PEARSON EDEXCEL IGCSE BIOLOGY · 4BI1

BIOLOGY



EXAM QUESTION PACK

SECTION 1: THE NATURE AND VARIETY OF LIVING ORGANISMS (PACK 2)

SCORE	PERCENTAGE
/186	%

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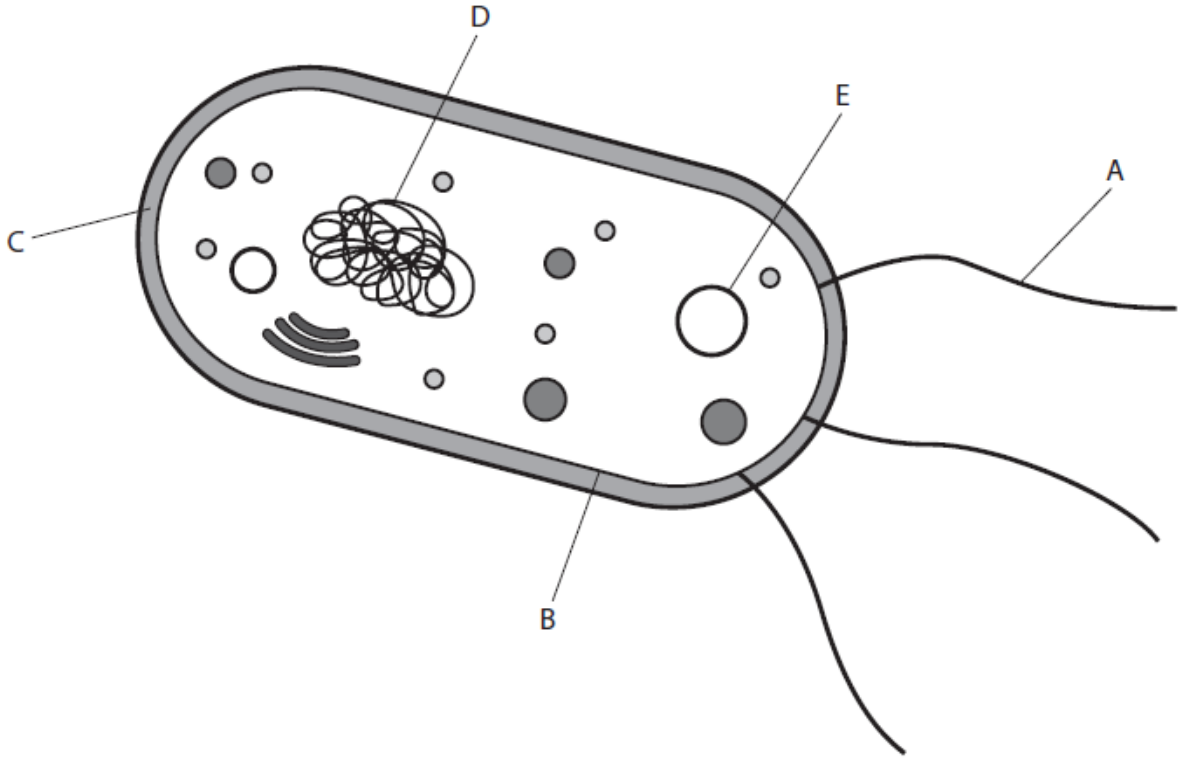
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Q1.

Answer the questions 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 ☒.

The diagram shows a bacterium with structures A, B, C, D and E labelled.



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(a) (i) Which structure contains the genetic material used by the bacterium in reproduction?

(1)

☒ **A**

☒ **B**

☒ **C**

☒ **D**

(ii) Which structure controls the substances entering and leaving the bacterium?

(1)

☒ **A**

☒ **B**

☒ **D**

☒ **E**

(b) Give three differences between the structure of this bacterium and the structure of a plant

cell.

(3)

1 .....

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2 .....

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3 .....

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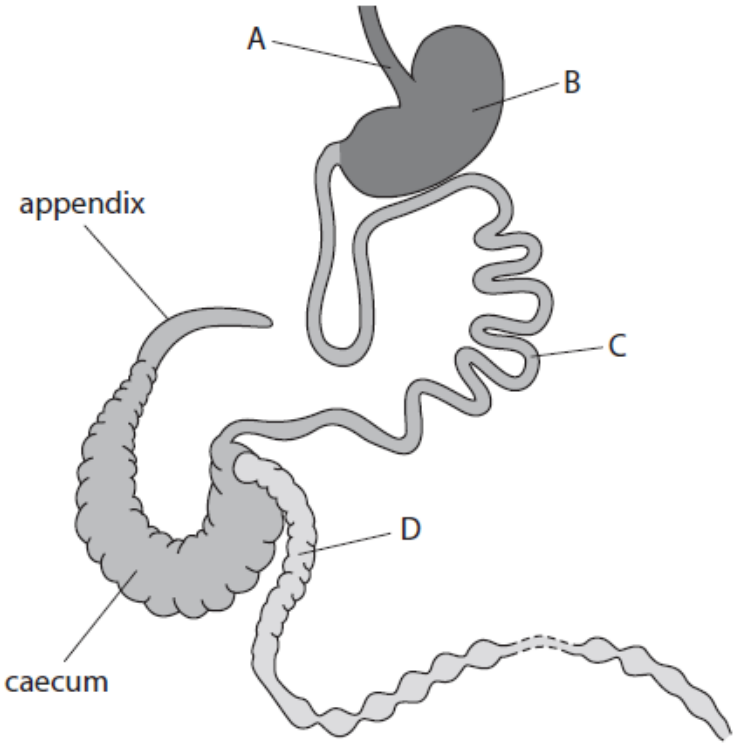
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(Total for question = 5 marks)

Q2.

