and commercial processes. The graph shows how the number of yeast cells present in a tank of sugar solution at 30 °C changed over a period of 25 days. Also shown is the concentration of ethanol, a product of the activity of the yeast.



a) What percentage of the final yeast number was present on day 10? 1

b) On which day had the ethanol concentration reached 90% of its final concentration. 1

11. Copy and complete the table comparing the structures of cells from different organisms.

Structure Present?	Animal cell	Plant cell	Bacterial cell	Fungal cell
Nucleus	yes			
Cell Wall	no		yes	
Ribosomes				
Mitochondria				yes
Vacuole		yes		

5

/20

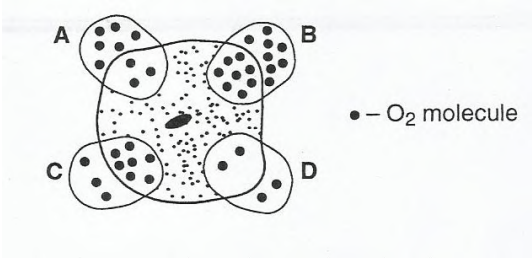
Homework 2

1. In Diffusion substances move from

A High to low concentration.
B High to high concentration.
C Low to high concentration
D Low to low concentration.

1

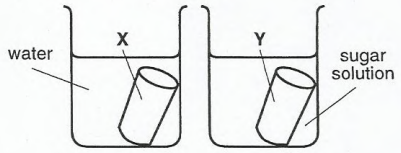
2. In which portion of the diagram will water move in by diffusion?



1

Questions 3 and 4 refer to the following diagram.

Two pieces of potato, each of mass 5 g, were cut. One piece (X) was put in 100 cm^3 of pure water and the other (Y) in 100 cm^3 of concentrated sugar solution, as shown.



The pieces were left for 4 hours, then removed, blotted and reweighed.

3. What changes in the masses of the potatoes would be expected?

A X increases, Y decreases.
B X and Y stay the same.
C X decreases, Y increases
D X and Y both increase.

1

4. What term would be applied to cells in piece X after immersion.

A Rigid
B Plasmolysed
C Turgid
D Flaccid

1

5. What solution should a plant cell be placed in to make it fully turgid?

A Hypotonic
B Very hypertonic
C Isotonic
D Slightly hypertonic

1

6. An investigation was carried out into the effects of different concentrations of salt solutions on a known mass of carrot tissue.

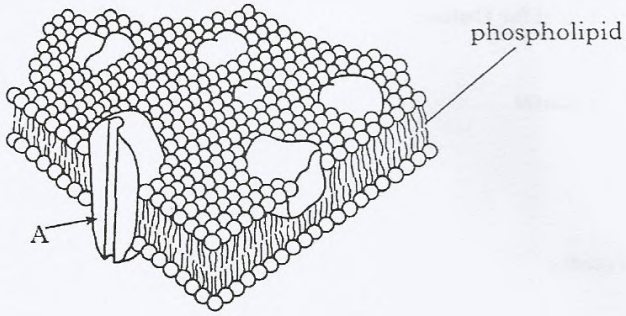
Solution	Concentration of solution (molarity)	Initial mass (g)	Final mass (g)	Percentage change in mass of carrot root tissue
A	0·05	5·0	6·35	+27
B	0·20	4·8	5·13	+7
C	0·30	5·1	4·74	–7
D	0·35	4·9	4·26	–13
E	0·40	4·9	3·92	–20

a) Plot a line graph of Percentage change in mass against molarity. 2

b) Which solution was most similar in concentration to that of the carrot tissue? 1

7.

(a) The diagram below shows the arrangement of molecules in part of a cell membrane.

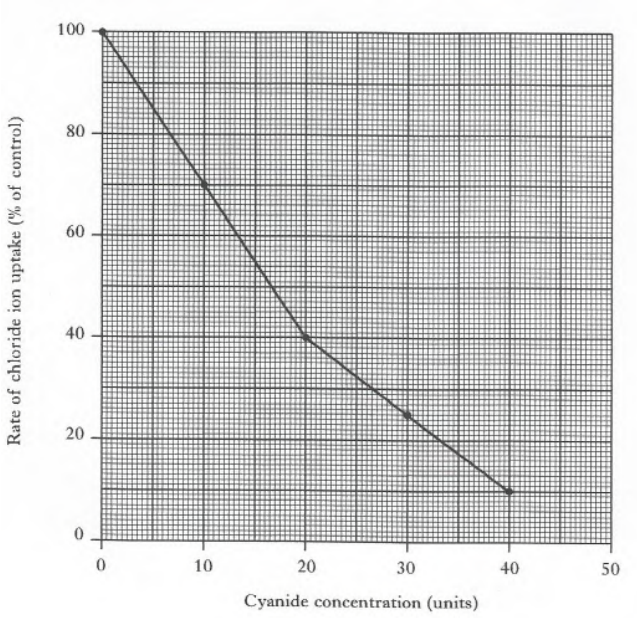


a) Name molecule A and state its function in the membrane. 2

b) The following sentences give information about the plasma membrane of beetroot cells. Copy and complete the sentence using the correct word from each bracket.

