AQA GCSE BIOLOGY (HIGHER) · 8461

BIOLOGY



EXAM QUESTION PACK

4.7.5 FOOD PRODUCTION (PACK 1)

SCORE	PERCENTAGE
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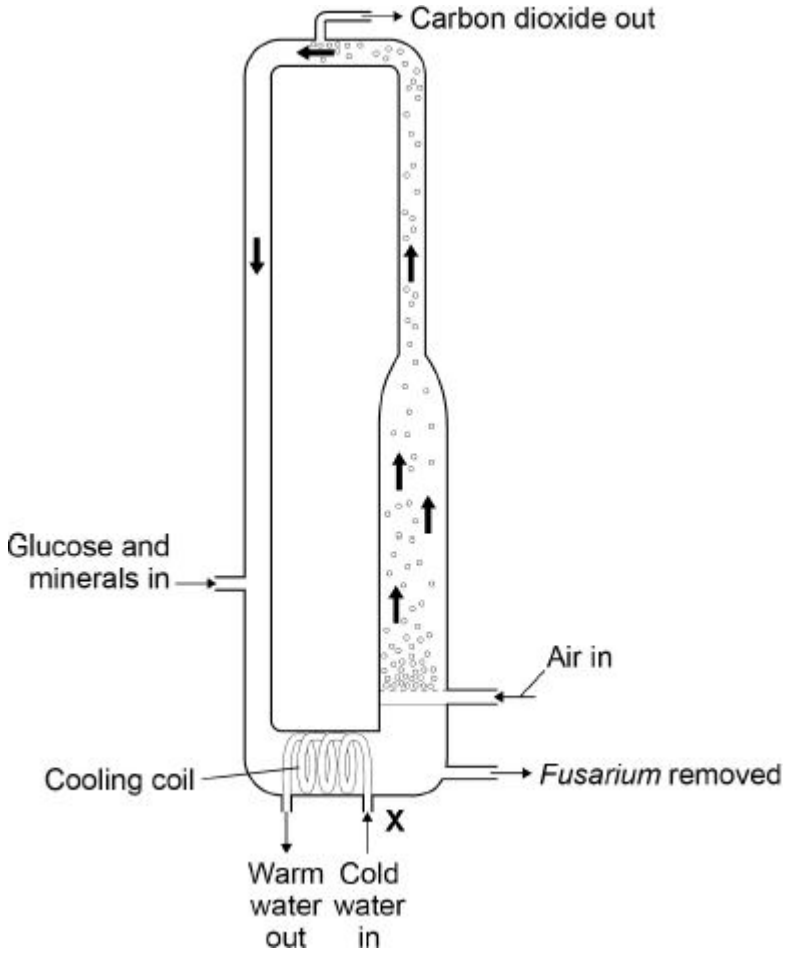
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Q1.

Mycoprotein is a protein-rich food.

Mycoprotein is made from the fungus *Fusarium*.

The diagram below shows a fermenter used for growing *Fusarium*.



(a) Explain why the fermenter is sterilised before use.

_____

_____

_____

_____

(2)

(b) Cold water is pumped through the cooling coil at point **X**.

This maintains a constant temperature inside the fermenter.

Suggest the temperature at which *Fusarium* grows fastest.

Tick **one** box.

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5 °C ☐

20 °C ☐

30 °C ☐

85 °C ☐

(1)

(c) Glucose and bubbles of air enter the fermenter.

The bubbles of air supply oxygen.

Explain why *Fusarium* needs glucose and oxygen.

_____

_____

_____

_____

(2)

(d) The bubbles of air also move materials around the fermenter.

Suggest why it is useful for bubbles of air and materials to move around inside the fermenter.

_____

_____

_____

_____

(2)

(e) 100 grams of chicken meat contains 22 grams of protein.

100 grams of mycoprotein contains 11 grams of protein.

A man ate 100 grams of chicken in one meal.

How many grams of mycoprotein would the man need to eat to get the same mass of protein as in 100 grams of chicken?

Tick **one** box.

100 grams ☐

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110 grams ☐

200 grams ☐

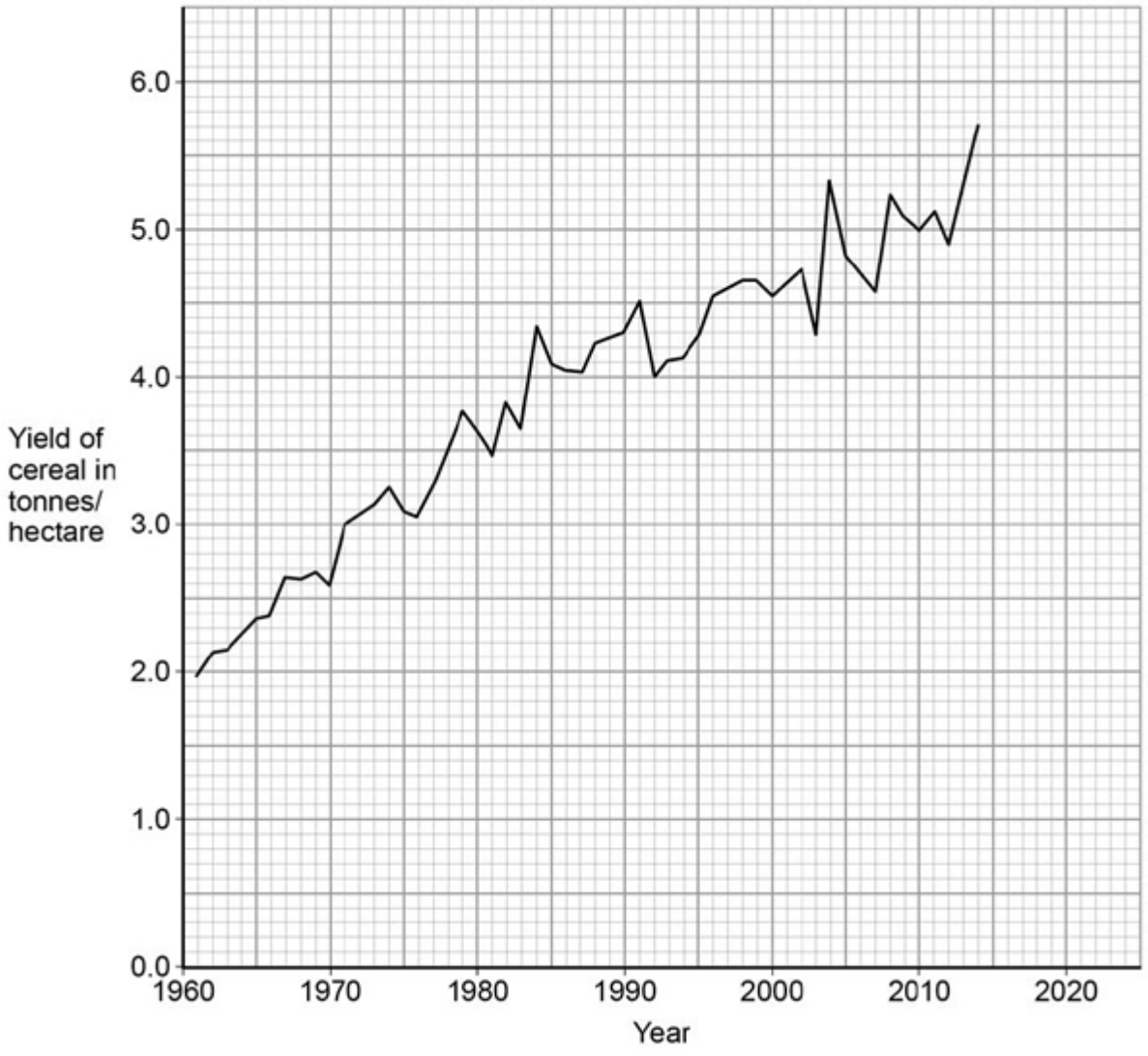
220 grams ☐

(1)

(Total 8 marks)

Q2.

