PEARSON EDEXCEL IGCSE BIOLOGY · 4BI1

BIOLOGY



EXAM QUESTION PACK

SECTION 5: USE OF BIOLOGICAL RESOURCES (PACK 3)

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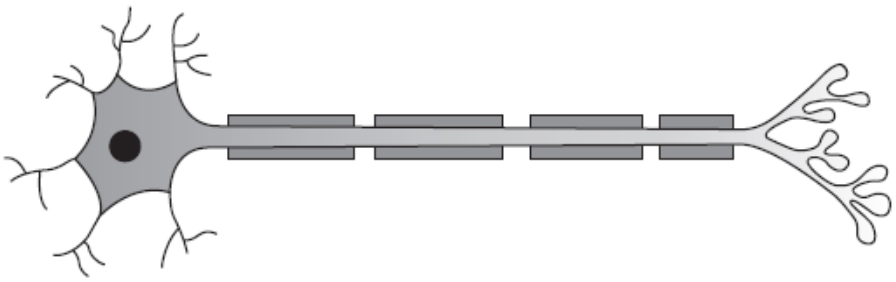
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Q1.

Electrical impulses pass along motor neurones to effectors.

(a) The diagram shows a motor neurone.



The neurone is stimulated by a neurotransmitter to pass an electrical impulse along its length.

(i) Draw a circle around the part of the neurone that is stimulated by the neurotransmitter.

(1)

(ii) The longest motor neurone in the human body passes electrical impulses from the base of the spinal cord to muscle in the big toe. This neurone can be up to 1.3 m in length.

An impulse passes along this neurone at a speed of 1.20×10^2 metres per second.

Calculate the time taken, in seconds, for an impulse to pass along this neurone.

(2)

time = ... s

(iii) All neurones need a supply of energy from respiration.

Name the organelle in this motor neurone that supplies energy.

(1)

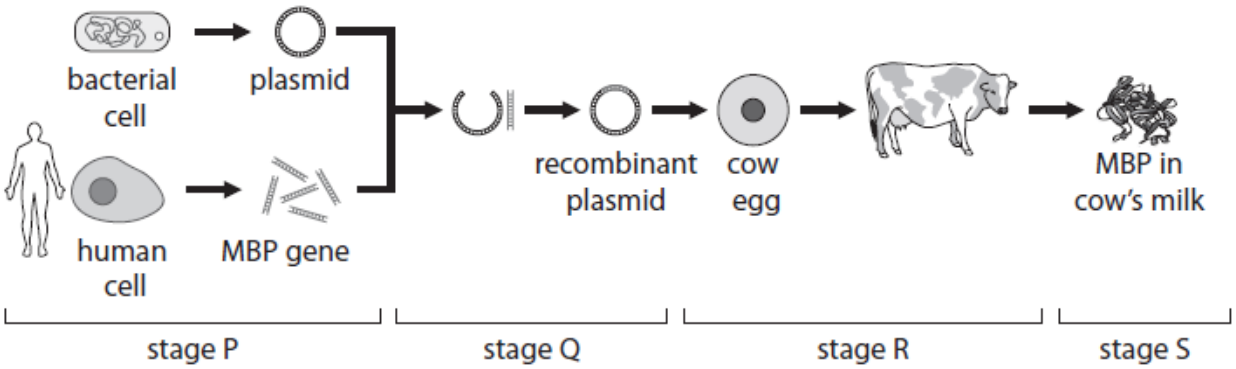
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(b) Multiple sclerosis is a disorder in which the insulating layer that surrounds a neurone is gradually destroyed. This prevents the passage of electrical impulses.

Scientists hope to treat multiple sclerosis using a protein called myelin basic protein (MBP).

Transgenic cows can produce large quantities of MBP in their milk.

The diagram shows four stages in the process of creating transgenic cows.



(i) Name the **two** structures in the bacterium that contain DNA.

(2)

1 .....

2 .....

(ii) Name the stage that involves the use of ligase.

(1)

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(iii) Name the stage that involves placing a transgenic embryo into a uterus.

(1)

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(Total for question = 8 marks)

Q2.

Biologists classify organisms into different groups. One group of organisms is fungi.

(a) Complete the passage about fungi by writing a suitable word or words in each blank space.

(4)

Fungi do not carry out photosynthesis. Their body is usually organised

into a mycelium made from thread-like structures called ..... .

Fungal cell walls are made of ..... .

Fungi feed by extracellular secretion of ..... onto food

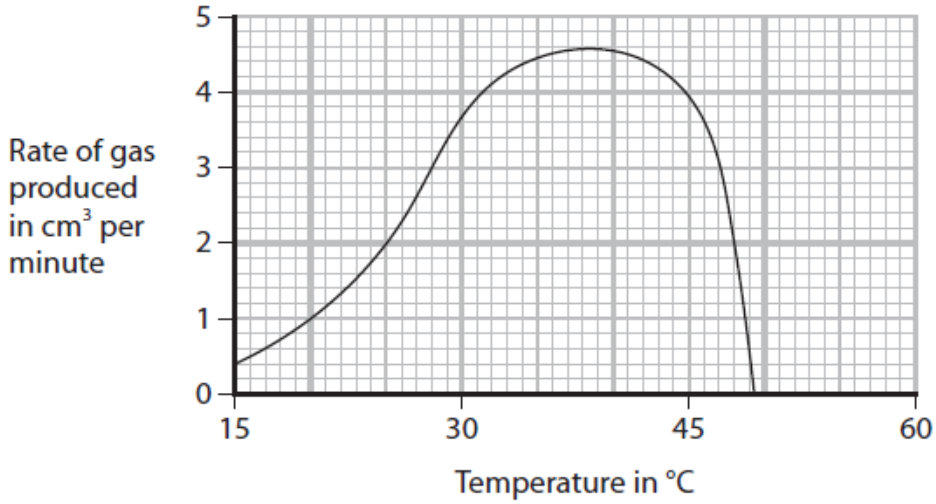
material and absorption of the organic products. This is known

as ..... nutrition.