The diagram shows part of the gut of a rabbit.

The rabbit is a primary consumer and eats mainly grass and other vegetable material.



(a) Name the parts labelled A, B, C and D.

(4)

A .....

B .....

C .....

D .....

(b) The gut of a rabbit has a large caecum and appendix. These contain bacteria that are able to produce the enzyme cellulase.

Explain how these bacteria help the rabbits with their diet of plant material.

(3)

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(c) The human gut has a caecum and appendix but they are much smaller than those in the rabbit.

(i) Suggest why the human gut only has a small caecum and appendix.

(1)

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(ii) In humans the appendix also acts as a store of useful bacteria. Scientists have discovered that patients who have had their appendix removed are more likely to develop infections of the colon.

Explain how having no appendix may increase the likelihood of bacterial infections of the colon.

(2)

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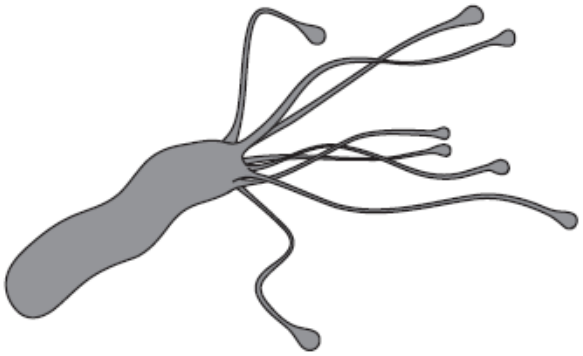
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(Total for question = 10 marks)

Q3.

The bacterium *H. pylori* causes stomach ulcers.

(a) The diagram shows this bacterium.



(i) Which of these is found in this bacterium?

(1)

☒ **A** cellulose

☒ **B** chitin

☒ **C** cytoplasm

☒ **D** nucleus

(ii) The bacterium has evolved to release an enzyme called urease.

The action of the bacterium neutralises the acid in the stomach.

What is the pH changed to?

(1)

☒ **A** 1

☒ **B** 2

☒ **C** 7

☒ **D** 12

(iii) Use the theory of evolution by natural selection to explain how *H. pylori* bacteria could have evolved to produce urease.

(4)

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(b) Probiotics are live microorganisms that can have health benefits when consumed.

Scientists investigate the ability of probiotics and cranberry juice to reduce the growth of *H.*

pylori.

The scientists give various treatments to a group of people who have *H. pylori*.

The treatments are given daily for three weeks.

The scientists measure the mean percentage reduction of *H. pylori* for each treatment.

The table shows the scientists' results.

Treatment	Mean percentage (%) reduction in *H. pylori*
probiotics	14.9
cranberry juice	16.9
probiotics and cranberry juice	22.9
control	1.5

Give two conclusions from these results.

(2)

1 .....

2 .....

(Total for question = 8 marks)

Q4.

All living organisms have certain characteristics.

(a) Describe what is meant by the following characteristics:

(i) respiration

(2)

.....

.....

.....

.....

(ii) control of their internal conditions

(2)

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.....

.....

(b) Organisms are organised into different levels.

What is the correct order of the levels?

(1)

☒ **A** organ, system, tissue, cell, organelle

☒ **B** organ, tissue, cell, system, organelle

☒ **C** organelle, cell, tissue, organ, system

☒ **D** system, cell, organelle, organ, tissue

(c) Yeast is an example of which group of organism?

(1)

☒ **A** animals

☒ **B** bacteria

☒ **C** fungi

☒ **D** protoctists

(Total for question = 6 marks)

Q5.

All living organisms have certain characteristics.

(a) Describe what is meant by the following characteristics:

(i) respiration

(2)

.....

.....

.....

.....

(ii) control of their internal conditions

(2)

.....

.....

.....

.....

(b) Organisms are organised into different levels.

What is the correct order of the levels?

(1)

☒ **A** organ, system, tissue, cell, organelle

☒ **B** organ, tissue, cell, system, organelle

☒ **C** organelle, cell, tissue, organ, system

☒ **D** system, cell, organelle, organ, tissue

(c) Yeast is an example of which group of organism?