The graph shows information about the yield of cereal crops grown in the European Union.



(a) Calculate the increase in the yield of cereal between 1970 and 2010.

_____

_____

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Increase in yield = _____ tonnes/hectare

(2)

(b) Estimate by what fraction the yield of cereal increased between 1971 and 1992.

Tick **one** box.

$\frac{1}{10}$ ☐ $\frac{1}{3}$ ☐ $\frac{1}{2}$ ☐ $\frac{3}{4}$ ☐

(1)

(c) The increase in yield is partly due to increased use of nitrate fertilisers.

Which substance do plants make using nitrate ions?

Tick **one** box.

Cellulose ☐

Fat ☐

Protein ☐

Starch ☐

(1)

(d) The yield of cereal in 2004 was much greater than the yield in 2003.

Suggest **three** possible reasons for the increased yield in 2004.

Tick **three** boxes.

A genetically-modified variety of seed was sown in 2004. ☐

A pathogenic fungus grew on the cereal in 2004. ☐

Farmers added more nitrate to the soil in 2003. ☐

More cereal seeds were sown in 2003. ☐

More rain fell in spring and early summer in 2004. ☐

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The mean summer temperature was lower in 2003. ☐

(3)

Humans eat cereals.

Humans also eat the animals that feed on cereals.

Figure 1 and **Figure 2** show two food chains.

Figure 1

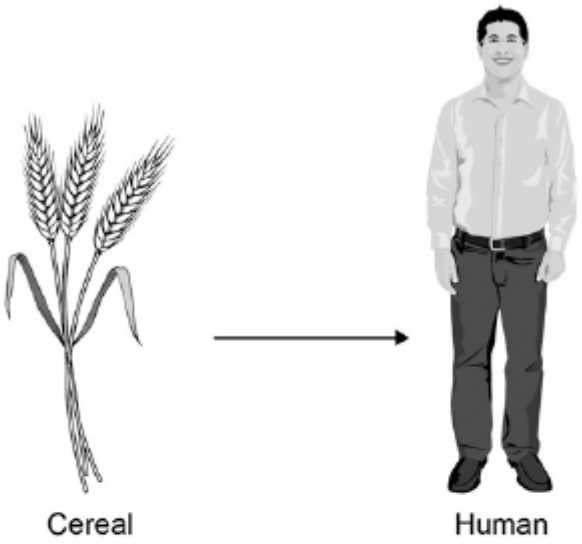
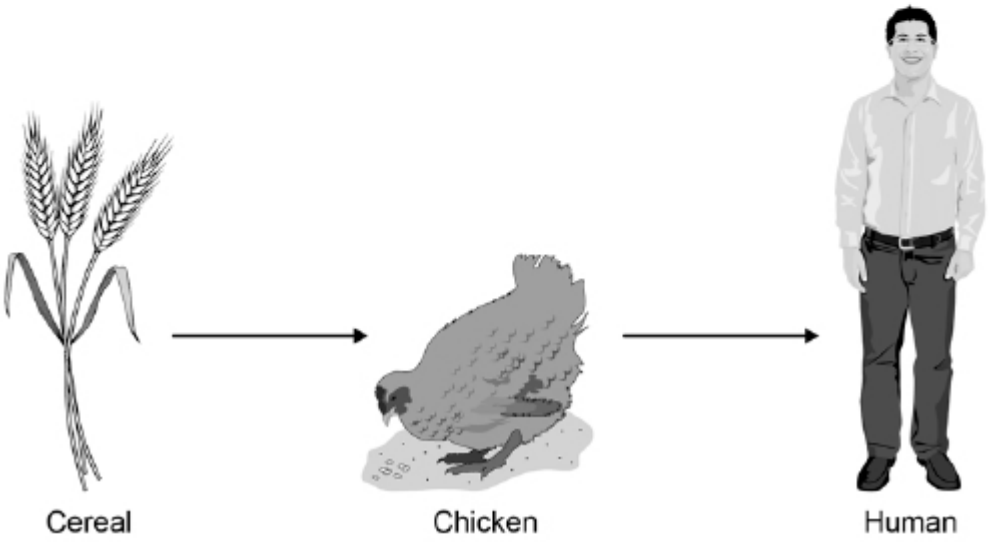


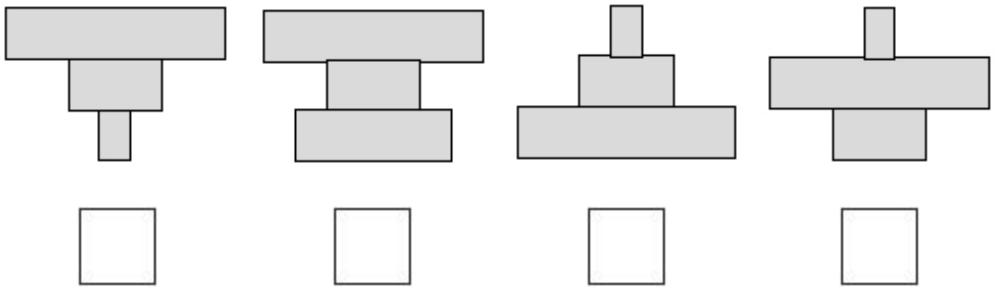
Figure 2



(e) Which pyramid of biomass is correct for the food chain shown in **Figure 2**?

Tick **one** box.

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In **Figure 1**, 1 hectare of cereal crop would provide enough energy for 8 people for a year.

In **Figure 2**, 10 hectares of cereal crop would be needed to provide enough energy for only 1 person for a year.

(f) It is much more efficient for humans to get energy by eating cereals than by eating chickens.

Calculate how many times more efficient.

_____

_____

Answer = _____ times

(1)

(g) Why is it more efficient for humans to get energy by eating cereals than by eating chickens?

Tick **two** boxes.

Cereals gain extra energy from mineral ions in the soil.	☐
Chickens contain more protein per gram than cereals.	☐
Chickens use energy for movement and for keeping warm.	☐
Much of the food eaten by chickens is wasted as faeces.	☐
Not all parts of the cereal plants are edible.	☐

(2)

(Total 11 marks)

Q3.

Cows are reared for meat production.

The cows can be reared indoors in heated barns, or outdoors in grassy fields.

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The table shows energy inputs and energy outputs for both methods of rearing cows.

	kJ / m² / year		
	Energy input		Energy output
	Food	Fossil fuels	Meat production
Indoors	10 000	6 000	40
Outdoors	5 950	50	**X**

(a) The percentage efficiency for rearing cows **outdoors** is 0.03%

Calculate the energy output value **X**.

Use the equation:

$$\text{percentage efficiency} = \frac{\text{energy output}}{\text{total energy input}} \times 100$$

Energy output value **X** = _____ kJ / m² / year

(3)

(b) The percentage efficiency for rearing cows **outdoors** is 0.03%

Calculate how many times more efficient it is to rear cows indoors than to rear cows outdoors.

Use the equation from (a).

Answer = _____ times

(3)

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(c) A large amount of energy is wasted in both methods of rearing cows.

Give **two** ways in which the energy is wasted.