(b) A student investigates the effect of temperature on the rate of anaerobic respiration in yeast.

The student measures the rate of gas produced in cm^3 per minute.

The graph shows their results.



(i) Name the gas produced by yeast during anaerobic respiration.

(1)

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(ii) Explain the effect that increasing temperature has on the rate of gas production by the yeast.

(3)

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(iii) Describe how the student could measure the rate of gas production in this experiment.

(2)

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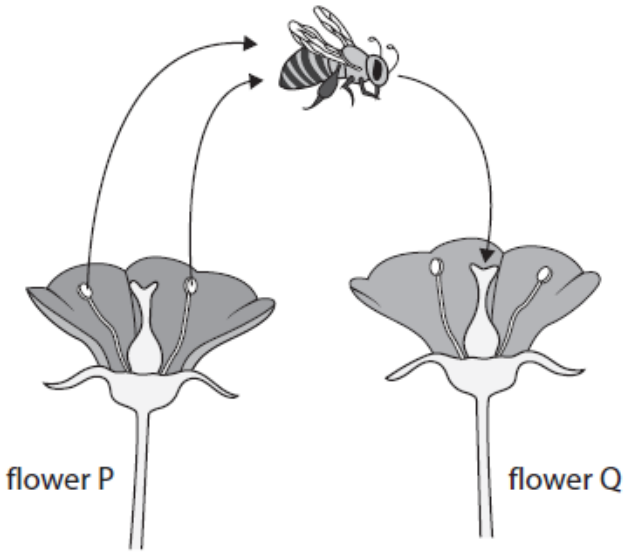
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(Total for question = 10 marks)

Q3.

The diagram shows an insect transferring pollen grains from flower P to flower Q.



(a) Which structure in flowers contains pollen grains?

(1)

☒ **A** anther

☒ **B** ovary

☒ **C** petal

☒ **D** sepal

(b) (i) Pollen grains are deposited on the stigma and grow tubes down the style.

Suggest how style tissue helps the tube to grow.

(2)

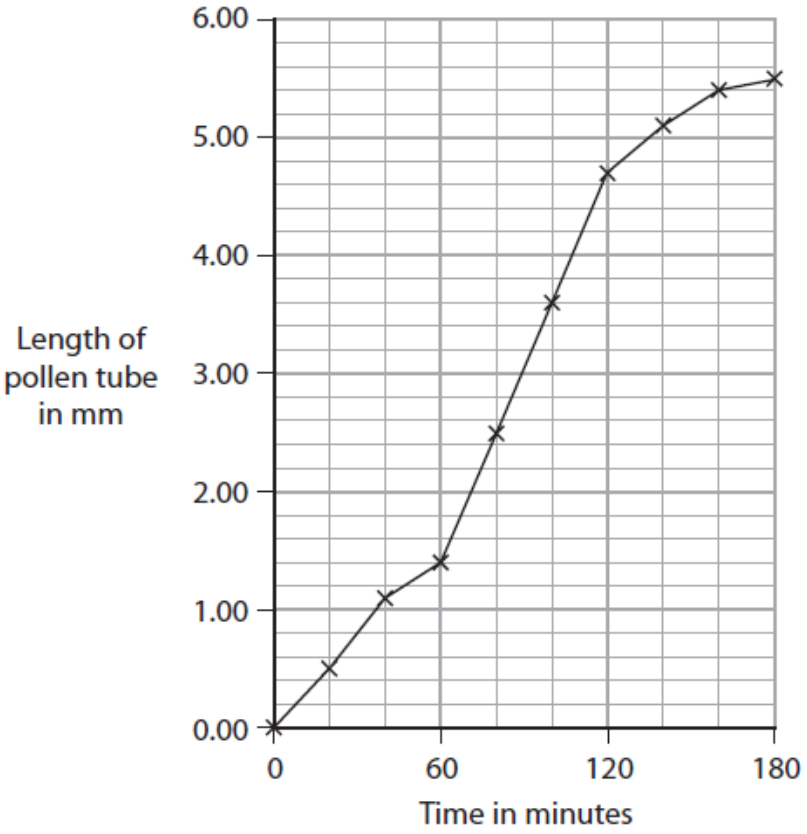
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(ii) The graph shows the change in the length of a pollen tube over a 180 minute period.



Calculate the fastest rate of pollen tube growth in mm per minute.

(3)

fastest rate of growth: ..... mm per minute

(c) A farmer grows apple trees.

The flowers on the apple trees must be pollinated by insects to produce an apple crop.

The farmer is concerned that the use of pesticides may affect the yield of apples.

Design an investigation to find out if pesticides reduce the yield of apples.

Include experimental details in your answer and write in full sentences.

(6)

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(Total for question = 12 marks)

Q4.

Enzymes are biological molecules that act as catalysts in metabolic reactions.

(a) (i) State what is meant by the term **catalyst**.

(1)

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(ii) State what is meant by the term **metabolic**.

(1)

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(b) A teacher investigates the effect of enzyme concentration on the rate of a reaction.

He uses the enzyme catalase, which is found in potato.

He changes the enzyme concentration by adding different numbers of potato discs.

Catalase breaks down hydrogen peroxide solution into water and oxygen.

This is his method.

- cut same-sized discs from a potato
- put 5 cm^3 of hydrogen peroxide solution into each of five test tubes
- add a different number of potato discs to the hydrogen peroxide
- measure the volume of oxygen gas produced in three minutes

The teacher repeats each test four times for each concentration.

He then calculates the mean rate of oxygen production for each concentration.

The table shows his results.

