PEARSON EDEXCEL IGCSE BIOLOGY · 4BI1

BIOLOGY



EXAM QUESTION PACK

SECTION 5: USE OF BIOLOGICAL RESOURCES (PACK 2)

SCORE	PERCENTAGE
/189	%

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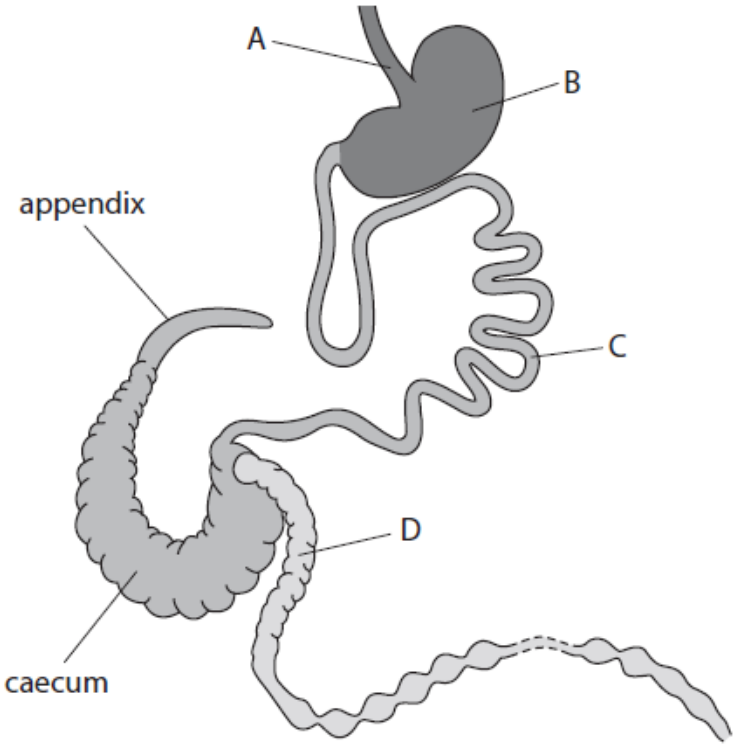
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Q1.

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.

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(Total for question = 10 marks)

Q2.

Farmers sometimes use biological control to reduce the damage to their crops caused by pests such as insects.

(a) Which of these is an advantage of using biological control over chemical control?

(1)

☒ **A** it lasts a short time

☒ **B** it leads to bioaccumulation

☒ **C** it is specific

☒ **D** it is quicker

(b) Aphids are tiny insects that have very sharp mouthparts. They push these mouthparts into the phloem found in stems. They then feed on the phloem contents.



(Source: © Scenics & Science / Alamy Stock Photo)

(i) Name two substances the aphids obtain from the phloem.

(2)

1 .....

2 .....

(ii) Explain how aphids feeding from the phloem of crop plants can lead to a reduction in yield.

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(c) Silverflies and hoverflies are two species of insects whose larvae feed on aphids.

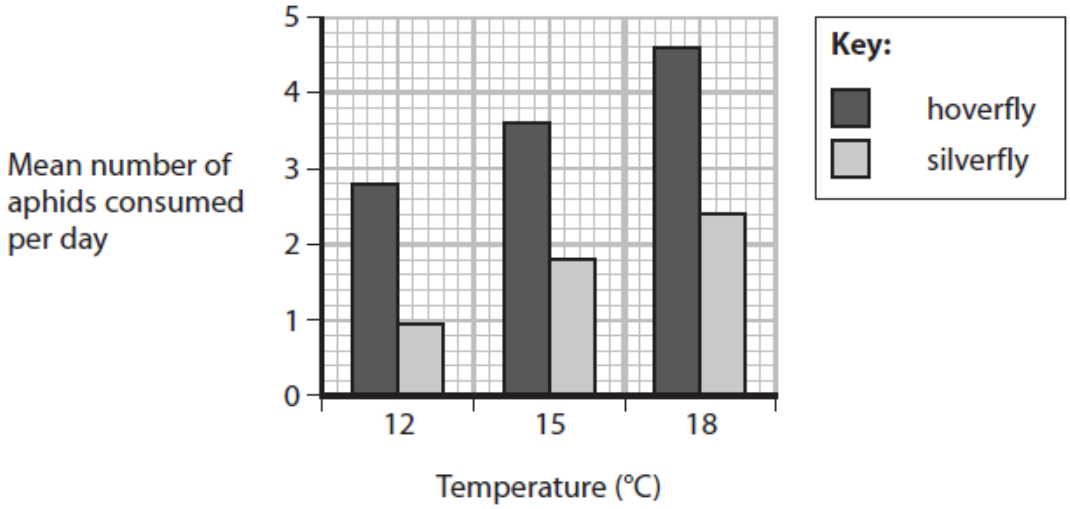
Scientists investigate the feeding behaviour of these species in a laboratory experiment.