1. _____

_____

2. _____

_____

(2)

(d) Suggest **two** reasons why it is more efficient to rear cows indoors than to rear cows outdoors.

1. _____

_____

2. _____

_____

(2)

(Total 10 marks)

Q4.

Food security is when a population has enough food to stay healthy.

Lack of food security is a global problem.

One way to maintain food security is to increase the efficiency of food production.

The diagram below shows how some pigs are farmed using intensive methods.



© Ingram Publishing/Thinkstock

(a) Some people think the farming methods shown in the diagram above are unethical.

Suggest **two** other possible disadvantages of intensive farming methods.

1. _____

_____

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2. _____

_____

(2)

(b) Explain how the intensive farming of pigs increases the efficiency of food production.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

(4)

(c) A newspaper reported that:

'Food security is a serious problem in remote communities in Canada. This is because Aboriginal communities are eating fewer traditional foods.'

One traditional food eaten by Aboriginal communities in Canada is seal.

Look at the table below

Year	Number of seals caught in thousands
2004	362
2005	316
2006	348
2007	224
2008	215
2009	91
2010	67

Calculate the percentage (%) decrease in the number of seals caught from 2004 to 2010.

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_____

_____

Decrease in seals = _____ %

(2)

(d) The conclusion in the newspaper might **not** be correct.

Suggest **two** reasons why.

1. _____

_____

2. _____

_____

(2)

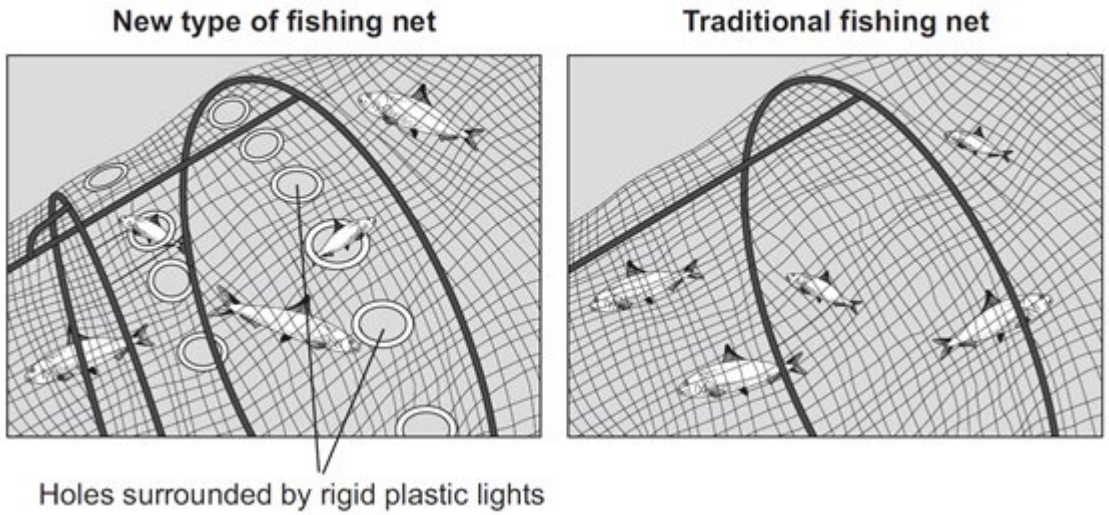
(Total 10 marks)

Q5.

It is important to conserve fish stocks.

Figure 1 shows a new type of fishing net and a traditional fishing net.

Figure 1



(a) (i) Describe how the new type of fishing net helps to conserve fish stocks.

_____

_____

_____

_____

_____

(3)

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(ii) Give **one** way, other than controlling nets, to reduce overfishing.

_____

_____

(1)

(b) Another way to make sure there is food for an increasing human population is to make food production more efficient.

Figure 2 shows how some cows are farmed.

Figure 2



© Dageldog/iStock

(i) Use information from **Figure 2** to suggest **two** ways in which this type of farming reduces energy loss from the cows.

1. _____

_____

2. _____

_____

(2)

(ii) Give **two** reasons why some people disagree with farming cows in this way.

1. _____

_____

2. _____

_____

(2)

(Total 8 marks)

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Q6.

Figure 1 shows some information about 'stem cell burgers'.

Figure 1

The first laboratory burger has now been cooked

In July 2013 the first burger grown from cow stem cells was cooked.

Muscle stem cells from cows were grown into strands of beef in a laboratory. About 20 000 strands of beef were then made into a burger. The burger can be cooked and eaten by humans. This type of meat is called cultured meat.

The cultured meat is exactly the same as normal cow muscle tissue and the cells are not genetically modified.

(a) (i) Some scientists think using cultured meat instead of traditionally-produced meat will help reduce global warming.

Suggest **two** reasons why using cultured meat may slow down the rate of global warming.

1. _____

_____

2. _____

_____

(2)

(ii) Suggest **two** other possible advantages of producing cultured meat instead of farmed meat.

Do **not** refer to cost in your answer.

1. _____

_____

2. _____

_____

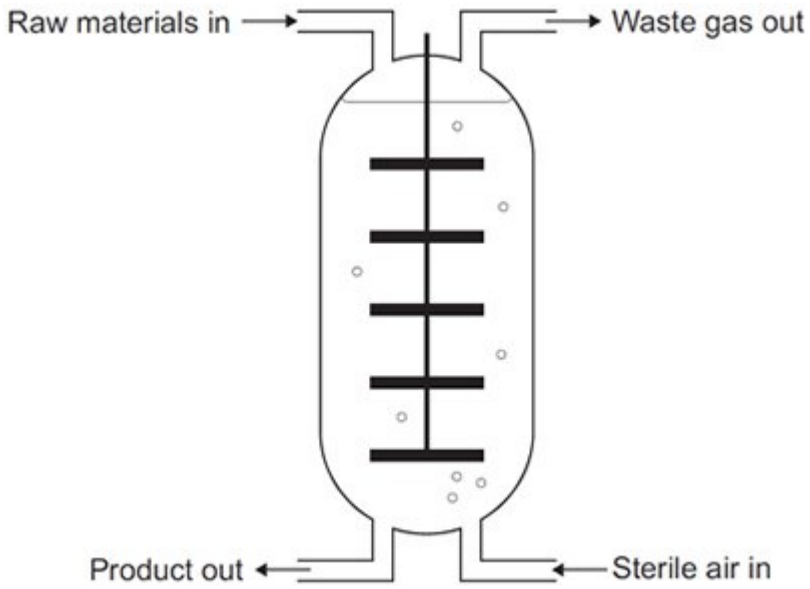
(2)

(b) Mycoprotein is one type of food that is mass-produced.

Figure 2 shows a fermenter used to produce mycoprotein.

Figure 2

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Describe how mycoprotein is produced.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

(4)

(Total 8 marks)

Q7.

Figures 1 and **2** show battery chickens and free-range chickens.

Figure 1
Battery chickens

Figure 2
Free-range chickens

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© studiodr/iStock/Thinkstock



© xlikovec/iStock/Thinkstock

Battery chickens are kept in cages indoors. Free-range chickens can walk around outside.

(a) Give **one** way in which food production might be more efficient from battery chickens than from free-range chickens. Give a reason for your answer.

_____

_____

_____

_____

_____

(2)

(b) Some farms use waste from chickens to produce biogas in an anaerobic digester.

Microorganisms in the digester break down the waste by anaerobic respiration.

(i) What does **anaerobic** mean?

_____

_____

(1)

(ii) One product of anaerobic respiration is methane.

Name **two** other products of anaerobic respiration.