The plasma membrane contains (cellulose/proteins) and (phospholipids/carbohydrate) and has a (porous/fibrous) nature. As a result the membrane is (fully/selectively) permeable. 2

c) Cyanide is an poison that inhibits enzymes involved in aerobic respiration. The graph shows how cyanide concentration affects the uptake of chloride ions by beetroot cells. The rates of chloride ion uptake have been given as percentages of those obtained in a control experiment with no cyanide.

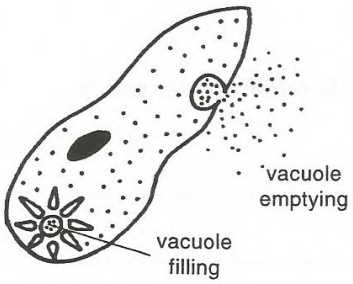


(i) Predict the cyanide concentration at which chloride ion uptake would stop. 1

(ii) The uptake of chloride ions occurs by active transport. Explain how the information given supports this statement. 2

8. *Paramecium* is a unicellular animal which lives in fresh water. Water which enters its body is collected in special vacuoles. When a vacuole is full it releases the water again at the surface of the organism. The more water that is absorbed by the organism, the more often the vacuoles empty.

In an investigation, cultures of *Paramecia* were kept in solutions of different salt concentration. Samples of *Paramecia* from each culture solution were removed and observed under the microscope. The average number of vacuoles emptied per hour was found and the results recorded as shown in the table.



Culture solution	*Average number of vacuoles emptied per hour*
A	3
B	8
C	14
D	19

a) For a valid comparison of the different cultures, name two factors which would have to be kept the same for each solution. 1

b) Which feature of the experimental method is designed to improve reliability? 1

c) Which culture had the highest salt concentration? 1

d) Which culture was most hypotonic to the Paramecium contents? 1

e) Name the process by which water enters a Paramecium. 1

20

Homework 3

Q1. A cell in the basal layer of skin contains 46 chromosomes and divides by mitosis to produce new skin cells. After 10 successive divisions, how many chromosomes will the basal cells have?

A. 460
B. 4600
C. 46
D. 46000

1

Q2 When chromosomes replicate , they produce

A. nuclei
B. chromatids
C. tissues
D. chromosomes

1

Q3. When carrying out tissue culture it is important to use which safe practice method?

A. disinfectant
B. purification
C. antiseptic
D. aseptic

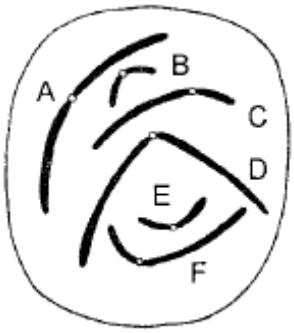
1

Q4. Commercial production of beer involves which production method?

A. discontinuous
B. batch
C. match
D. continuous

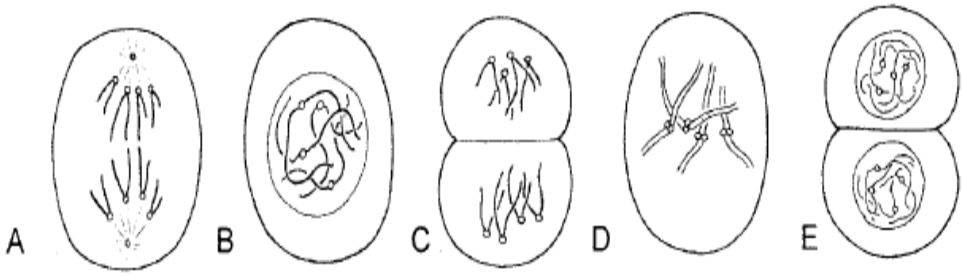
1

Q5.



Using the letters from the diagram above write down the letter pairs which form diploid chromosomes. 1

Q6.



a) Write down the letters in the order in which these stages of mitosis occur.

b) How many pairs of chromosomes are there in the cell? 3

c) What is the diploid number of chromosomes in these cells?

Q7. Daughter cells produced by this type of cell division contain the same number of chromosomes as their parent cell. Explain the importance of this. 1

Q8. The process of mitosis in grasshopper cells can be divided into four stages.

Measurements were made of the length of time taken by each of these stages at 38°C.

Stages of mitosis	Average length of time (min)
A	100
B	20
C	15
D	65

a) Use the above results table to draw a bar chart on graph paper. 2

b) What percentage of the total time was taken up by Stage B? 1

Q9. Bacterial cells can be grown in a laboratory.

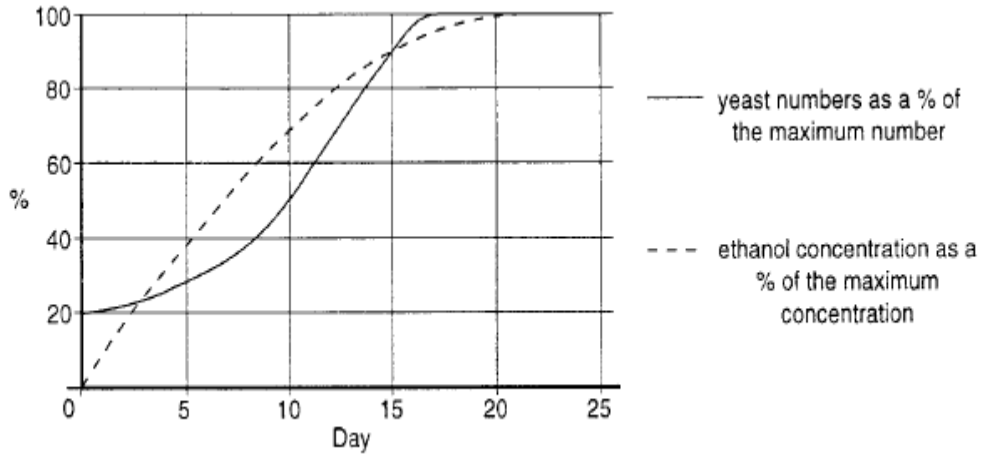
a) Explain why aseptic techniques are used? 1