This is the scientists' method.

- place a single silverfly in a container
- place a single hoverfly in a separate container
- keep the containers at 12 °C
- put 30 aphids in each container
- count the number of aphids consumed each day for several days
- determine the mean number of aphids consumed per day

The scientists repeat the method at two higher temperatures.

The graph shows the scientists' results.



The scientists conclude that the hoverfly is the most effective biological control agent for aphids.

Discuss the scientists' conclusion, referring to information in the graph and the scientists' method in your answer.

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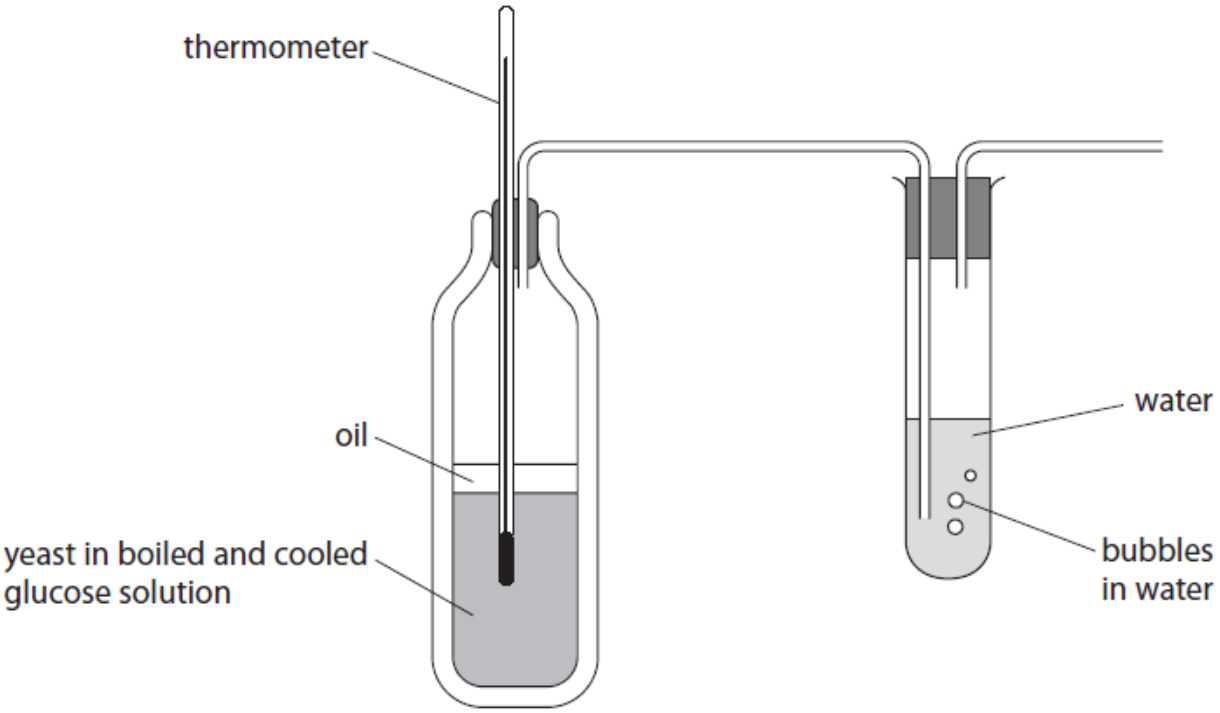
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(Total for question = 12 marks)

Q3.

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 ☒.

A student uses this apparatus to investigate anaerobic respiration by yeast.



(a) Explain why the student boils and cools the glucose solution before the yeast is added.

(2)

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(b) The student measures the rate of anaerobic respiration by counting the number of bubbles produced per minute.

Explain how she could modify her apparatus to obtain a more accurate measurement of the rate of anaerobic respiration.

(2)

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(c) (i) The student wants to compare the rate of anaerobic respiration with the rate of aerobic respiration by yeast.

How should the student modify the apparatus in order to measure the rate of aerobic respiration?