1. _____

2. _____

(2)

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(c) The best temperature for anaerobic digesters is about 35 °C.

Explain why the volume of biogas produced would be **less** at higher temperatures.

_____

_____

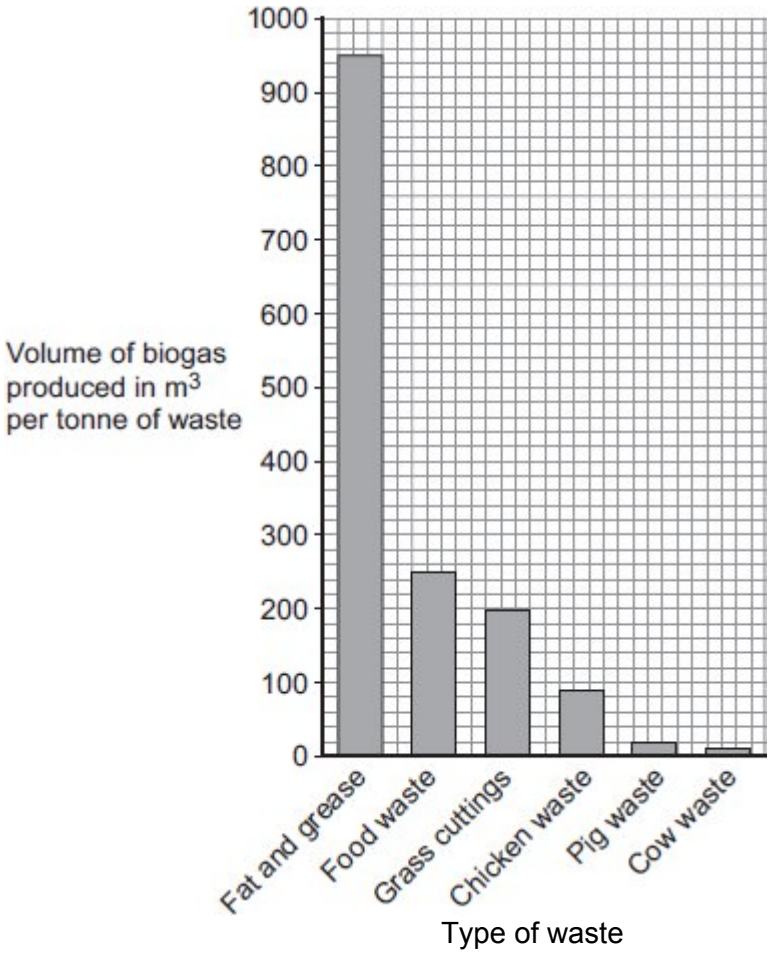
_____

_____

(2)

(d) **Figure 3** shows other types of waste that can be used in an anaerobic digester to produce biogas.

Figure 3



(i) What is the volume of biogas produced by a tonne of grass cuttings?

_____ m^3

(1)

(ii) Biogas is 60% methane.

Calculate the volume of methane gas produced per tonne of grass cuttings.

_____ m^3

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(1)

(e) Why should biogas **not** be allowed to escape into the atmosphere?

_____

_____

_____

_____

(2)

(Total 11 marks)

Q8.

The world population is increasing and the need for food is increasing.

Mycoprotein is a high-protein food made in fermenters using the organism *Fusarium*.

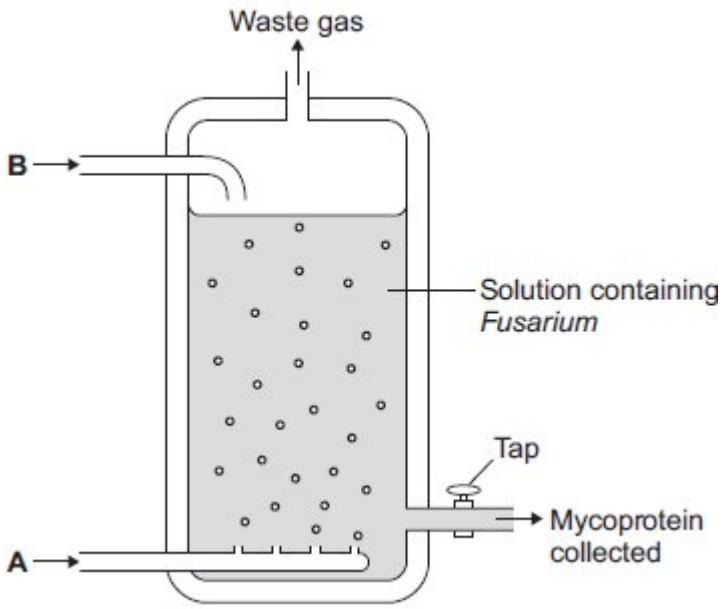
The process takes only a few weeks to produce a large amount of food.

(a) (i) What type of organism is *Fusarium*?

Draw a ring around the correct answer.

bacterium **fungus** **virus**

The diagram below shows a fermenter used in mycoprotein production.



(1)

(ii) *Fusarium* makes mycoprotein. *Fusarium* respires aerobically.

Suggest which gas is added to the fermenter at point **A**.

_____

(1)

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(iii) Another substance is added to the fermenter at point **B**. This substance is used in aerobic respiration.

Name this substance.

_____

(1)

(b) People need to eat protein to grow and to be healthy.

Some people think that it would be an advantage to get more food from mycoprotein and less from farming animals.

Suggest **two** possible advantages of getting more food from mycoprotein.

1. _____

_____

2. _____

_____

(2)

(Total 5 marks)

Q9.

Herring are a type of fish found in the North Sea. Herring are caught using nets which are pulled by large boats.

The photographs show a fishing boat and some herring.