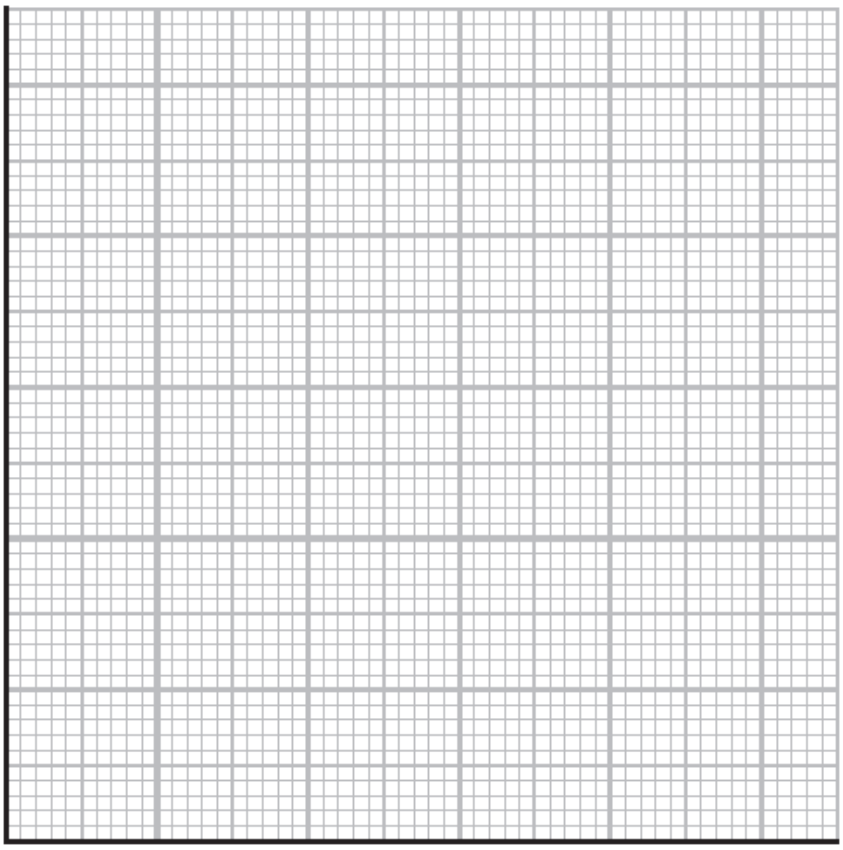
Enzyme concentration (number of potato discs)	Mean rate of oxygen production in cm^3 per minute
2	2.0
4	4.4
6	7.0
8	8.2
10	8.2

(i) Plot a line graph to show the effect of enzyme concentration on the mean rate of oxygen

production.

Use a ruler to join the points with straight lines.

(5)



(ii) Explain the effect of increasing enzyme concentration on the rate of oxygen production.

(3)

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(iii) Name a piece of apparatus suitable for measuring the volume of oxygen produced.

(1)

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(iv) Explain why it is important for the teacher to keep the volume and concentration of the hydrogen peroxide constant.

(2)

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(v) Name another variable the teacher should keep constant in his investigation.

(1)

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(Total for question = 14 marks)

Q5.

Selective breeding has been used to develop modern varieties of wheat.

(a) Describe how scientists could use selective breeding to increase wheat yield.

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(b) During a long-term study of selective breeding, scientists collected data for the mean yield of wheat in tonnes per hectare.

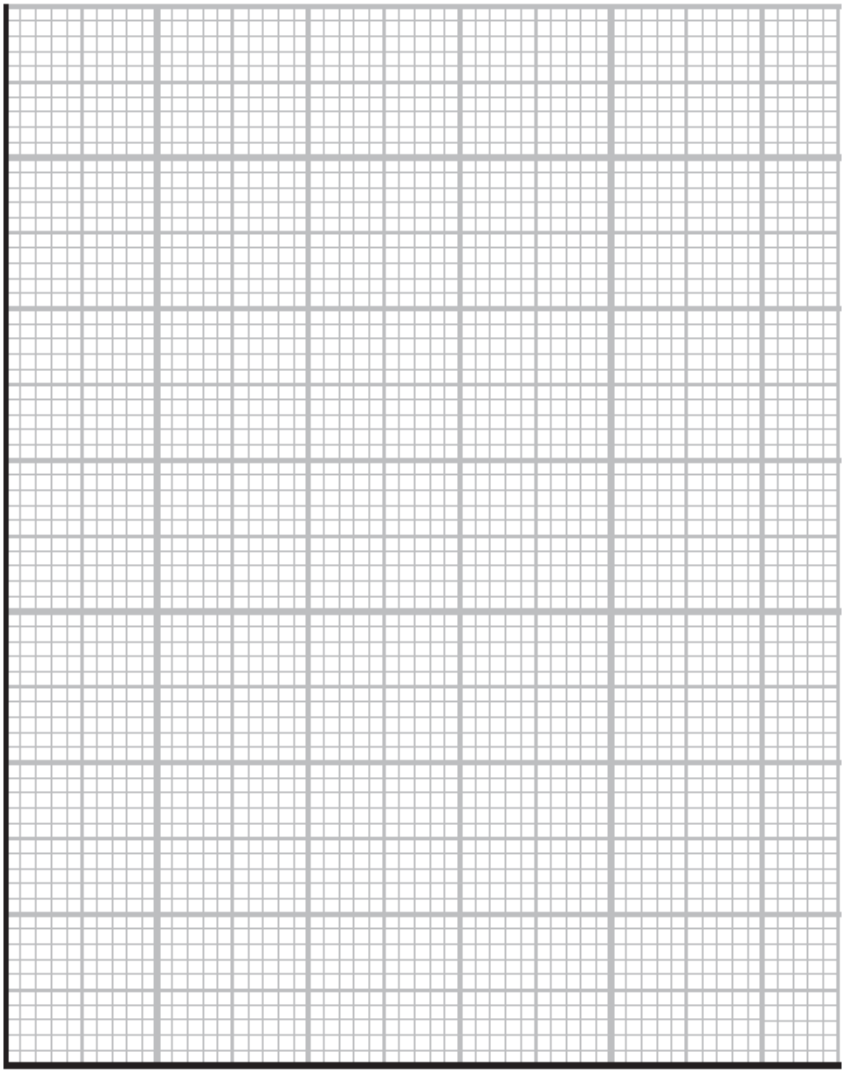
The table shows the scientists' data.