(1)

- ☒ **A** remove liquid oil to allow oxygen diffusion
- ☒ **B** remove liquid oil to allow carbon dioxide diffusion
- ☒ **C** add more liquid oil to prevent oxygen diffusion
- ☒ **D** add more liquid oil to prevent carbon dioxide diffusion

(ii) The student found that more bubbles were produced during aerobic respiration than during anaerobic respiration.

Sketch a bar chart to show these results.

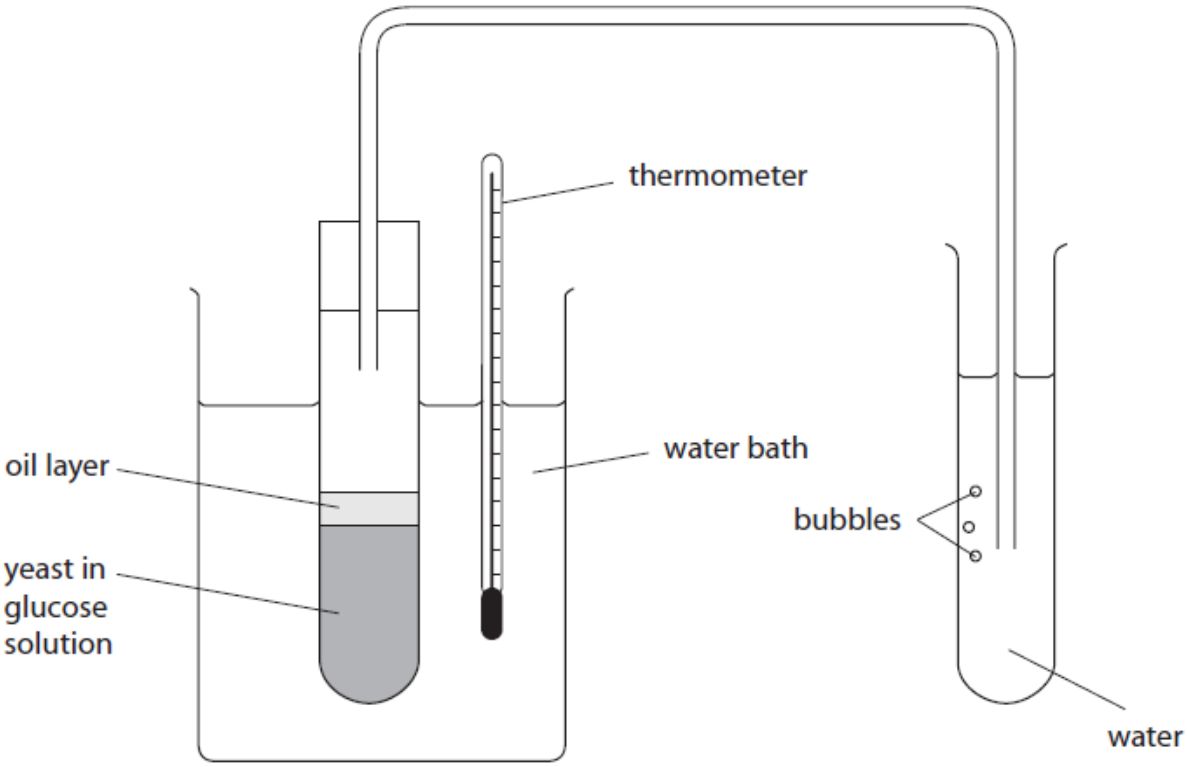
(2)

(Total for question = 7 marks)

Q4.

A student wants to investigate the effect of temperature on the rate of anaerobic respiration by yeast.

She set up this apparatus.



(a) The oil layer prevents the entry of air into the glucose solution.

Explain why this is necessary.

(2)

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(b) The student varies the temperature of the water bath between 15 °C and 60 °C.

She measures the rate of respiration by counting the number of carbon dioxide bubbles produced per minute.

These are her results.

Temperature / °C	Number of bubbles produced in one minute				
	trial 1	trial 2	trial 3	trial 4	trial mean
15	6	7	5	5	6
20	7	8	7	9	8
35	10	12	11	14	
45	12	15	14	16	14
60	3	2	1	2	2

(i) Calculate the mean number of bubbles produced in one minute at 35 °C.

(2)

mean number of bubbles in one minute = ...

(ii) Calculate the percentage change in the mean number of bubbles produced in one minute as the temperature increases from 15 °C to 45 °C.

(2)

percentage change = ... %

(iii) Explain the change in the rate of respiration by yeast as the temperature increases from 45 °C to 60 °C.