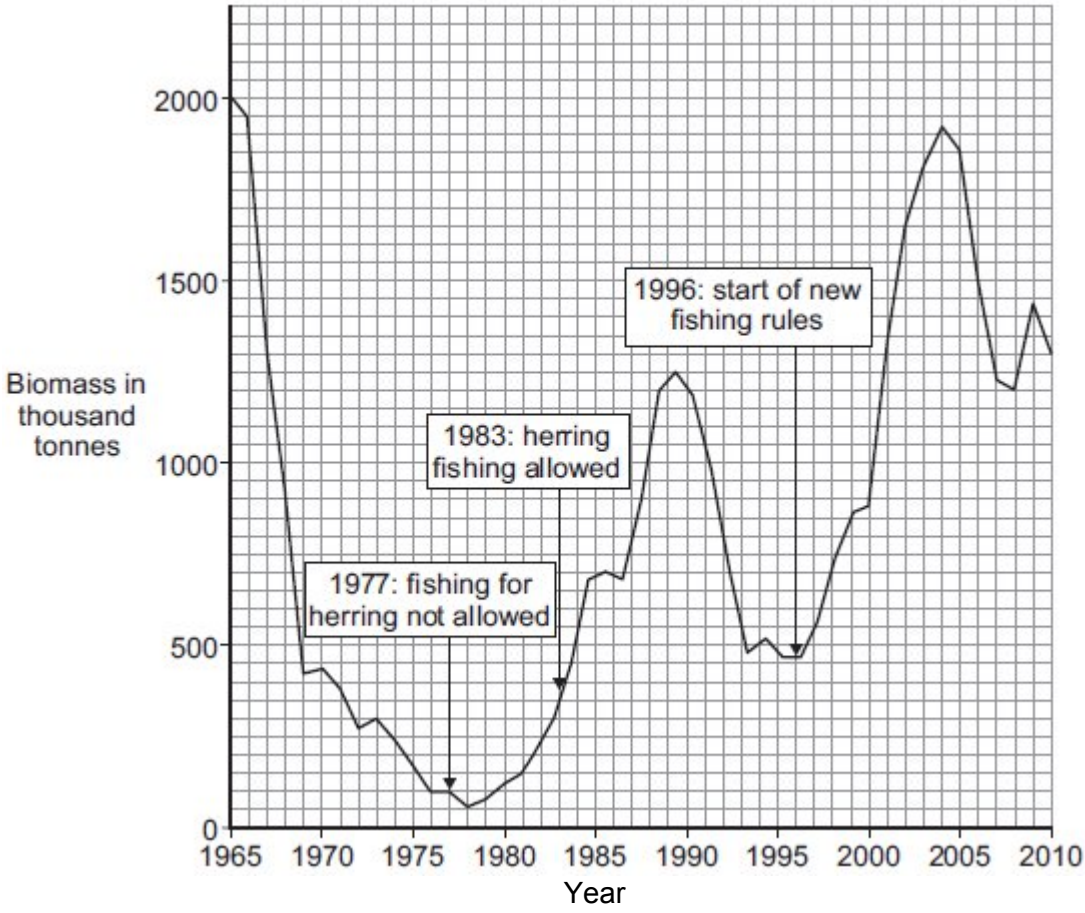


By Atle Grimsby from Utsira, Norway (Herring Catch at Utsira) [CC-BY-2.0 (http://creativecommons.org/licenses/by/2.0)], via Wikimedia Commons.

The herring population in the North Sea has changed a lot in recent years.

The graph shows the estimated biomass of herring in the North Sea between 1965 and 2010.

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(a) Suggest why the biomass can only be estimated.

Tick (✓) **one** box.

Scientists are not properly trained. ☐

There are too many different types of fish in the sea. ☐

It is impossible to weigh all the herring in the sea. ☐

(1)

(b) (i) Describe the pattern shown in the graph from 1978 to 1983.

_____

_____

(1)

(ii) Suggest a reason for the pattern you have described in part **(b) (i)**.

_____

_____

(1)

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(c) In 1996 the Government brought in strict rules to help to conserve fish stocks.

(i) State **two** rules that would help to conserve fish stocks.

1. _____

_____

2. _____

_____

(2)

(ii) Were the Government's rules effective?

Use data from the graph to support your answer.

_____

_____

_____

_____

(2)

(iii) Why should fish stocks be kept above a certain minimum level?

_____

_____

(1)

(iv) The Government did not introduce rules about the amount of herring caught until 1977.

This was in response to a dramatic decrease in herring stocks.

What was the percentage decrease in herring stocks between 1965 and 1977?

_____

_____

Percentage decrease = _____

(2)

(d) Herring migrate to feed and spawn (lay eggs).

The eggs normally take about 3 weeks to hatch at 12 °C.

If the temperature of the water is higher the eggs will hatch more quickly.

But, if the temperature of the water is above 19 °C, the eggs will die.

Other fish, such as cod, feed on herring.

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Suggest how climate change could affect North Sea fish.

_____

_____

_____

_____

_____

_____

_____

_____

_____

(4)

(Total 14 marks)

Q10.

The number of fish in the oceans is decreasing.

The table below shows information about the mass of fish caught by UK fishermen between 2002 and 2010.

Year	Mass of fish caught by UK fishermen from ALL SOURCES in thousands of tonnes	Mass of fish caught by UK fishermen from SUSTAINABLE SOURCES in thousands of tonnes	Percentage of fish caught from sustainable sources
2002	690.0	427.8	62.0
2004	655.0	396.6	60.5
2006	619.0	386.0	62.4
2008	589.0	436.1	74.0
2010	611.5	465.0	

(a) (i) Calculate the percentage of fish caught from sustainable sources in 2010.

_____

_____

_____

_____ %

(2)

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(ii) Describe the pattern in the table above for the mass of fish caught from all sources.

Suggest reasons for this pattern.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

(4)

(iii) Suggest why the percentage of fish caught from sustainable sources is increasing.

_____

_____

(1)

(b) Give **two** methods of maintaining fish stocks at a sustainable level.

1. _____

2. _____

(2)

(c) The image below shows a fish farm.



© debsthelio/iStock/Thinkstock

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In a fish farm, large numbers of fish are grown in cages in the sea.

Why do fish in the cages grow faster than fish of the same species that are free in the sea?
You should refer to energy in your answer.

_____

_____

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_____

(4)

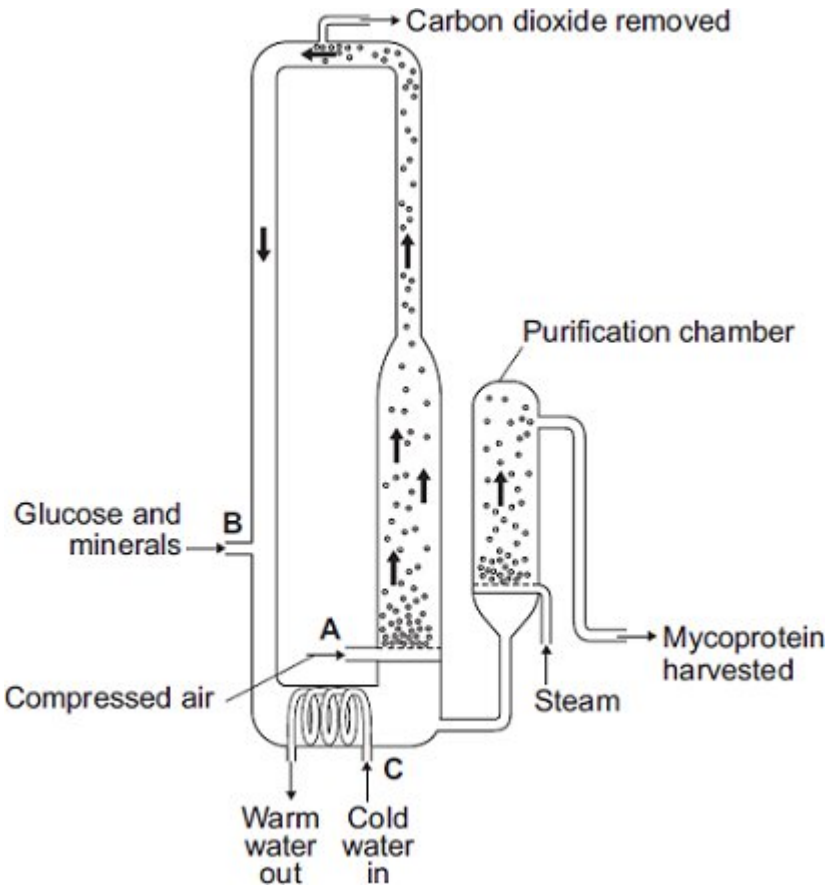
(Total 13 marks)

Q11.

The diagram shows a fermenter. This fermenter is used for growing the fungus *Fusarium*.

Fusarium is used to make mycoprotein.

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(a) Bubbles of air enter the fermenter at **A**.

Give **two** functions of the air bubbles.

1. _____

_____

2. _____

_____

(2)

(b) Why is glucose added to the fermenter?

_____

_____

(1)

(c) The fermenter is prevented from overheating by the cold water flowing in through the heat exchanger coils at **C**.

Name the process that causes the fermenter to heat up.

_____

(1)

(d) It is important to prevent microorganisms other than *Fusarium* growing in the fermenter.

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(i) Why is this important?