b) Some bacterial cells multiply every 20 minutes. 1

How many cells would be produced from a single bacteria in 2 hours?

Q10.

Yeast cells are used in industrial and commercial processes. The graph below shows how the number of yeast cells present in a tank of sugar solution at 30°C changes over a period of 25 days. Also shown is the concentration of ethanol, a product of the activity of the yeast.



a) What percentage of the final yeast number was present on day 10? 1

b) On which day had the ethanol concentration reached 90% of its final concentration? 1

c) Apart from ethanol, what other product of yeast activity is important in industrial processes. 1

d) Explain what is meant by a closed system in the batch processing of beer. 1

e) Why is a mixture of barley malt, water and hops boiled before yeast is added in beer making? 1

f) Why is the yeast not added immediately after the barley malt, water and hops have been boiled ? 1

/20

Homework 4

Q1.
How many sets of chromosomes would be found in a normal human body cell?

A. 1
B. 2
C. 23
D. 46

1

Q2.
The units which make up proteins are called?

A. Bases
B. Sugars
C. Amino acids
D. Genes

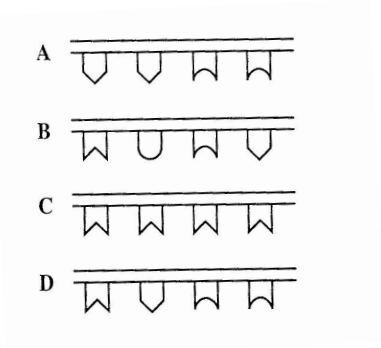
1

Q3.
A chromosome?

A. Carries genetic information
B. Controls cell respiration
C. Is the site of photosynthesis
D. Speeds up chemical reactions

1

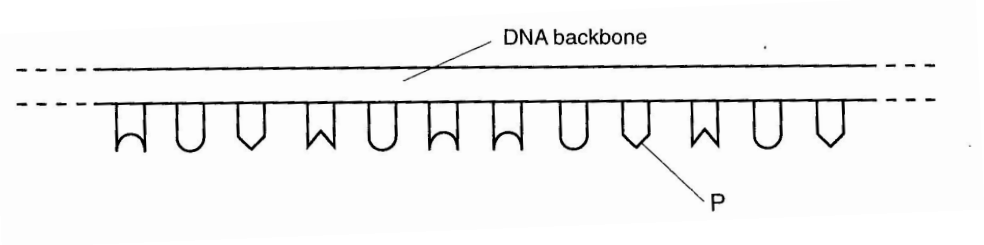
Q4.
Which diagram best shows the range of bases in DNA?



1

Q5

The drawing shows a small section of a large DNA molecule.



(a) What term refers to the parts of the DNA molecule, such as the one labelled P, which are attached to the backbone of the structure? 1

(b) Explain how the structure of DNA carries a code for the synthesis of protein within a cell. 2

(c) Describe exactly where DNA molecules are found within a cell. 1

Q6

The following statements refer to stages in the formation of a protein molecule from genetic information carried on DNA.

A: amino acid molecules link together to form a chain

B: sequence of DNA bases is exposed

C: chain of amino acid units is folded to form a 3D shape

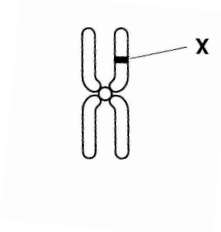
D: amino acid molecules line up depending on the DNA base sequence

(a) Arrange the normal sequence of events in the formation of a protein molecule in the correct order. 2

(b) Why are proteins different from each other? 1

Q7

The diagram shows a human chromosome just before cell division.



(a) Name the part of a chromosome, such as X, which contains information that determines one human characteristic. 1

(b) Chromosomes are composed of DNA .

Underline one term in each set of choices to make the following sentence read correctly. 2

The sequence of sugars/amino acids/bases in DNA encodes information for the sequence of sugars/amino acids/bases in substances such as enzymes.

Q8

The following table gives DNA codes for four different amino acids.