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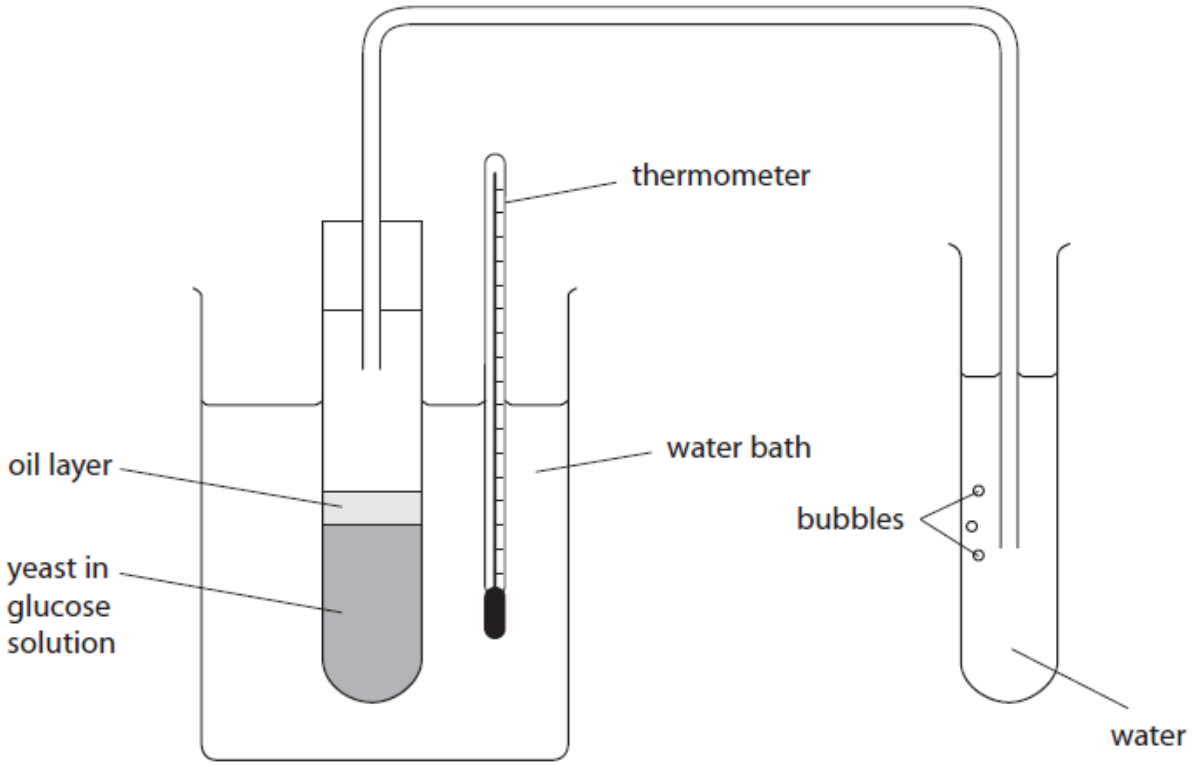
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(Total for question = 9 marks)

Q5.

A student wants to investigate the effect of temperature on the rate of anaerobic respiration by yeast.

She set up this apparatus.



(a) The oil layer prevents the entry of air into the glucose solution.

Explain why this is necessary.

(2)

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(b) The student varies the temperature of the water bath between 15 °C and 60 °C.

She measures the rate of respiration by counting the number of carbon dioxide bubbles produced per minute.

These are her results.

Temperature / °C	Number of bubbles produced in one minute				
	trial 1	trial 2	trial 3	trial 4	trial mean
15	6	7	5	5	6
20	7	8	7	9	8
35	10	12	11	14	
45	12	15	14	16	14
60	3	2	1	2	2

(i) Calculate the mean number of bubbles produced in one minute at 35 °C.

(2)

mean number of bubbles in one minute = ...

(ii) Calculate the percentage change in the mean number of bubbles produced in one minute as the temperature increases from 15 °C to 45 °C.

(2)

percentage change = ... %

(iii) Explain the change in the rate of respiration by yeast as the temperature increases from 45 °C to 60 °C.

(3)

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(Total for question = 9 marks)

Q6.

Farmers may add chemical fertilisers to their soil.

(a) Explain how chemical fertilisers can increase crop yield.