_____

_____

(1)

(ii) Suggest **one** way in which contamination of the fermenter by microorganisms could be prevented.

_____

_____

(1)

(e) Human cells cannot make some of the amino acids which we need. We must obtain these amino acids from our diet.

The table shows the amounts of four of these amino acids present in mycoprotein, in beef and in wheat.

Name of amino acid	**Amount of amino acid per 100 g in mg**			**Daily amount needed by a 70 kg human in mg**
	Mycoprotein	**Beef**	**Wheat**	
Lysine	910	1600	300	840
Methionine	230	500	220	910
Phenylalanine	540	760	680	980
Threonine	610	840	370	490

A diet book states that mycoprotein is the best source of amino acids for the human diet.

Evaluate this statement.

Remember to include a conclusion in your evaluation.

_____

_____

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_____

_____

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_____

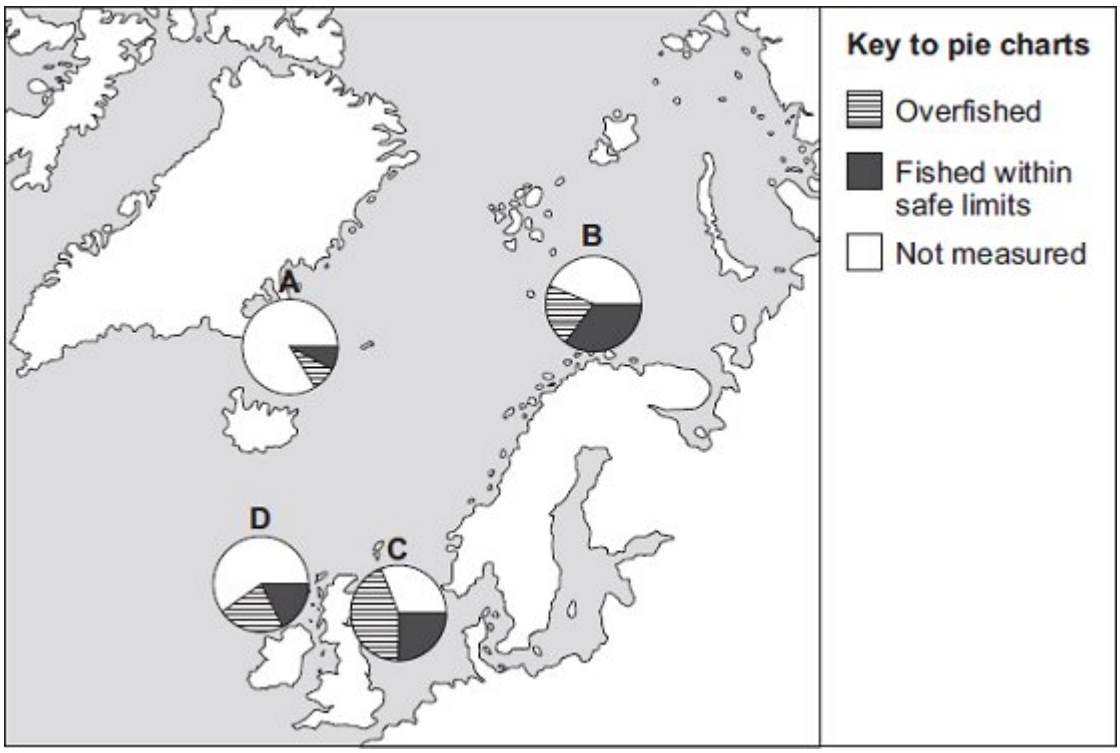
_____

(4)

(Total 10 marks)

Q12.

The map shows pie charts, **A**, **B**, **C** and **D**, that give information about fisheries in some of the seas around Europe.



© European Environment Agency

(a) Which pie chart, **A**, **B**, **C** or **D**, shows the fishery with the largest amount of overfishing? ☐

(1)

(b) It is important to maintain fish stocks high enough for breeding to continue.

Give the reason why.

_____

_____

(1)

(c) Give **two** ways fish stocks can be conserved.

_____

_____

_____

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_____

(2)

(Total 4 marks)

Q13.

There are many ways to increase the efficiency of food production.

(a) The table shows the energy available to humans from two different food chains.

Food chain	Energy transferred to humans in kJ per hectare of crop
Wheat → humans	900 000
Wheat → pigs → humans	90 000

(i) Compare the amount of energy the two food chains transfer to humans.

_____

_____

(1)

(ii) Give **one** reason for the difference in the amount of energy the two food chains transfer to humans.

_____

_____

(1)

(b) *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

Give methods used in the factory farming of animals.
Explain the advantages and disadvantages of these methods.

_____

_____

_____

_____

_____

_____

_____

_____

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_____

(6)

(Total 8 marks)

Q14.

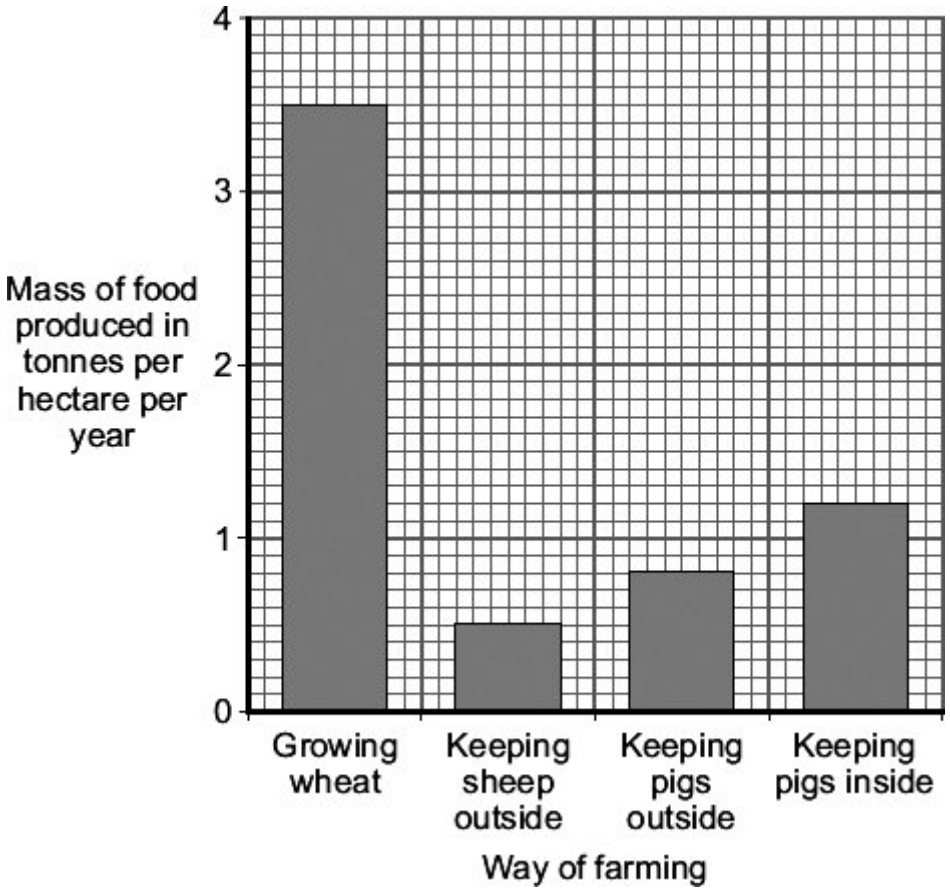
The photographs show four ways of farming.