Year	Mean yield in tonnes per hectare
1840	2.6
1860	2.5
1880	2.4
1900	2.4
1920	2.5
1940	2.6
1960	2.8
1980	4.2
2000	5.3
2020	6.7

(i) Plot a line graph to show how the mean yield changes from 1840 to 2020.

Use a ruler to join the points with straight lines.

(5)



(ii) In 1960, a dwarf variety of wheat replaced the old variety.

Scientists compared the percentage change in yield for the two varieties.

The percentage change in yield per year from 1840 to 1960 was 0.06% per year.

Calculate the percentage change in yield per year from 1960 to 2020.

(3)

percentage change = ... %

(iii) Dwarf wheat has a shorter, thicker stem than the old variety.

Suggest why growing dwarf wheat is an advantage for farmers.

(3)

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(Total for question = 14 marks)

Q6.

Selective breeding has been used by farmers to improve the quality of their animals.

(a) (i) Describe how selective breeding could be used to improve the volume of milk produced by cows.

(3)

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(ii) In recent years farmers have used artificial insemination to fertilise their cows.

In this technique many samples of semen are collected from one bull.

These samples can be used to fertilise cows.

Suggest the advantages of using artificial insemination in selective breeding.

(3)

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(b) Farmers use a variety of methods to improve the growth of their crops.

One method is the use of a glasshouse.

Describe how the use of a glasshouse improves the growth of crops.

(4)

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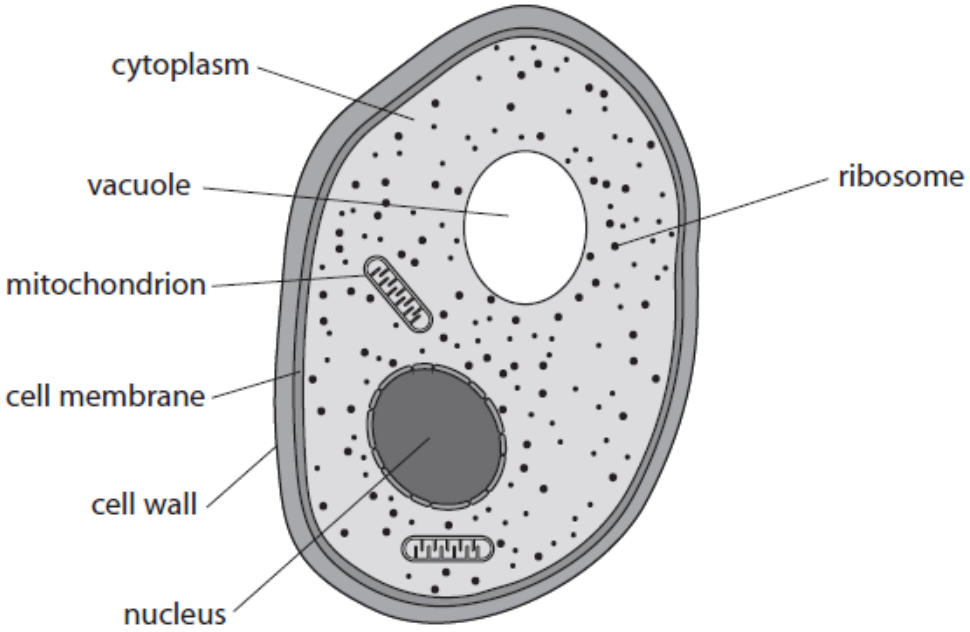
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(Total for question = 10 marks)

Q7.

The diagram shows a yeast cell.



(Source: Pearson Education Ltd)

(a) (i) In which of the labelled structures in the yeast cell does aerobic respiration occur?

(1)

☒ **A** mitochondrion

☒ **B** nucleus

☒ **C** ribosome

☒ **D** vacuole

(ii) What substance is the yeast cell wall made of?

(1)

☒ **A** cellulose

☒ **B** chitin

☒ **C** glycogen

☒ **D** starch

(iii) Which of these structures found in the yeast cell would also be present in a prokaryotic cell?

(1)

☒ **A** cell membrane

☒ **B** mitochondrion

☒ **C** nucleus

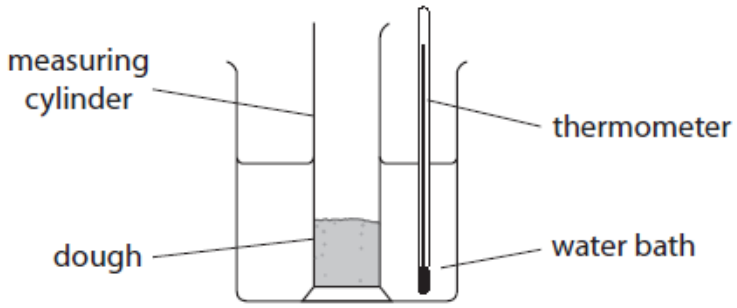
☒ **D** vacuole

(b) Yeast cells are often used when making bread.

A student uses this method to investigate the effect of temperature on the height that bread dough rises.

- place dough containing flour, sugar, water and yeast into a measuring cylinder
- measure the height of the dough
- place the measuring cylinder in a 25 °C water bath
- measure the height of the dough after two hours
- repeat the experiment at temperatures of 35 °C and 65 °C

The diagram shows the student's apparatus.