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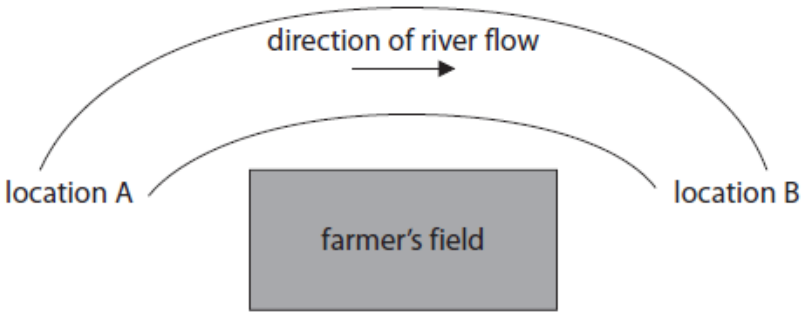
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(b) These fertilisers may leak into rivers.

A scientist measures the oxygen content of water in two different locations of the same river during the month of April.



In location A he finds that the mean dissolved oxygen was 6 mg per litre and at location B he finds that the mean dissolved oxygen was 3 mg per litre.

He concludes that the use of fertiliser in the field has affected the oxygen content of the river.

Discuss his conclusion.

(4)

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(c) Some farmers use alternative substances to chemical fertilisers.

Suggest one alternative substance that a farmer may use.

(1)

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(Total for question = 9 marks)

Q7.

The table shows data on crops grown and pesticide used in Norway in 2011.

Crop type	Crop	Total area in km²	Percentage of area sprayed with each type of pesticide (%)		
			herbicide	fungicide	insecticide
vegetable	potato	128	92	88	40
	onion	7	99	96	26
	carrot	13	93	42	73
fruit	strawberry	14	72	87	80
	apple	13	56	80	70
meadows	meadows for mowing and pastures	6207	6	–	–
cereals	barley	1450	91	64	10
	oats	694	94	24	4
	spring wheat	588	98	86	27
	winter wheat	139	96	85	7

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

(1)

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(b) Determine which crop had the largest area sprayed with herbicide.

Show your working.

(2)

largest area = ... km^2

crop = ...

(c) Suggest why spring and winter wheat have different percentages of insecticide applied to them.

(2)

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(d) Discuss the different combinations of pesticides applied to fruit and cereal crops.

(4)

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(e) Explain an alternative to insecticide that a farmer could use.

(2)

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(Total for question = 11 marks)

Q8.

A student uses this method to investigate the effect of fertiliser on the growth of plant seedlings.

- set up two trays with an equal mass of compost in each tray
- plant 100 seeds, equally spaced, in each tray
- place the trays under the same lamp until the seeds start to germinate
- water each tray every day with the same volume of water
- add fertiliser to one of the trays every day
- remove five seedlings from each tray every four days for a period of 20 days
- dry these seedlings in an oven and find their mass

The table shows the student's results.

Day	Dry mass of seedlings in g	
	Without fertiliser	With fertiliser
4	3.5	3.8
8	4.9	5.8
12	5.8	6.7
16	6.3	7.8
20	6.8	8.5

(a) (i) Give two abiotic variables that the student controls.

(2)

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2 .....

(ii) The student dries the seedlings in an oven to find their dry mass.

Suggest why it is important to use dry mass in this investigation.

(2)

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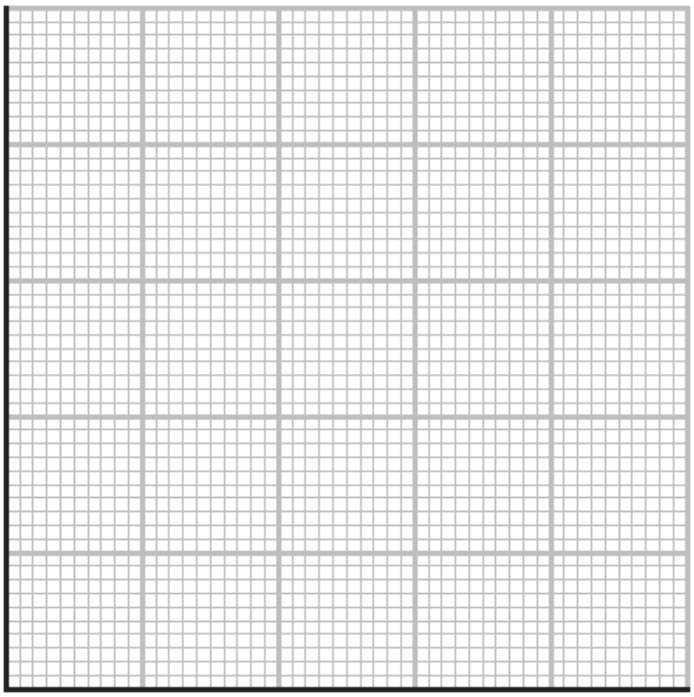
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(b) (i) Plot a line graph to show the dry mass of seedlings without fertiliser and the dry mass of seedlings with fertiliser, from day 4 to day 20.