(1)

☒ **A** animals

☒ **B** bacteria

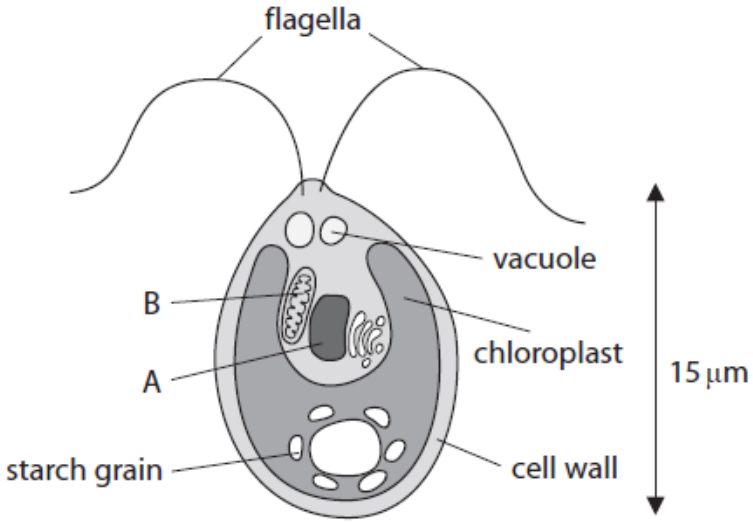
☒ **C** fungi

☒ **D** protoctists

(Total for question = 6 marks)

Q6.

The diagram shows *Chlamydomonas*, a single-celled protoctist that is found in water.



(a) Name the structures labelled A and B.

(2)

A .....

B .....

(b) (i) *Chlamydomonas* has some structures that are normally found in plant cells, but not found in animal cells.

Name two of these structures.

(2)

1 .....

2 .....

(ii) State why *Chlamydomonas* is not classified as a plant.

(1)

.....

.....

(c) Explain how *Chlamydomonas* obtains energy.

(2)

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(d) *Chlamydomonas* has flagella.

Suggest a function of these flagella.

(1)

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(e) The magnification of the cell in the diagram is calculated using this formula.

$$\text{magnification} = \frac{\text{length of cell in diagram}}{\text{actual length of cell}}$$

The actual length of the cell is 15 µm.

Calculate the magnification of the diagram.

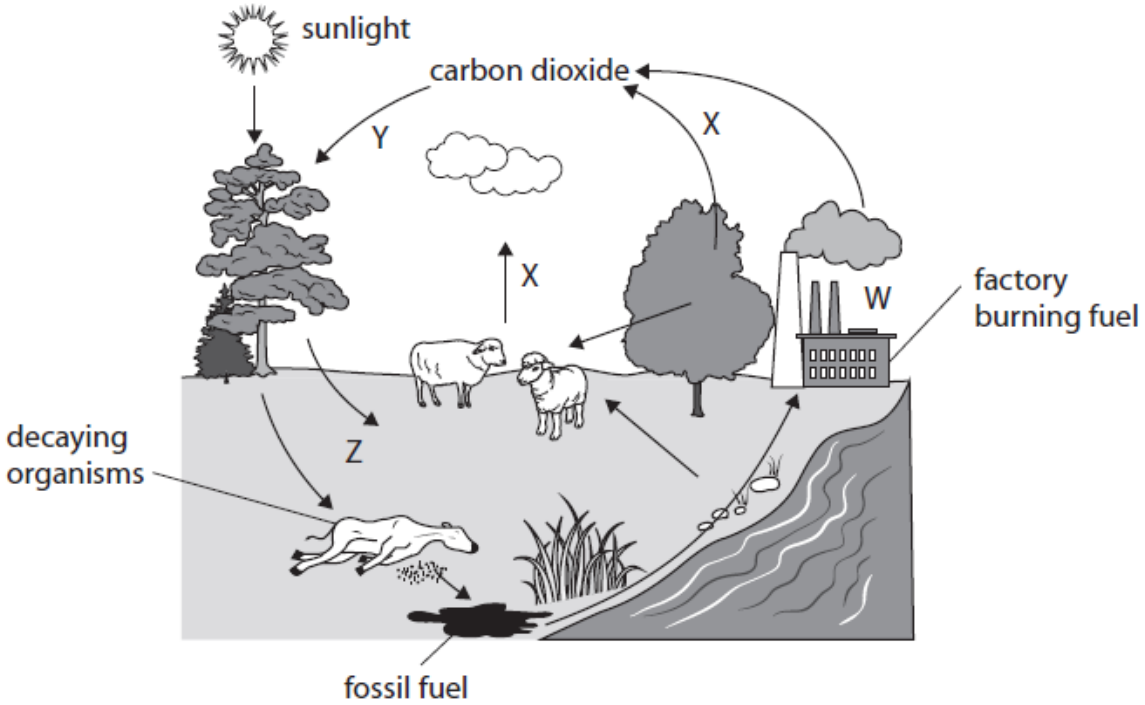
(2)

magnification = ...

(Total for question = 10 marks)

Q7.

The diagram shows a cycle found in ecosystems.



(a) Give the name of the cycle.

(1)

.....

(b) (i) Which process is represented by the letter W?

(1)

☒ **A** combustion

☒ **B** decomposition

☒ **C** feeding

☒ **D** respiration

(ii) Which process is represented by the letter X?

(1)

☒ **A** combustion

☒ **B** decomposition

☒ **C** feeding

☒ **D** respiration

(c) Name a group of organisms that is responsible for decomposition.