The table shows the student's results.

Temperature in °C	Height of dough in mm		Percentage (%) increase in height of dough
	at start	after two hours	
25	25	35	40
35	25	45	
65	25	27	8

(i) Calculate the percentage increase in the height of the dough after two hours at a temperature of 35 °C.

(2)

percentage increase = ... %

(ii) Explain why yeast causes the bread dough to increase in height.

(2)

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(iii) Explain why the dough rises to a different height at 25 °C compared with the height at 35 °C.

(2)

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(iv) Explain why the dough rises to a different height at 35 °C compared with the height at 65 °C.

(2)

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(Total for question = 11 marks)

Q8.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Enzymes are involved in many processes.

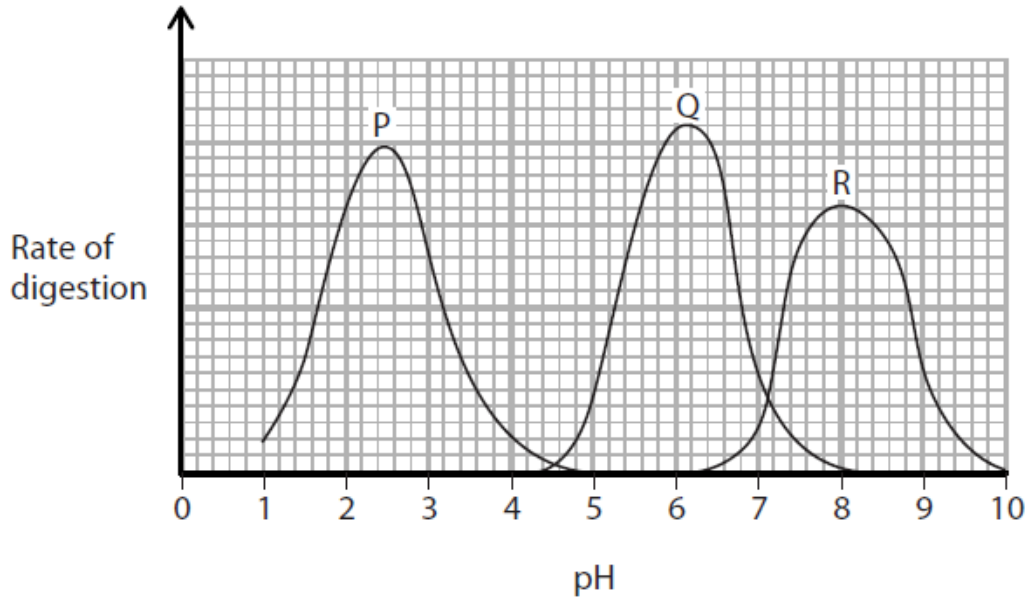
(a) The table gives some information about different enzymes.

Complete the table by giving the missing information.

(4)

Enzyme	Function	Name of process
	breakdown of protein into amino acids	
maltase		digestion
	to cut DNA	genetic modification

(b) The graph shows how pH affects the rate of digestion for reactions involving three enzymes found in the digestive system.



(i) One of these three enzymes is found in the mouth.

Which is the optimum pH for this enzyme shown on the graph?

(1)

☒ **A** 1.0

☒ **B** 2.5

☒ **C** 6.2

☒ **D** 10.0

(ii) Explain the difference in the rate of digestion by enzyme P at pH 1.0 and pH 2.5

(2)

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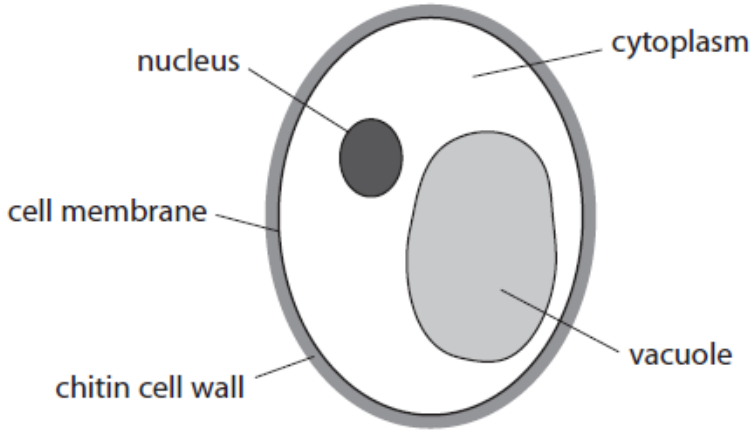
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(Total for question = 7 marks)

Q9.

Yeast is used to make bread.

The diagram shows a yeast cell.



(a) Give two differences between the structure of a yeast cell and the structure of a plant leaf cell.

(2)

1 .....

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2 .....

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(b) A student uses this method to investigate the effect of oxygen on the growth of yeast.

- put 100 cm^3 of glucose solution into each of two beakers
- add 0.1 g of yeast to each beaker
- bubble sterile oxygen into one beaker and sterile nitrogen into the other beaker
- after 24 hours, take three samples from each beaker
- observe these samples using a microscope
- count the number of yeast cells in one field of view for each sample

The table shows the student's results.

Sample	Number of yeast cells	
	glucose solution with oxygen	glucose solution with nitrogen
1	20	17
2	25	14
3	22	11

(i) Explain the student's results.

(2)

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(ii) The oxygen and nitrogen are sterilised to remove micro-organisms.

Suggest why micro-organisms need to be removed from these gases.

(2)

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(iii) The student controls these variables in his investigation.

- the volume of glucose solution
- the mass of yeast
- the time of sampling

Give three other variables he needs to control.

(3)

1 .....

2 .....

3 .....

(iv) Comment on the reliability of the student's data.

(1)

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(Total for question = 10 marks)

Q10.

Faeces contain undigested food.