Use a ruler to join your points with straight lines.

(5)



(ii) The fertiliser contains magnesium ions and nitrate ions.

Explain the effect of these two ions on the growth of the seedlings.

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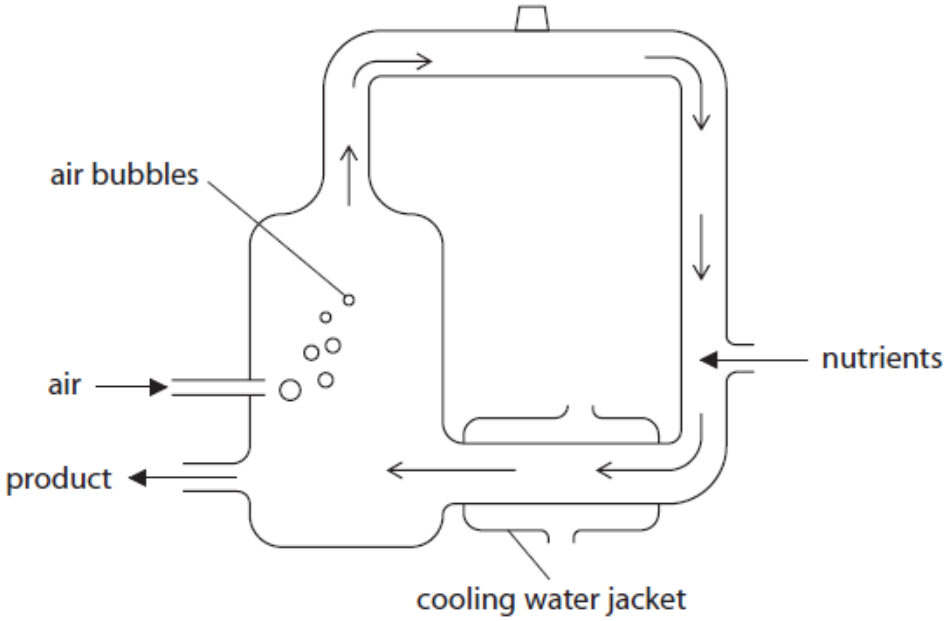
(Total for question = 13 marks)

Q9.

Mycoprotein is protein produced by fungi that can be made into meat substitutes.

Large amounts of fungus are grown in fermenters to produce the mycoprotein.

The diagram shows a typical mycoprotein fermenter.



(a) (i) Explain why air is bubbled into the fermenter.

(2)

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(ii) Explain why the fermenter is cleaned using steam before the fungus and nutrients are added.

(2)

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(b) A scientist investigates the production of mycoprotein by a genetically modified (GM) fungus and a non-genetically modified fungus (non-GM).

The scientist claims that the GM fungus will be better for large-scale production of mycoprotein.

The scientist measures the mass of mycoprotein produced by the fungi in fermenters for 30 days.