Growing wheat by Eileen Henderson [CC-BY-SA-2.0], via Wikimedia Commons. Keeping Sheep outside by Andrew Smith [CC-BY-SA-2.0], via Wikimedia Commons. Keeping Pigs outside by David Williams [CC-BY-SA-2.0], via Wikimedia Commons. Keeping Pigs inside supplied by iStockphoto/ Thinkstock.

The bar chart shows the amount of food produced from these four ways of farming.

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(a) How much extra food can be produced when farmers grow wheat, compared with keeping sheep outside?

Show clearly how you work out your answer.

_____

_____

Answer _____ tonnes per hectare per year

(2)

(b) Sheep eat grass.
For every 1000 g of grass eaten, a sheep increases in mass by only 50 g.
The other 950 g is lost.

How is the other 950 g lost?

Tick (✓) **two** boxes.

As oxygen from photosynthesis ☐

As faeces ☐

As meat ☐

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As carbon dioxide from respiration ☐

(2)

(c) (i) Pigs kept inside lose less energy than pigs kept outside.

Why?

Tick (✓) **two** boxes.

Pigs kept inside are fed more. ☐

Pigs kept inside are kept in small pens. ☐

Pigs kept inside are kept warm in the winter. ☐

Pigs kept inside are healthier. ☐

(2)

(ii) Meat from pigs kept inside is usually cheaper than meat from pigs kept outside.

Give **one** reason why.

_____

_____

(1)

(Total 7 marks)

Q15.

There are plans for a 'cattle factory' to be built in the UK.

Information about the cattle factory and traditional cattle farming in the UK is given below.



Cattle factory



Traditional cattle farming

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Cattle factory

- There will be over 8 000 cows in three large sheds.
- Each cow will be milked three times a day.
- Each cow will produce about 50 litres of milk every day.
- Waste will be collected and used to produce electricity for 2 000 homes.
- Cows are kept near to each other so disease can spread easily.

Traditional cattle farming

- Most farms have between 5 and 500 cows.
- The cows spend most of the time in fields.
- Cows are milked once or twice a day.
- Each cow produces up to 20 litres of milk a day.
- The waste is used as natural fertiliser for crops.

(a) Use the information to answer the questions.

(i) Give **two** reasons why some people think the cattle factory is a good idea.

1. _____

_____

2. _____

_____

(2)

(ii) Give **two** reasons why some people think traditional farming is better than the cattle factory.

1. _____

_____

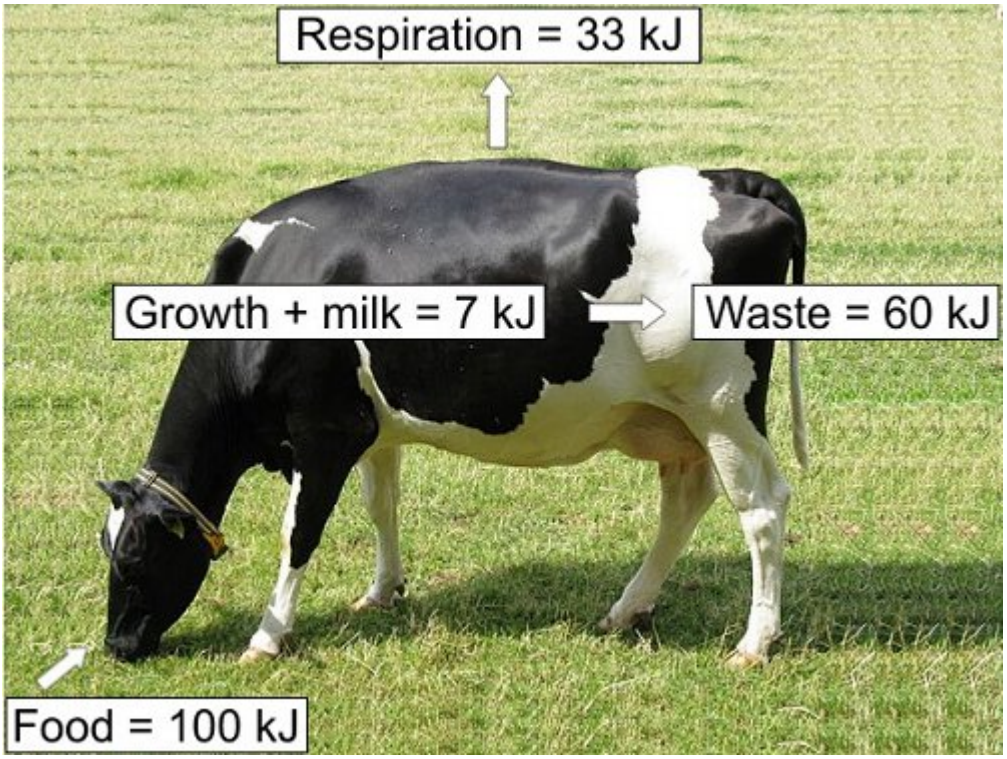
2. _____

_____

(2)

(b) The diagram shows what happens to 100 kJ of energy in the food eaten by a cow on a traditional farm.

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By Dohduhdah (Own work) [Public domain], via Wikimedia Commons

Use your knowledge and the information in the diagram to answer this question.

Compare the transfer of energy from the food eaten by cows in the cattle factory with the energy transferred by cows on a traditional farm.

Use words from the box to complete the table.

more	less	the same

Energy	Amount of energy transferred by cows in a cattle factory compared with cows on a traditional farm
transferred for growth and milk	
transferred in respiration	

(2)

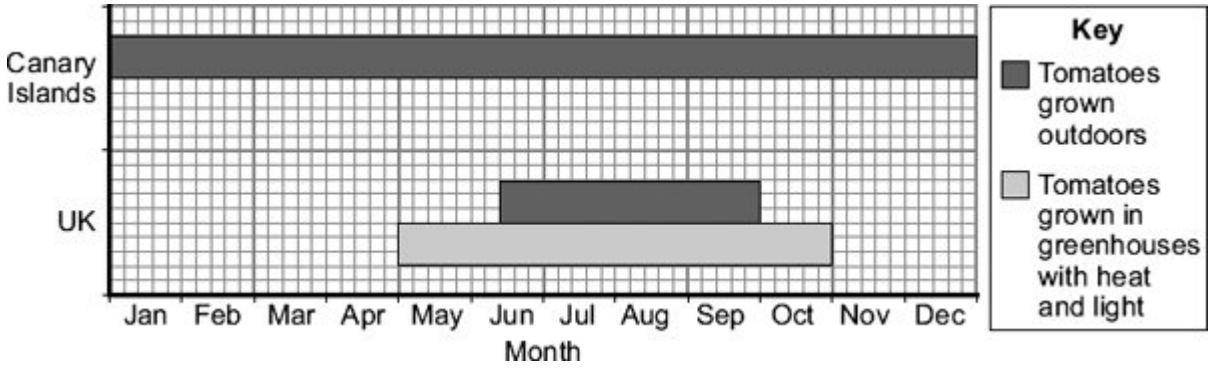
(Total 6 marks)

Q16.

Tomatoes are grown in greenhouses in the UK and outdoors in the UK and the Canary Islands.

The chart shows in which months these tomatoes can be bought in shops in the UK.

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The Canary Islands are about 3000 km from the UK.

Some people prefer to buy tomatoes grown in the UK.

What are the **advantages** and **disadvantages** of buying tomatoes grown in the UK, instead of buying tomatoes grown in the Canary Islands?

Advantages of buying tomatoes grown in the UK

_____

_____

_____

_____

Disadvantages of buying tomatoes grown in the UK

_____

_____

_____

_____

(Total 3 marks)

Q17.