(a) The table shows the percentage of different substances in a dry sample of faeces.

Substance	Percentage in dry sample of faeces (%)
carbohydrate	30
fat	20
protein	3

(i) Name a carbohydrate that could be found in faeces.

(1)

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(ii) Describe how you would test the sample of faeces for fat.

(2)

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(iii) State the five chemical elements that could be present in protein.

(1)

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(b) Grass is eaten by many animals.

Diagram 1 shows a grass cell.

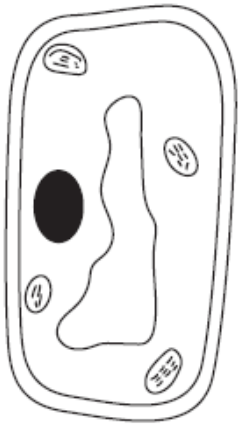


Diagram 1

Diagram 2 shows this grass cell in the faeces of an animal.

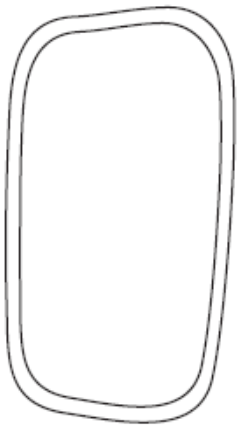


Diagram 2

Explain the difference in the appearance of these grass cells.

(3)

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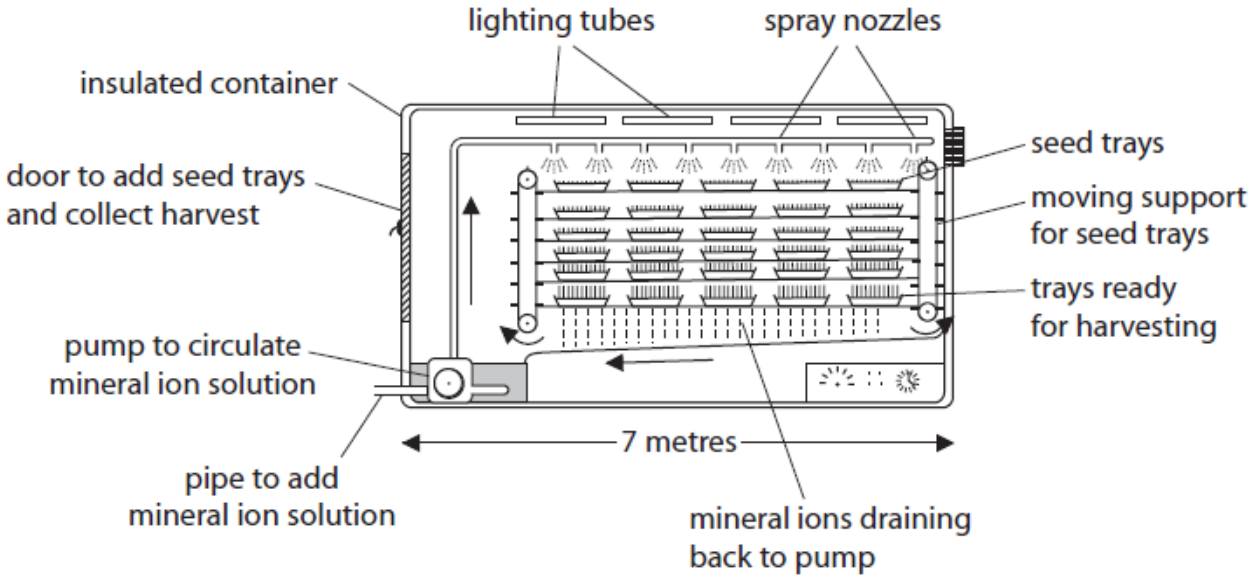
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(c) The diagram shows a section through a building that has been designed to grow grass indoors.



This is the method used to grow grass in the building.

- wash and sterilise empty trays
- fill these trays with soil containing grass seeds
- put these trays in the building
- spray mineral ion solution on to the soil in the trays
- provide light and keep the temperature at 20 °C
- collect the grass after a week and feed to animals

1000 kg of grass can be grown every day using this method.

A farmer would need to use several fields to grow this mass of grass every day outdoors.

The farmer decides to grow grass in the building to feed his animals, rather than letting them eat grass from his fields.

Discuss this decision.

(6)

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(Total for question = 13 marks)

Q11.

A balanced diet contains the correct proportion of vitamins.

(a) The table lists the functions of some vitamins.

Complete the table by stating the correct vitamins.

The first one has been done for you.

(2)

Function of vitamin	Vitamin
prevents scurvy	C
improves vision	
helps bone growth	

(b) Yeast is used to make bread.

A student investigates the effect of vitamin C on the growth of yeast cells.

This is his method.

- put 0.50 g of yeast into a flask containing 200 cm^3 of glucose solution and add 0.10 g of vitamin C
- put 0.50 g of yeast into another flask containing 200 cm^3 of glucose solution without vitamin C
- measure the dry mass of yeast in each flask after 30 hours

The table shows the student's results.

Time in hours	Dry mass of yeast in g	
	with vitamin C	without vitamin C
0	0.50	0.50
30	7.10	6.50

(i) The student calculates that the mean rate of yeast growth with vitamin C is 0.22 g per hour.

Calculate the mean rate of yeast growth without vitamin C.

(2)

mean rate = ... g per hour

(ii) Suggest how to find the dry mass of yeast in each flask.

(2)

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(iii) State the dependent variable in this investigation.

(1)

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(iv) The method gives some variables that the student controlled.

Justify two other variables the student should control.

(4)

1 .....

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2 .....

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(Total for question = 11 marks)

Q12.

Weeds are plants that compete with crop plants.

A scientist investigates the use of two different ways of reducing the population of weeds.

This is her method.