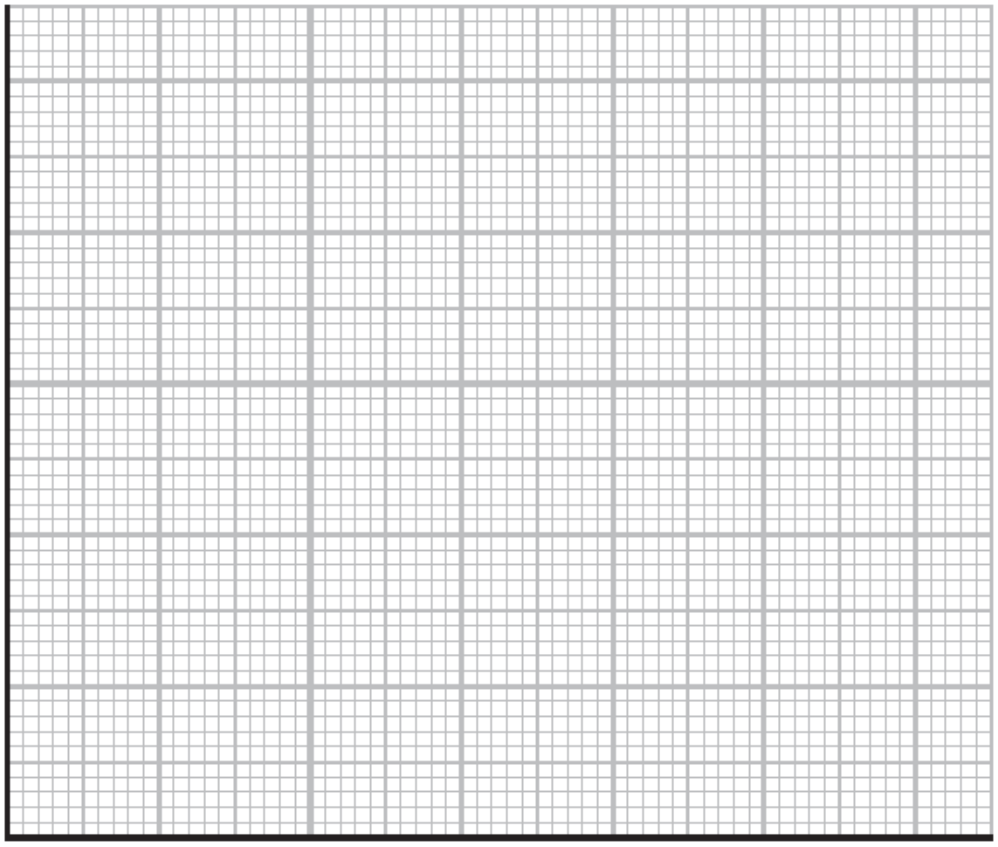
The table shows the scientist's results.

Time in days	Mass of mycoprotein produced in kg	
	GM fungus	Non-GM fungus
5	130	125
10	220	190
15	330	270
20	420	360
30	430	460

(i) Plot a line graph to show how the mass of mycoprotein changes over the 30 days for each type of fungus.

Use a ruler to join the points with straight lines.

(5)



(ii) The scientist claims that the GM fungus will be better for large-scale production of mycoprotein than the non-GM fungus.

Comment on the scientist's claim.

(2)

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(iii) The table shows the nutritional composition of mycoprotein and the nutritional composition of lamb.

Nutritional component	Mass of nutritional component in 100 grams of food in grams	
	mycoprotein	lamb
protein	10.5	20.2
cholesterol	0.0	0.1
fat	3.0	25.5
fibre	6.0	0.7
iron	0.00039	0.0025
calcium	0.048	0.010

Discuss whether eating mycoprotein is more healthy than eating lamb for a growing human.

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(Total for question = 16 marks)

Q10.

Genetic modification is a process used to improve crop yield.

(a) Describe the role of a named vector in the process of genetic modification.

(2)

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(b) Weeds are plants that grow where they are not wanted.

Removing weeds reduces competition for mineral ions and improves crop yield.

(i) Name the mineral ion used to make chlorophyll.

(1)

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(ii) Two different methods can be used to remove weeds to improve crop yield.

- Method A pull weeds out of the ground by hand
- Method B spray weeds with a chemical that kills them

Design an investigation to find out which method produces the highest crop yield.

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

(6)

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(Total for question = 9 marks)

Q11.

Plants can be genetically modified (GM) to produce insect poison.

They are modified using a bacterium called *Agrobacterium*.

This bacterium has a plasmid that contains recombinant DNA.

(a) Describe how the plasmid is modified to contain recombinant DNA.

(3)

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(b) A farmer can use either of these methods to improve his crop yield.

- grow GM plants that produce the insect poison
- grow non-GM plants and use pesticides

The farmer decides to grow the GM plants rather than using pesticides.

Discuss the decision made by the farmer.

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(Total for question = 9 marks)

Q12.

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)

Q13.

Genetically modified bacteria can be used to produce large quantities of human insulin.

(a) State what is meant by the term **genetically modified bacteria**.

(1)

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(b) Describe how bacteria can be genetically modified to produce large quantities of human insulin.

(4)

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(Total for question = 5 marks)

Q14.

Scientists have developed genetically modified (GM) crops in order to increase food production by increasing crop yields.

(a) (i) Some GM crops are described as transgenic.

Explain what is meant by the term **transgenic**.

(2)

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(ii) Give the role of **two** named enzymes in the production of GM organisms.