(1)

.....

(d) Carbon dioxide is released into the atmosphere by the decomposition of organic material.

The rate of this decomposition depends on a number of factors.

Design an investigation to find out if changing the pH of organic material affects the rate of decomposition.

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

(6)

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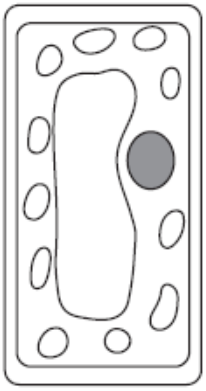
(Total for question = 10 marks)

Q8.

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

Plant cells contain organelles.

The diagram shows a plant cell containing some organelles.



(a) (i) What is the total number of organelles shown in the diagram that absorb light?

(1)

☒ **A** 1

☒ **B** 6

☒ **C** 11

☒ **D** 12

(ii) Name an organelle **not** shown in the diagram that makes ATP.

(1)

.....

(b) The magnification of the cell is calculated using this formula.

$$\text{magnification} = \frac{\text{width of cell in diagram}}{\text{actual width of cell}}$$

The actual width of the cell is 40 µm.

The magnification of the plant cell is

(1)

☒ **A** ×0.06

☒ **B** ×0.6

☒ **C** ×6

☒ **D** ×600

(c) (i) Name an organelle found in a plant cell but not found in an animal cell.

(1)

.....

(ii) The location of the genetic material in a bacterium is different from the location of the genetic material in a plant cell.

Give a location in a bacterium where genetic material is found.

(1)

.....

(Total for question = 5 marks)

Q9.

Organisms can be classified into groups based on their features.

(a) State three differences between eukaryotic and prokaryotic organisms.

(3)

1 .....

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2 .....

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3 .....

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(b) Give an example of a disease caused by a protoctist.

(2)

name of protoctist

.....

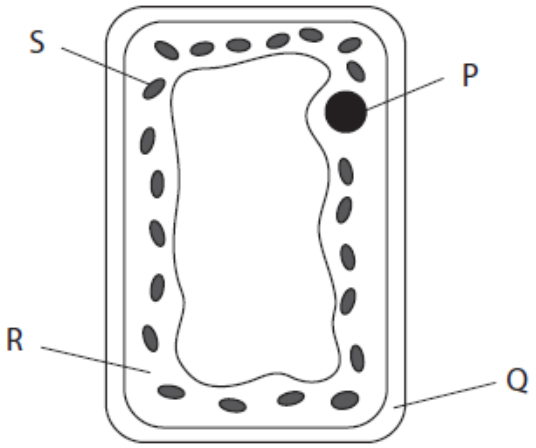
name of disease

.....

(Total for question = 5 marks)

Q10.

(a) The diagram shows a plant cell.



(i) Which part of this cell contains chlorophyll?

(1)

☒ **A** P

☒ **B** Q

☒ **C** R

☒ **D** S

(ii) Which of these is found in chlorophyll?

(1)

☒ **A** calcium

☒ **B** iron

☒ **C** magnesium

☒ **D** water

(iii) Describe the role of chlorophyll.

(2)

.....

.....

.....

.....

(b) Which of these is an example of positive phototropism?

(1)

☒ **A** a plant root growing away from light

☒ **B** a plant root growing downwards due to gravity

☒ **C** a plant stem growing towards light

☒ **D** a plant stem growing upwards due to gravity

(c) The table lists the roles of some substances found in living organisms.

Complete the table by naming each substance.

The first one has been done for you.

(3)

Role of substance	Name of substance
positive phototropism	auxin
digests fat	
diffuses across a synapse	
prevents scurvy	

(Total for question = 8 marks)

Q11.

Bacteria are genetically modified to make human proteins.

(a) Which part of a bacterium is used in genetic modification?

(1)

☒ **A** cell wall

☒ **B** nucleoid

☒ **C** plasmid

☒ **D** RNA

(b) The passage describes the use of an industrial fermenter to grow genetically modified bacteria.

Complete the passage by writing a suitable word in each blank space.

(6)

The hormone called ..... is needed to control the blood glucose levels in humans.

Bacteria have been genetically modified to produce this hormone.

The fermenter is cleaned with ..... before adding a nutrient broth that contains the genetically modified bacteria.

This cleaning provides aseptic conditions that prevent ..... from other bacteria.

Paddles are used to ..... the contents.

A gas called ..... is bubbled into the fermenter.

The ..... is controlled by using a cooling jacket.

(Total for question = 7 marks)

Q12.

Bread contains starch.

(a) Describe how you would test a piece of bread to show it contains starch.