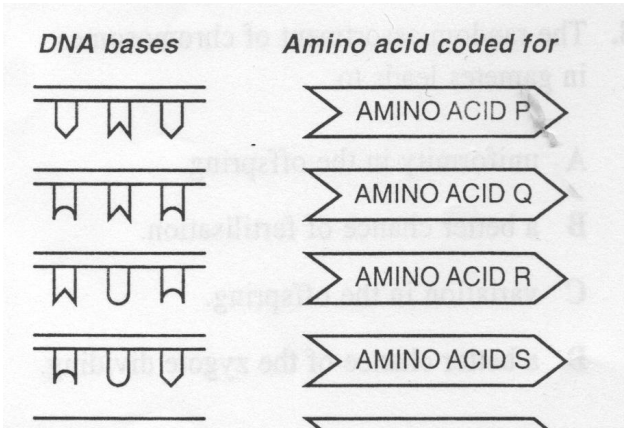
DNA Code	Amino Acid
CCG	Gly
GCC	Arg
CGG	Ala
GGC	Pro

Write the DNA code for the following section of a protein molecule.

Arg—Ala—Gly—Pro

1

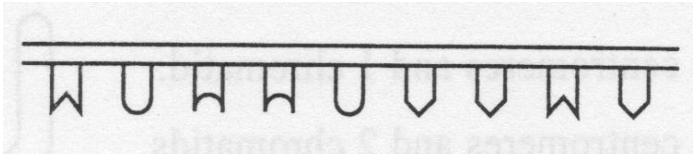
Questions 9 and 10 relate to the following information about DNA.



Q9

Write down the piece of protein made if the following DNA sequence was read.

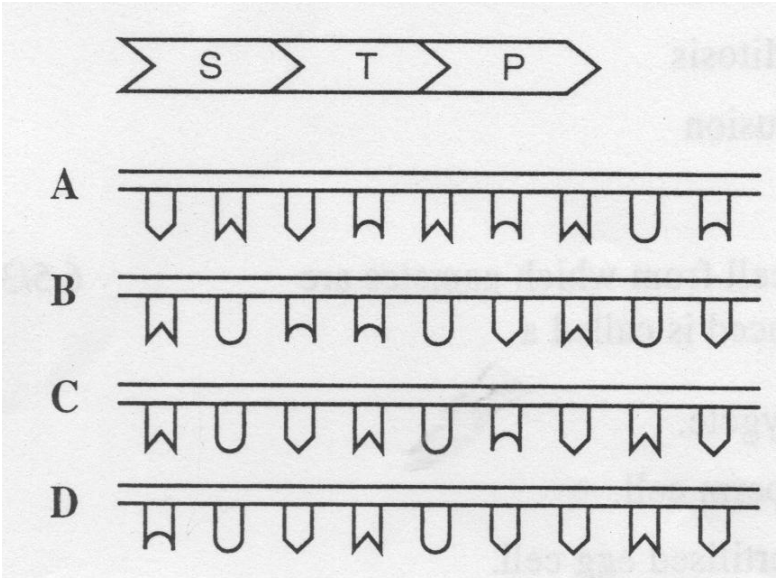
1



Q10

Which DNA sequence would give the following piece of protein?

1



Questions 11 and 12 refer to a procedure used to isolate DNA from onion cells.

Q11

Why is the onion tissue added to detergent, salt and water then placed in a water bath at 60°C? 1

Q12

In the final part of the procedure, where do you find the DNA forming? 1

Q13

Where are chromosomes found? 1

/20

Homework 5

Q1. The units which make up proteins are called

A. bases
B. sugars
C. amino acids
D. genes

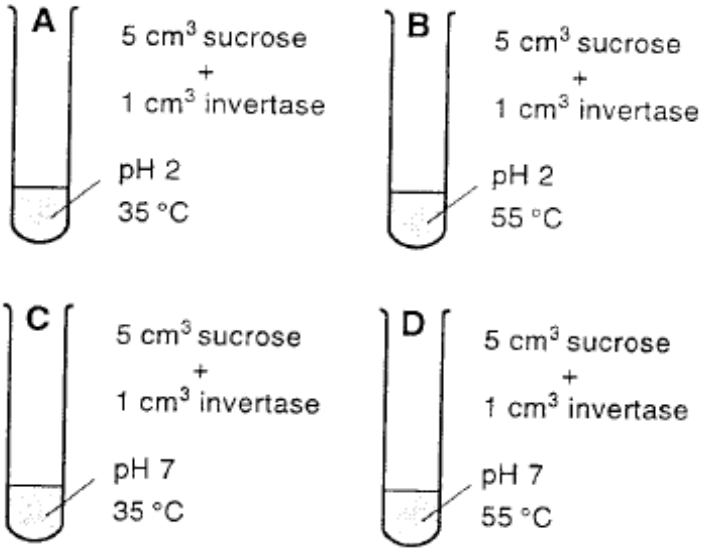
1

Q2 Which of the following statements about enzymes are false ?

A. they are found in living cells
B. they are natural substances
C. their active sites are complementary to their substrates
D. they are changed by their reactions

1

Q3. In which test tubes below would glucose be detected first?



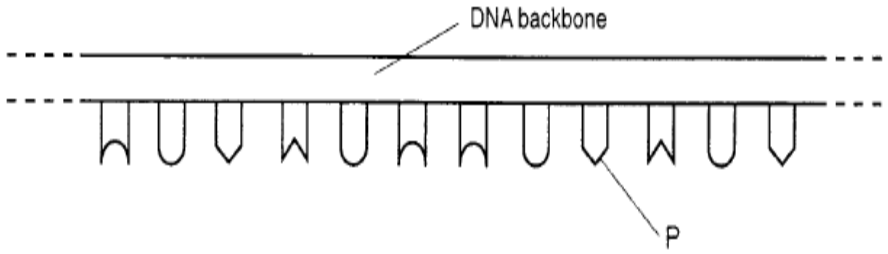
1

Q4 In an experiment it was found that an invertase solution produced 0.2g of fructose in 4 minutes. What mass of fructose would be produced in one minute?