(2)

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(b) Some GM crops that are available to farmers are resistant to herbicides (weedkillers).

Other GM crops are resistant to diseases caused by viruses and to damage by insects.

Some people are for the use of GM crops because they may be beneficial to ecosystems.

Some people are against the use of GM crops because they could harm ecosystems.

Discuss these opinions for and against the use of GM crops.

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(Total for question = 8 marks)

Q15.

Organisms can be genetically modified (GM) by changing their DNA.

(a) Explain how enzymes are used to modify the DNA of an organism.

(2)

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(b) GM plants can be produced that can survive very low temperatures.

Design an investigation to find out if these GM plants are more able to survive low temperatures than non-GM plants.

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

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(Total for question = 8 marks)

Q16.

Farmers can increase their crop yield by growing crops in a temperature controlled glasshouse.

(a) (i) Explain how increasing the temperature can result in an increase in crop yield.

(2)

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(ii) Farmers sometimes use a type of heater that burns gas or oil to raise the temperature of their glasshouse to improve crop yield.

Explain why they use this type of heater to improve crop yield.

(2)

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(b) Some farmers also add chemical fertilisers to their crops in a glasshouse.

(i) Different minerals are added to chemical fertilisers. Explain one mineral that should be added to these fertilisers.

(2)

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(ii) Discuss why some farmers limit the amount of chemical fertilisers they add to their crops.

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(Total for question = 11 marks)

Q17.

The photograph shows a type of fish called a salmon.



(Source: © Alexander Raths/Shutterstock)

Some humans eat salmon as a source of protein.

Protein is a component of a balanced diet.

(a) Which statement describes what happens to salmon protein in the human stomach?

(1)

☒ **A** it is digested into amino acids

☒ **B** its surface area is increased by bile

☒ **C** its pH is raised by hydrochloric acid

☒ **D** it is absorbed by villi

(b) The table lists other components of a balanced diet and their functions.

Complete the table by giving a function of each component.

The first one has been done for you.

(3)

Component	Function
lipid	store of energy
vitamin D	
iron	
fibre	

(c) A student investigates the effect of genetic modification on the growth of salmon.

The student measures the mass and length of one normal salmon and one genetically modified salmon when both salmon are 18 months old.

The table shows the student's results.

Type of salmon	Mass in g	Length in cm
normal	1250	33
genetically modified	3000	61

(i) It is recommended that a 15-year-old person needs 50 g of protein per day for a balanced diet.

A normal salmon contains 20% protein.

Calculate how many 15-year-olds can have their recommended daily allowance of protein supplied by the 18-month-old normal salmon.

(2)

number = ...

(ii) The student concludes that his results show that genetically modified (GM) salmon are useful in providing a balanced diet.

Discuss the student's conclusion.

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(d) The passage describes the role of enzymes involved in the genetic modification of salmon.

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

(3)

All salmon contain a length of DNA called a ....., which controls the production of growth hormone. Another length of DNA, from a different species of fish, is cut out using a ..... enzyme. This DNA is then joined to the salmon DNA using an enzyme called ..... .

This causes the salmon to produce growth hormone at all times.

(Total for question = 15 marks)

Q18.

The table gives the masses of protein and lipid (fat) in the same volume of milk from a cow and from a human.

	Protein in g	Lipid in g
cow	3.3	3.9
human	1.3	4.1

(a) Describe how you would test a sample of cow's milk and a sample of human milk to show they contain different masses of protein.

(2)

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(b) Some of the proteins in milk are antibodies.

Explain why antibodies in milk are useful for babies.

(2)

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(c) Give two ways that lipid in milk is used by babies.

(2)

1 .....

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2 .....

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(d) Milk is used to make yoghurt.

(i) Name the carbohydrate in milk used to make yoghurt.

(1)

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(ii) Name the bacteria added to milk to make yoghurt.

(1)

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(iii) Explain why milk needs to be heated to a high temperature at the start of the process for making yoghurt.

(2)

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(Total for question = 10 marks)

Q19.

Bread can be produced from flour using yeast.

Design an investigation to find out if changing the starch content of the flour causes the bread to expand more.

Your answer should include experimental details and be written in full sentences.

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(Total for question = 6 marks)

Q20.

The diagram shows a pot containing yoghurt and fruit.



(a) Describe how a named bacterium produced this yoghurt from milk.

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(b) Suggest the health benefits to a human of adding fruit to the yoghurt.

(2)

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(Total for question = 5 marks)