(2)

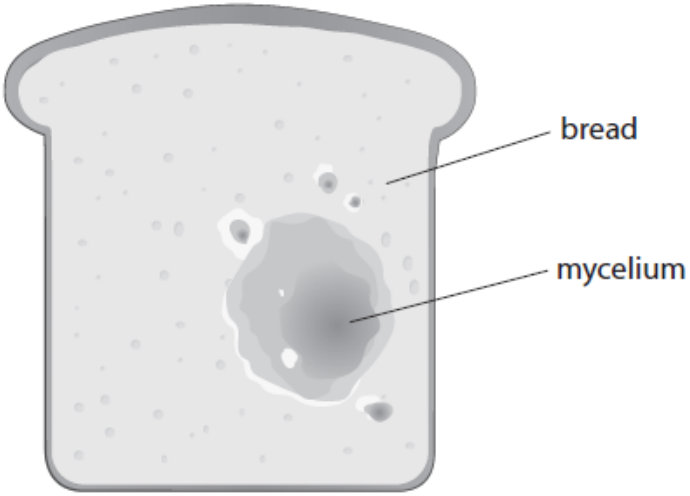
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(b) The diagram shows the mycelium of an organism growing on a piece of bread.



(i) Which type of organism is shown growing on the bread?

(1)

☒ **A** bacterium

☒ **B** fungus

☒ **C** protoctist

☒ **D** virus

(ii) Which enzyme is released by the organism to digest starch?

(1)

☒ **A** amylase

☒ **B** ligase

☒ **C** lipase

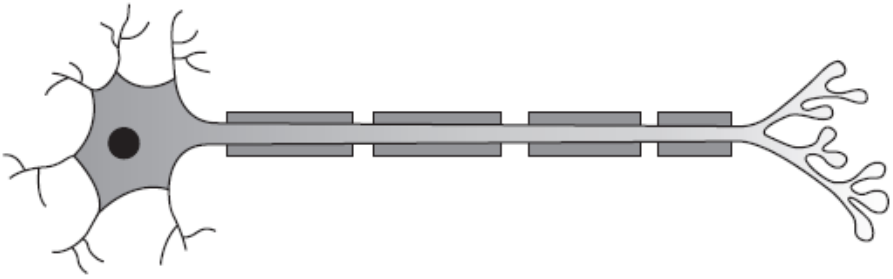
☒ **D** protease

(Total for question = 4 marks)

Q13.

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)

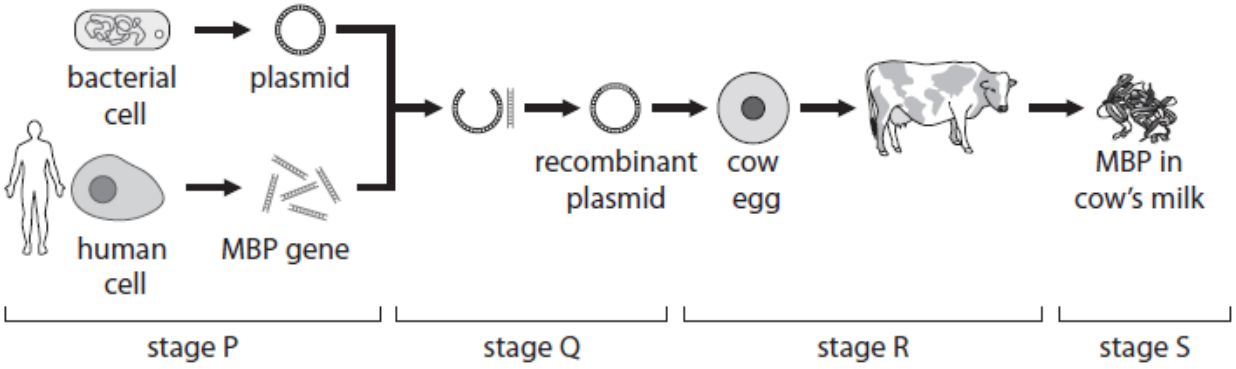
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(b) Multiple sclerosis is a disorder in which the insulating layer that surrounds a neurone is gradually destroyed. This prevents the passage of electrical impulses.

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)

.....

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

(1)

.....

(Total for question = 8 marks)

Q14.

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

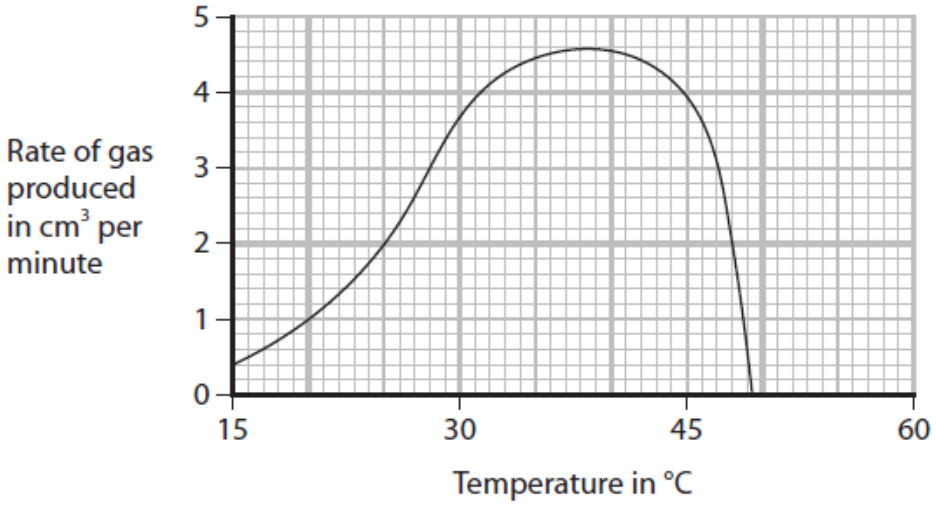
material and absorption of the organic products. This is known