A 0.05g
B 0.1g
C 0.8g
D 20g

1

Q5 The diagram below shows a small section of a large DNA molecule.



a) What term refers to the parts of the DNA molecule, such as the one labelled P, which are attached to the backbone of the structure?

1

b) Explain how the structure of DNA carries a code for the synthesis of protein within a cell.

2

Q6 Explain how enzymes speed up chemical reactions.

1

Q7 In an experiment, 1g of fresh potato was added to hydrogen peroxide solution at different pH valves and the volume of oxygen produced was measured in each case. The results are shown in the table below.

pH oh hydrogen peroxide	Volume of oxygen foam cm^3
6	0.5
7	0.6
8	2.0
9	3.0
10	1.5
11	0.7
12	0.6

a) Using graph paper , plot a line graph to show the effect of pH on the volume of oxygen produced. 2

b) From the graph, state the pH at which the enzymes was most active. 1

c) From the graph, state the pH at which the enzyme was the least active. 1

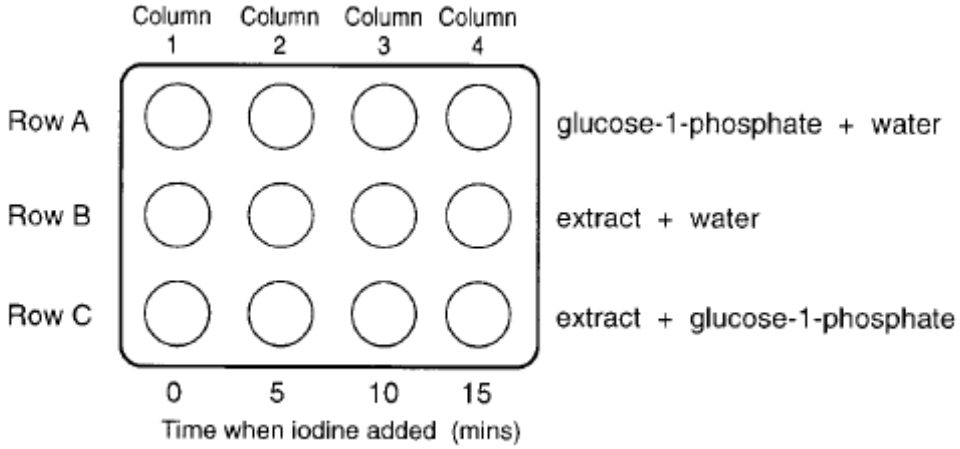
d) Which term describes the pH at which the enzyme was most active? 1

e) What would the results of the experiment be if boiled potato had been used instead of fresh potato. 1

f) Name the enzyme in potato which breaks down hydrogen peroxide. 1

Q8 A potato extract was made by liquidising then filtering a peeled fresh potato. The extract contains an enzyme which synthesises starch.

An experiment using the extract was set up in a dimple tile as shown. The columns of dimples were tested for starch at 5 minute intervals.

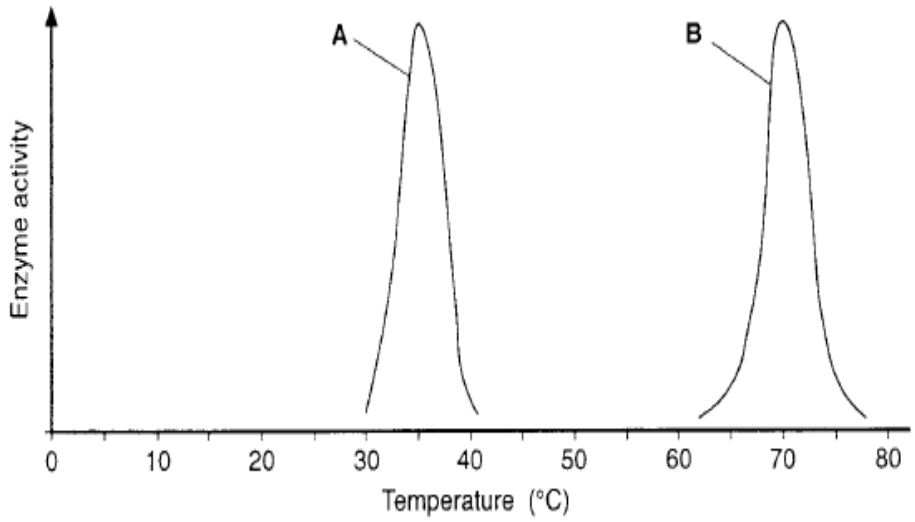


a) Name the enzyme present in the potato extract and the substrate. 2

Q9 Proteases are enzymes which are used in "biological " washing powders. They digest difficult stains caused by proteins such as blood, egg yolk etc.
Some fabrics are damaged by washing in very hot water whereas other fabrics wash better in very hot water.

The graph on the next page shows the effect of temperature on two different proteases (A and B) being considered for use in a new biological washing powder.