- use chemical control in one field by spraying herbicides, a type of pesticide, that kill the weeds
- use biological control in another field by releasing insects that eat the weeds
- measure the mean (average) number of weeds in each field once a month from February to August

The table shows the scientist's results.

Month	Mean number of weeds per m^2	
	chemical control	biological control
February	2	12
March	16	8
April	3	4
May	20	3
June	3	4
July	18	3
August	2	3

(a) Describe a method to measure the mean number of weeds per m^2 in each field.

(3)

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(b) The scientist concludes that biological control is a better way of controlling weeds than chemical control.

Discuss this conclusion.

Use data from the table and your own knowledge to support your answer.

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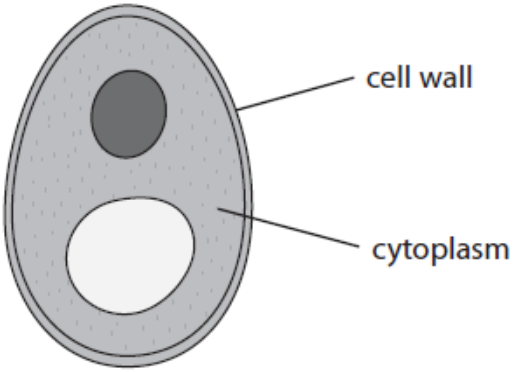
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(Total for question = 8 marks)

Q13.

The diagram shows a yeast cell.



(a) (i) Which row of the table is correct for this yeast cell?

(1)

		Substance in cell wall	Substance stored in cytoplasm
☒	**A**	cellulose	glycogen
☒	**B**	cellulose	starch
☒	**C**	chitin	glycogen
☒	**D**	chitin	starch

(ii) Which type of organism is a yeast cell?

(1)

☒ **A** a bacterium

☒ **B** a fungus

☒ **C** a plant

☒ **D** a protoctist

(b) Biofuel is made from ethanol.

Scientists use genetically modified (GM) yeast to produce biofuel.

The GM yeast contains an enzyme that digests plant cell walls to produce glucose.

The yeast uses the glucose in respiration to produce ethanol.

(i) Which of these equations shows the respiration in the yeast?

(1)

☒ **A** glucose → ethanol

☒ **B** glucose → ethanol + carbon dioxide

☒ **C** glucose + oxygen → ethanol

☒ **D** glucose + oxygen → ethanol + carbon dioxide

(ii) Name an enzyme used by scientists to genetically modify the yeast.

(1)

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(iii) The GM yeast is a recombinant strain.

State what is meant by the term **recombinant**.

(1)

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(iv) Suggest why biofuel produced using glucose from plants could reduce global warming.

(2)

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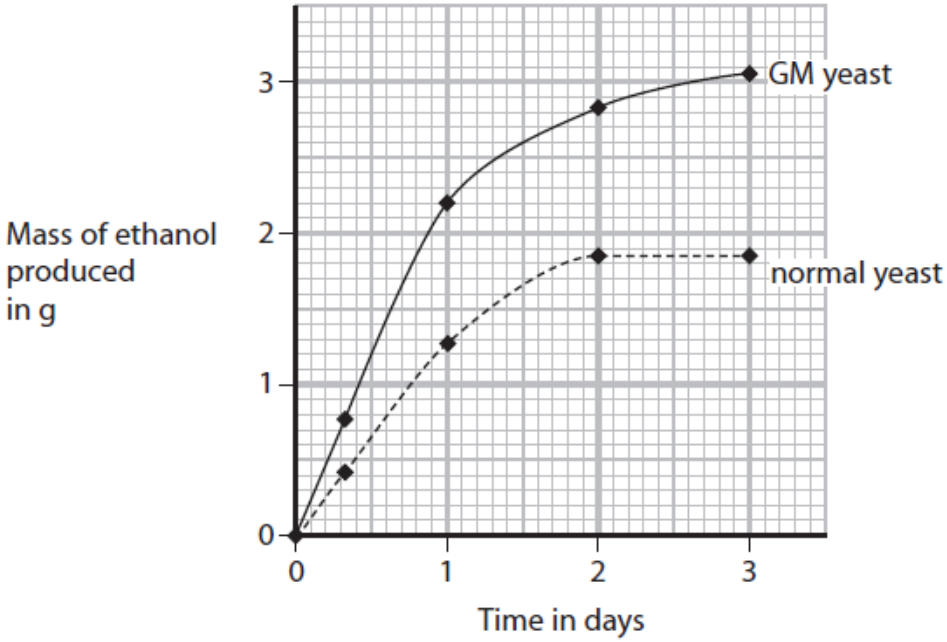
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(c) The graph shows the mass of ethanol produced by GM yeast and by normal yeast over a period of 3 days.



(i) Calculate the percentage increase in the mass of ethanol produced by GM yeast compared to normal yeast after
1 day.

(2)

percentage increase = ... %

(ii) Give two reasons why the rate of ethanol production decreases after 1 day.

(2)

1 .....

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2 .....

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(Total for question = 11 marks)

Q14.

Yeast cells can be genetically modified to produce the proteins found on the outside of viruses.

(a) (i) Yeast is a single-celled organism.

A yeast cell has a nucleus, and the cell wall is made of chitin.

Which group of organisms does yeast belong to?

(1)

☒ **A** animals

☒ **B** fungi

☒ **C** plants

☒ **D** protoctists

(ii) Give a reason why viruses are not considered to be living organisms.

(1)

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(b) A species of yeast is genetically modified to produce a protein found on the outside of a hepatitis B virus.

This protein is used to make vaccines to prevent people being infected with hepatitis B.

The gene for this protein is inserted into a plasmid.

This plasmid is then used to modify the yeast cells.

Give the roles of two named enzymes used to produce plasmids containing the gene for the hepatitis B protein.