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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(Total for question = 10 marks)

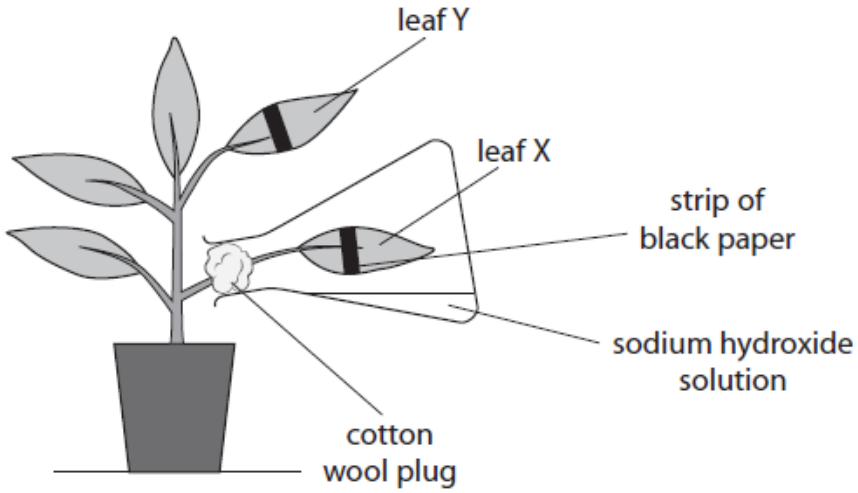
Q15.

A teacher does an investigation to show that plants require carbon dioxide and light for photosynthesis.

This is the teacher's method.

- place a potted plant in the dark for 24 hours
- place a strip of black paper over two of the plant's leaves
- pour some sodium hydroxide solution into a flask
- insert one of the leaves into the flask
- seal the flask with a cotton wool plug
- place the plant in bright light for 12 hours
- remove the two leaves and safely test them for starch

This diagram shows the teacher's apparatus.



(a) (i) Explain why the potted plant is placed in the dark for 24 hours.

(2)

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(ii) Explain one role of leaf Y in the investigation.

(2)

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(iii) Describe how to test the leaves for starch safely.

(4)

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(b) Explain how the results of this investigation would show that light is required for photosynthesis.

(3)

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(c) Plants convert the glucose they produce into starch.

Explain why plants store carbohydrate as starch rather than as glucose.

(2)

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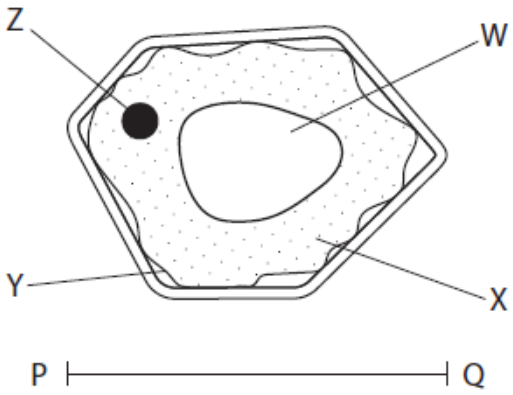
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(Total for question = 13 marks)

Q16.

The diagram shows a root cell from a plant with structures labelled W, X, Y and Z.



(a) (i) Which structure is the nucleus?

(1)

☒ **A** W

☒ **B** X

☒ **C** Y

☒ **D** Z

(ii) Which structure is **not** found in human white blood cells?

(1)

☒ **A** W

☒ **B** X

☒ **C** Y

☒ **D** Z

(iii) Which molecule is the storage carbohydrate in the root cell?

(1)

☒ **A** glucose

☒ **B** glycerol

☒ **C** glycogen

☒ **D** starch

(b) The actual width of the cell from P to Q is 125 µm.

Determine the magnification of the diagram.

[1 mm = 1000 µm]

(3)

magnification = ...

(Total for question = 6 marks)

Q17.

Sickle cell anaemia is a condition in which some of the person's red blood cells develop abnormally.

The diagram shows red blood cells from a healthy person and red blood cells from a person with sickle cell anaemia.



cells from a healthy person



cells from a person with sickle cell anaemia

(Source: © solar22/Shutterstock)

(a) A person with sickle cell anaemia often suffers pain as some of their blood vessels become blocked by the sickle cells.

(i) Suggest why the person's blood vessels may become blocked.

(1)

.....

.....

(ii) People with sickle cell anaemia have symptoms of tiredness and joint pain that get worse if they are exposed to cold temperatures and high altitudes.

Suggest why these symptoms get worse.

(3)

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(b) Sickle cell anaemia is caused by a single recessive allele.

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

(1)

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(ii) A man and a woman who are both heterozygous for the sickle cell allele have a child.

Calculate the probability that the child will be female and **not** have sickle cell anaemia.

(2)

probability = ...

(c) Sickle cell anaemia is more common in countries where malaria is found. This is because having an allele for sickle cell anaemia can reduce the likelihood of developing malaria.