Q9 continued



a)

Give one advantage of using protease A in the new washing powder.

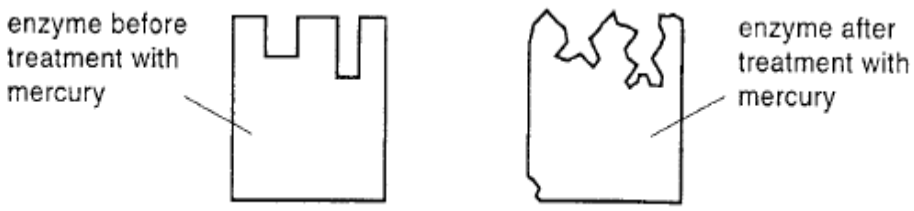
1

b) Give one disadvantage of using protease B in the new washing powder.

1

Q10 The diagram below shows the effect that mercury has on the structure of amylase.

Explain why the amylase will no longer bind to the substrate starch when mercury is present.



1

/20

Homework 6

Q1.
The normal control of activity in a bacterium depends on its
A. Cell walls
B. Cytoplasm
C. Membrane
D. Chromosomes

1

Q2
The genes of an organism are made of
A. ATP
B. Plasmids
C. DNA
D. Carbohydrates

1

Q3.
Genetic Engineering is the
A. swapping of genes between organisms
B. Construction of new genetic codes on DNA
C. Hybridising of different species
D. Transfer of DNA from one organism to another

1

Q4.
Plasmids are used to
A. cut genes out of chromosomes
B. Carry genes into bacterial cells
C. Make proteins in animal cells
D. Join genes together

1

Q5

Give one concern that has been raised about the use of genetic modification of animals for human food consumption. 1

Q6

(a) The following list shows stages in the genetic engineering of a bacterial species.

1. Insertion of required gene into bacterial plasmid
2. Synthesis of required product by bacteria
3. Removal of required gene from source organism
4. Opening of bacterial plasmid
5. Insertion of plasmid into bacterial cell

Arrange these in the correct order. 2

(b) State one disadvantage of genetically engineering animals, rather than bacteria, to make useful products. 1

Q7

Read the following passage about the GM issue:

"Genetically modified (GM) crops have been developed to improve both the quality and the quantity of food production. There is no doubt that GM crops do provide opportunities for the future wellbeing of the human species. However, some concerns have been raised about the long term safety of the foods produced and that genetically modified plants may pass on their new genes to wild populations causing "genetic pollution". In order to ease public anxiety, extensive scientific research needs to be done to assess the risks to human health and to the genetic purity of wild populations."

(a) Copy and complete the following table to show two benefits and two concerns with GM crops. 2

Benefits	Concerns

(b) Explain how gene therapy could provide a cure for genetically inherited diseases. 2

Q8

Give one advantage of genetic engineering compared to selective breeding 1

Q9

In recent years, genetic modification has been suggested as an alternative to selective breeding. What is meant by "genetic modification"? 1

Q10

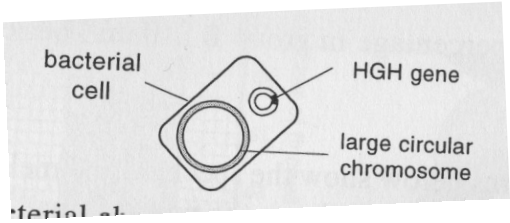
Genetic Engineering is important in the manufacture of biologically useful products, such as the human growth hormone (HGH)

(a) read the following passage about the history of developments with DNA, the key substance in genetic engineering.

" it was in the early 1900s that the four bases in DNA were first identified but it was not until the mid-1940s that DNA was recognised as the material of genetic inheritance. In the early 1950s the molecular structure of DNA was determined and by the mid-1960s the genetic code itself had been solved. In the early 1970s enzymes were first used to cut open and also to rejoin DNA molecules. In the mid-1980s, DNA fingerprinting became possible and in the early 2000s the complete sequence of genes in the human genome had been determined..

Based on the passage, when could the technology of genetic engineering be said to have been "born" ? 1

(b) The diagram shows a bacterial cell which has been genetically engineered to produce HGH.

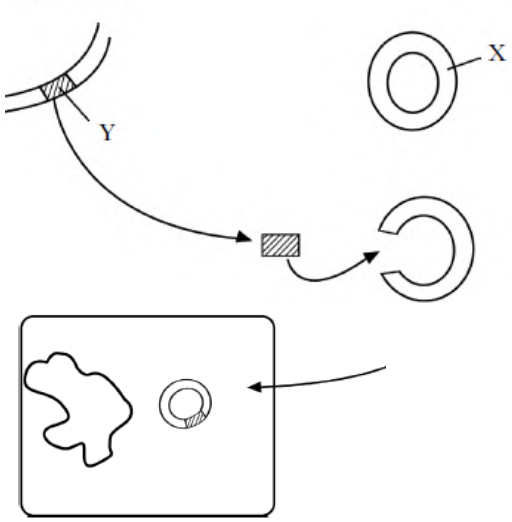


i) Name the substance of which bacterial chromosomes are made. 1

ii) Name the circular structure into which the HGH gene has been inserted. 1

iii) HGH is used in the treatment of certain growth disorders. Name another substance made by genetic engineering and state what it is used for. 2

Q. 11 The diagram below shows stages in the production of a desired product by genetic engineering.



1

/20

Which line in the table identifies correctly the structures labelled above?