(2)

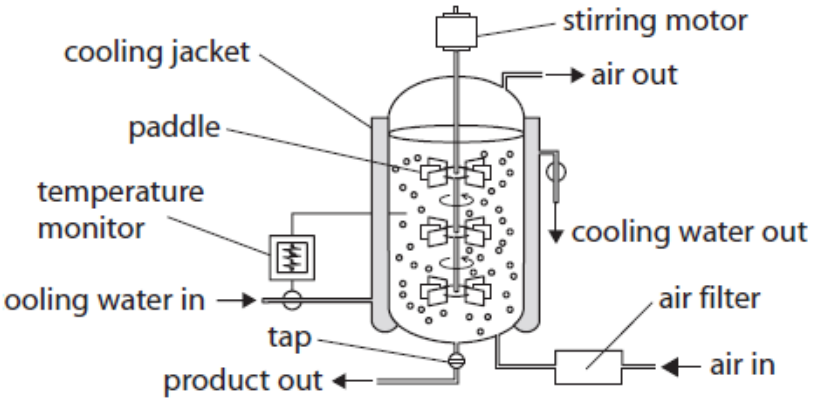
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(c) The diagram shows an industrial fermenter that can be used to grow large quantities of genetically modified yeast.



(i) Explain the function of the temperature monitor and cooling jacket.

(3)

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(ii) Explain why air is needed in the fermenter.

(2)

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(iii) Explain why the air is filtered before going into the fermenter.

(2)

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(Total for question = 11 marks)

Q15.

Farmers often want to increase the yield of their crops.

Design an investigation to find out if crop yield is increased by changing the carbon dioxide concentration in a glasshouse.

Include experimental details in your answer and write in full sentences.

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(Total for question = 6 marks)

Q16.

Scientists carry out an experiment to see if reducing the availability of oxygen affects the production of yoghurt.

They use increasing acidity as a measure of yoghurt production.

They record the acidity of two cultures, one with a reduced oxygen level and one with a normal oxygen level, over 210 minutes.

The table shows their results.

Time in minutes	Acidity (%)	
	reduced oxygen level	normal oxygen level
0	0.20	0.20
30	0.22	0.22
60	0.25	0.24
90	0.40	0.25
120	0.50	0.31
150	0.62	0.41
180	0.70	0.51
210	0.70	0.70

(a) Explain why increasing acidity can be used as a measure of yoghurt production.

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(b) Give one abiotic variable that the scientists should control in their experiment.

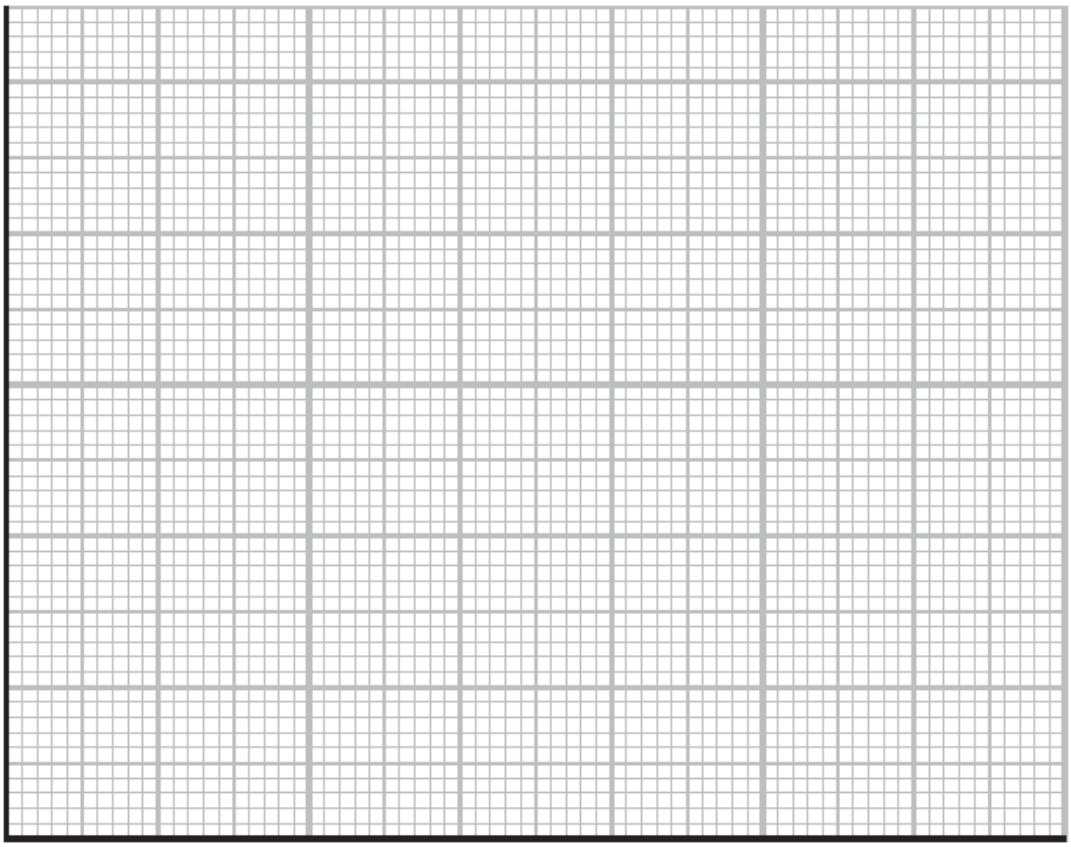
(1)

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(c) (i) Plot a line graph to show how the percentage acidity changes over the period of 210 minutes for the reduced oxygen level and for the normal oxygen level.

Use a ruler to join the points with straight lines.

(5)



(ii) Explain why the changes in percentage acidity are different in the reduced oxygen level and in the normal oxygen level cultures.

(2)

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(Total for question = 10 marks)