Which type of organism causes malaria?

(1)

☒ **A** bacterium

☒ **B** fungus

☒ **C** plant

☒ **D** protoctist

(d) What is the name of the pigment found in red blood cells?

(1)

☒ **A** chlorophyll

☒ **B** haemoglobin

☒ **C** iron

☒ **D** magnesium

(e) Give two differences in structure between red blood cells and white blood cells.

(2)

1 .....

.....

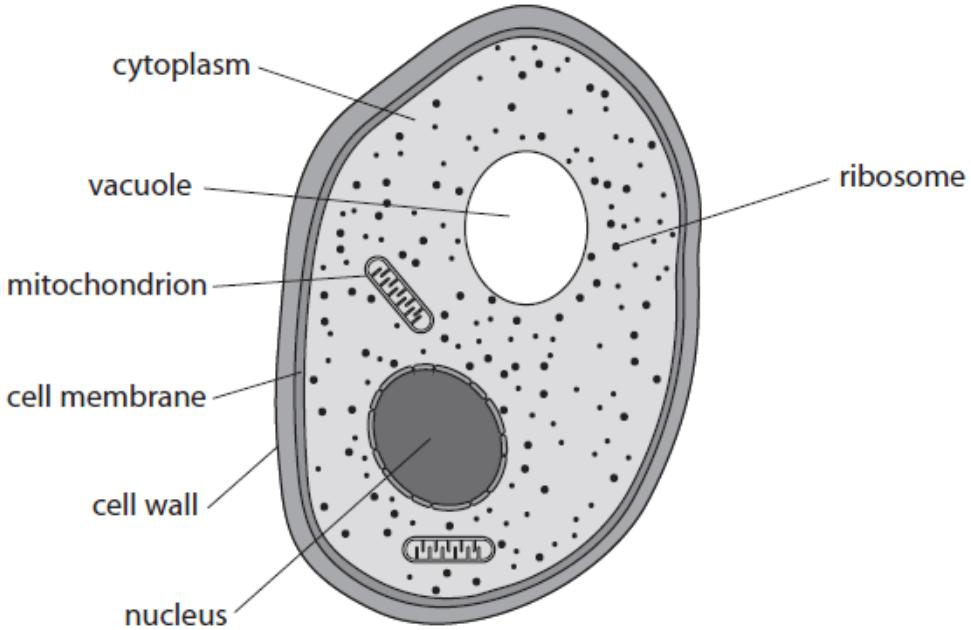
2 .....

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(Total for question = 11 marks)

Q18.

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

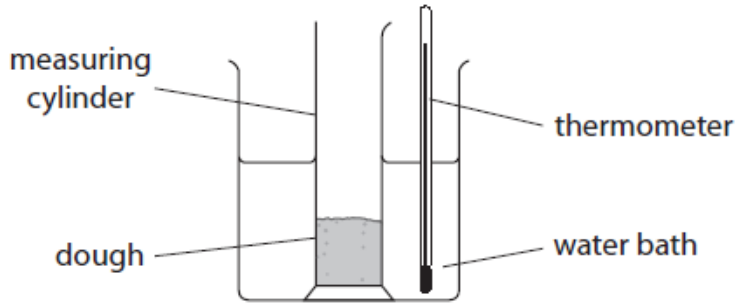
☒ **D** vacuole

(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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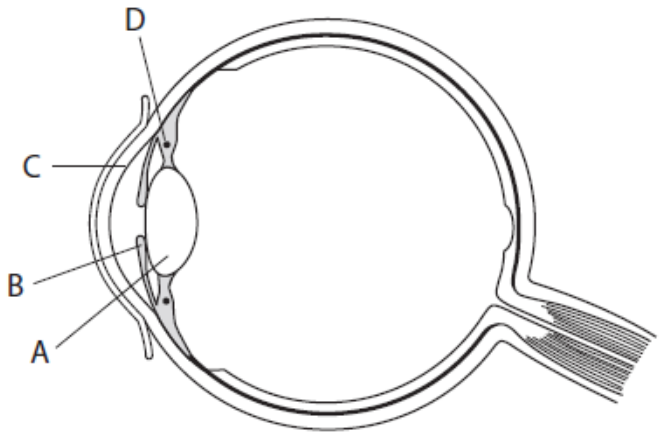
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(Total for question = 11 marks)

Q19.

The diagram shows a section through the human eye.



(a) (i) Describe the role of structures A, C and D in focusing light from a near object onto the retina.

(4)

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(ii) Bright light can damage the retina.

Explain how a reflex involving structure B protects the retina from this damage.

(3)

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(b) There are tear glands that release liquid into the eye.

This liquid contains an enzyme called lysozyme that breaks down cell walls.

(i) Suggest why the liquid contains lysozyme.