	X	*Y*
A	bacterium	gene
B	plasmid	chromosome
C	bacterium	chromosome
D	plasmid	gene

Homework 7

Q1. The following list gives some measurements which can be made with plants.

1 Increase in dry mass/hour
2 Mass of water loss/hour
3 Volume of CO_2 absorbed/hour
4 Volume of O_2 released/min

Which measurements could be used to indicate the rate of photosynthesis?

A 1, 2 and 4
B 1, 3 and 4
C 2, 3 and 4
D 1, 2 and 3

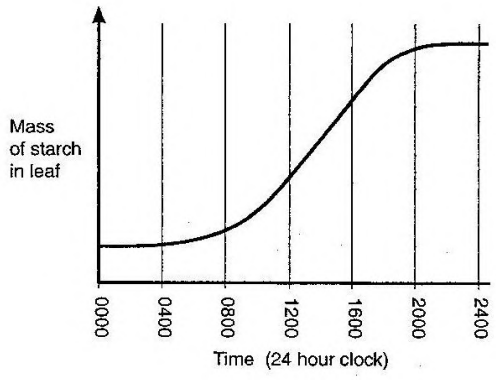
Q2. A role of ATP in photosynthesis is:

A trapping energy released in carbon fixation
B providing energy for photolysis
C storing energy first trapped by chlorophyll
D trapping energy released in photolysis

Q3. A chloroplast suspension was prepared and DCPIP added to detect hydrogen production. When the suspension was illuminated the DCPIP was decolourised.
Which set of conditions from the following would be a suitable control for this experiment?

A DCPIP, no chloroplasts, kept in darkness
B Chloroplasts, no DCPIP, kept in light
C Chloroplasts and DCPIP, kept in darkness
D Chloroplasts, no DCPIP, kept in darkness

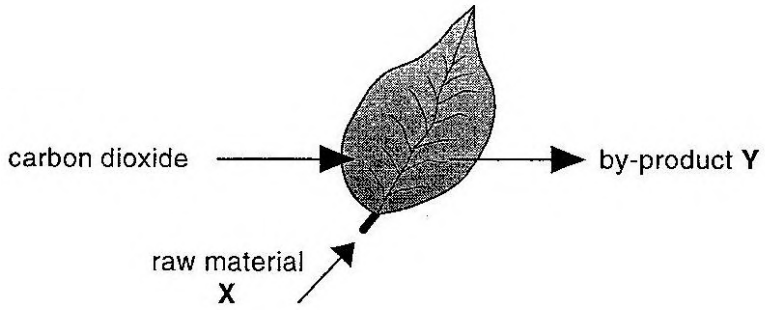
Q4. The graph shows the mass of starch in a leaf during a 24 hour period.



Between which times was the rate of photosynthesis greatest?

A 0400 and 0800
B 0800 and 1200
C 1200 and 1600
D 1600 and 2000

Q5) The diagram summarises the process of photosynthesis in a leaf.



a) Name the raw material X and the by-product Y. 1

b) State the energy change which takes place in photosynthesis. 1

Q6) An investigation was carried out to compare the total uptake of carbon dioxide by a green leaf and a variegated leaf of the same species. The volume of carbon dioxide was measured (in cubic millimetres) after 4 hours and again after 8 hours.

Time (hours)	**Volume of carbon dioxide absorbed (mm^3)**	
	Green leaf	**Variegated leaf**
0	0	0
4	280	186
8	516	337

a) Calculate the average uptake of carbon dioxide per hour by the green leaf during the 8-hour period. 1

b) What further information is required to allow a valid comparison of carbon dioxide uptake by the two leaves? 1

c) What is the role of chlorophyll which accounts for the results of the investigation? 1

d) What structures in a cell contain chlorophyll? 1

Q7) During carbon fixation, carbon dioxide combines with hydrogen.

a) Name the substance which provides the source of hydrogen used in the process. 1

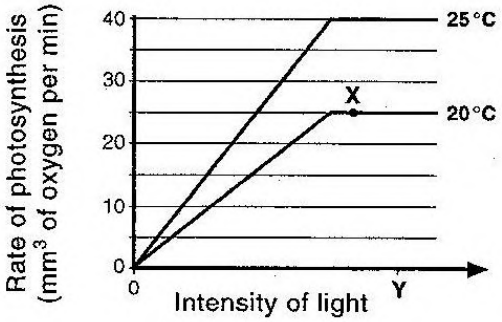
b) Name one other substance that is required for carbon fixation and give its function. 2

Q8) The glucose produced in photosynthesis is converted to other carbohydrates. Copy and complete the following table:

Carbohydrate	Function	Form
Starch		grains
	Cell wall component	

2

Q14) An investigation was carried out to find the effect of increasing light intensity on the rate of photosynthesis at different temperatures.



a) In the experiment at 20 °C, what factor is no longer acting as a limiting factor at point X on the graph? 1

b) Why was it important to keep the concentration of carbon dioxide constant during this investigation? 1

c) At light intensity Y, what is the percentage increase in the rate of photosynthesis obtained by carrying out the experiment at 25°C rather than 20°C? 1

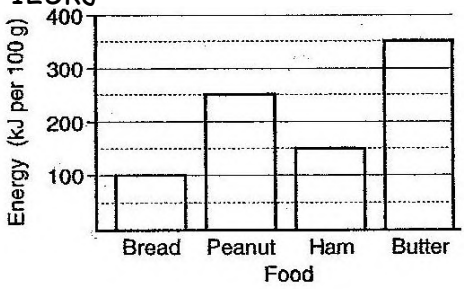
d) Explain why a high temperature can lower the rate of photosynthesis to zero. 2

/20

Homework 8

Q1. The chart gives energy values for some foods.
What is the energy value of 50g of bread and 200g of ham?

A 125kJ
B
C
D



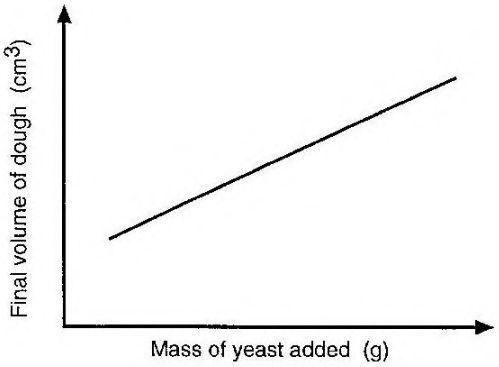
Q2. Respiration takes place in a series of controlled steps in order to:

A ensure that enough oxygen is available
B avoid a sudden drop in glucose concentration
C prevent release of excessive energy at once
D avoid a build-up of carbon dioxide in cells

Q3. After treatment with ATP, a muscle fibre contracts from 40mm to 35mm. What is the percentage decrease in length?

A 14.3%
B 12.5%
C 10.3%
D 87.5%

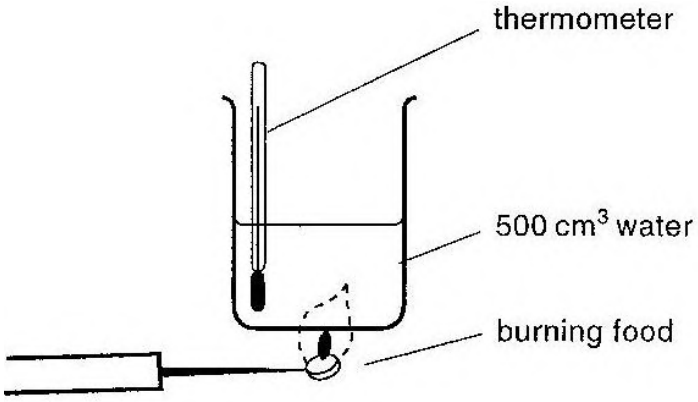
Q4. A pupil carried out an investigation into how the mass of yeast added affected the rising of a fixed volume of dough. The graph shows the results:



What does the graph show?

A As the mass of yeast added increases, the volume of dough stays the same.
B As the mass of yeast added decreases, the volume of dough increases.
C As the mass of yeast added increases, the volume of dough decreases.
D As the mass of yeast added increases, the volume of dough increases.

Q5) An investigation was carried out to find the energy content of different foods. In each case, a sample of 1g of burning food was used to heat 500cm^3 of water in a beaker. The temperature of the water was measured using a thermometer.



The energy content of the food can be calculated using the following expression:

Energy content (kJ/g) = 2.1 x rise in temp. of the water (°C)

a) Copy and complete the following table:

Food	Water temperature (°C)			Energy (kJ/g)
	Start	End	Rise	
Bread	20	22		
Peanut	21	25		

2

b) Express the energy content of the bread and the peanut as a simple whole number ratio. 1

c) Name the form of energy stored in food. 1

d) State the two forms of energy released or transferred during respiration of food. 2

Q6) The flow diagram shows the steps for the breakdown of glucose in muscle cells.

process A process B

glucose → substance X → lactic acid

a) Name process A. 1

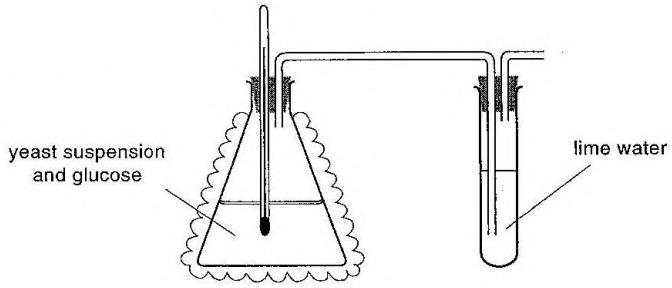
b) Name substance X. 1

c) Which letter(s) show where molecules of ATP are formed? 1

d) Under what conditions might muscle cells be caused to carry out anaerobic respiration? 1

e) Describe two effects that lactic acid can have on muscle cells. 2

Q7) The diagram shows an experiment set up to investigate anaerobic respiration in yeast.



a) State two precautions which would need to be taken to ensure that the yeast in the flask respired anaerobically. 2

b) Describe the appearance of the lime water after anaerobic respiration in yeast. 1

c) How many molecules of ATP are formed when one molecule of glucose is broken down during anaerobic respiration in yeast? 1

/20