(2)

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(ii) Suggest why the liquid is maintained at pH 7

(2)

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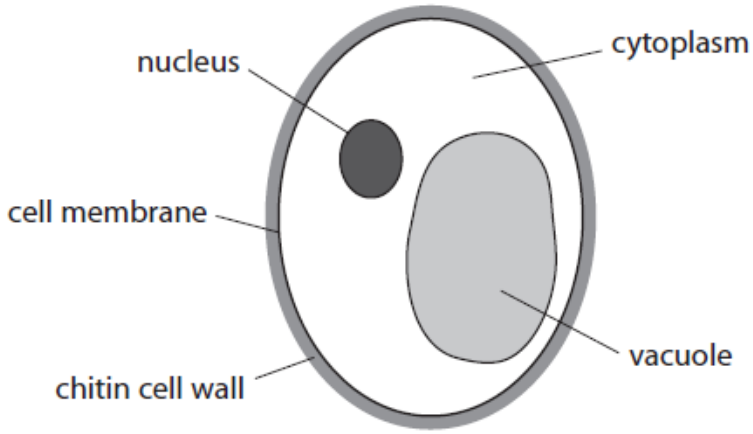
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(Total for question = 11 marks)

Q20.

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)

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2 .....

3 .....

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

(1)

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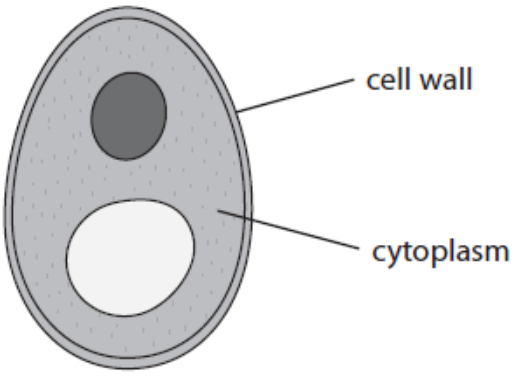
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(Total for question = 10 marks)

Q21.

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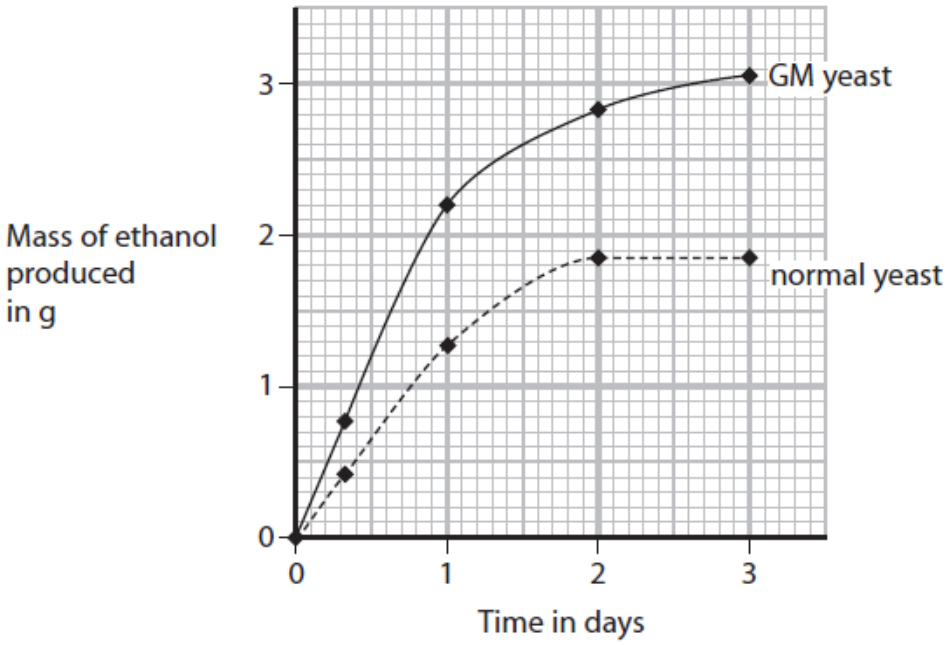
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(c) The graph shows the mass of ethanol produced by GM yeast and by normal yeast over a period of 3 days.



(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)

Q22.

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)

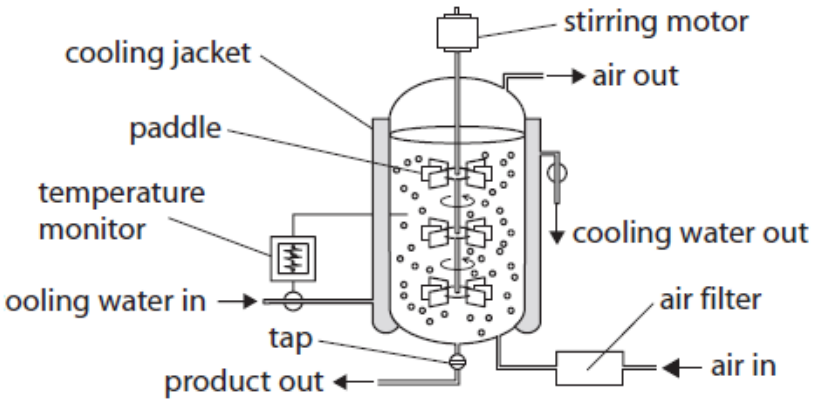
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(c) The diagram shows an industrial fermenter that can be used to grow large quantities of genetically modified yeast.



(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)