Mycoprotein is produced from the fungus *Fusarium*. Mycoprotein is sometimes used instead of meat in foods for vegetarians.

(a) The table shows the amounts of some substances in mycoprotein and in chicken.

Substance	Mass in grams per 100 grams	
	Mycoprotein	Chicken
Protein	11.8	22.0
Dietary fibre	4.8	0.0
Fat	3.5	6.2

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Carbohydrate	2.0	0.0
Cholesterol	0.0	0.1

(i) Draw a ring around the correct answers to complete the sentence.

Eating mycoprotein instead of chicken helps to lower the risk of heart disease because

mycoprotein contains no [fat / carbohydrate / cholesterol] and

mycoprotein contains less [dietary fibre. / fat. / carbohydrate.]

(2)

(ii) A body-builder ate 4 kilograms of chicken each week to help him build up his muscles.

If he ate mycoprotein instead of chicken, he would need to eat about twice as much to have the same effect.

Use information from the table to give **one** reason why.

_____

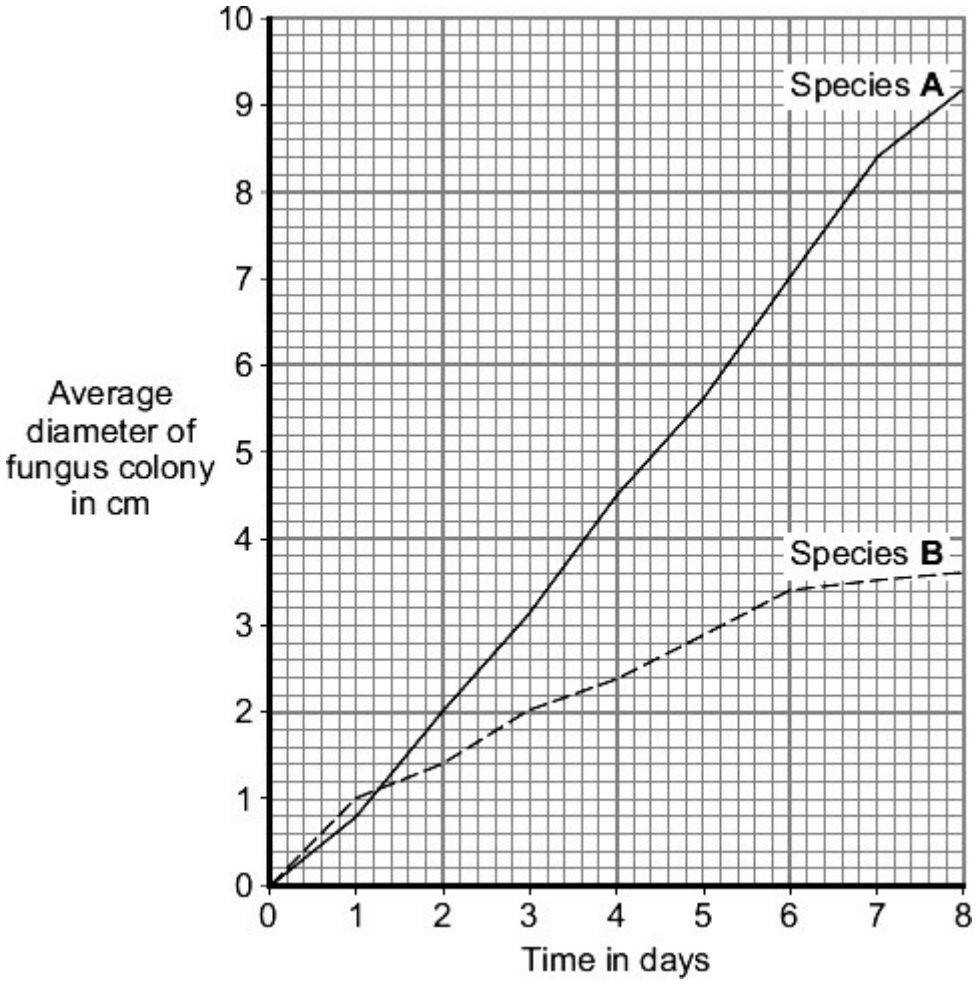
_____

(1)

(b) Scientists investigated the growth of two species, **A** and **B**, of the fungus *Fusarium*.
The scientists grew the fungus on agar jelly in Petri dishes.
They measured the diameter of a colony of each fungus every day for 8 days.

The graph shows the results.

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(i) Describe how the diameter of the colony of species **A** changed between day 0 and day 8.

_____

_____

_____

_____

(2)

(ii) Give **one** difference between the results for species **A** and the results for species **B**.

_____

_____

(1)

(c) Both Petri dishes contained the same nutrients.
Both Petri dishes were kept at 25 °C.

When *Fusarium* is grown in an industrial fermenter, other factors also need to be controlled.

Give **two** of these other factors.

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1. _____

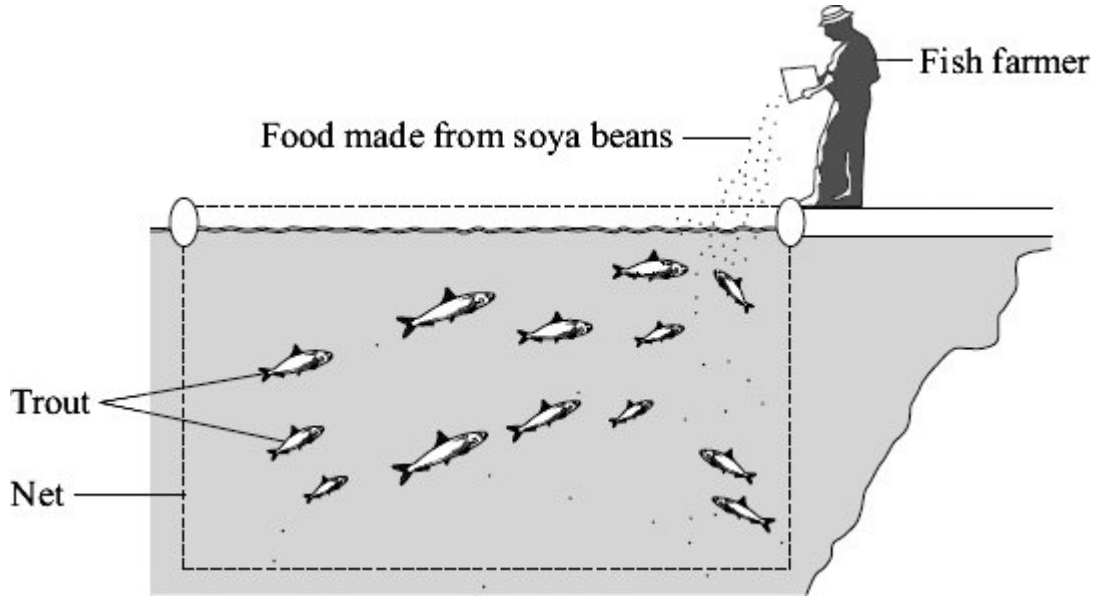
2. _____

(2)

(Total 8 marks)

Q18.

A fish farmer keeps trout in a large net in a lake.



The fish farmer feeds the trout on food made from soya beans.

When the trout are large enough the farmer sells them for food for people.

(a) Draw a pyramid of biomass for the three organisms in this food chain.

Label the pyramid.

(2)

(b) It would be more energy efficient if people ate the soya beans rather than eating the trout.

Which **two** of the following are reasons for this?

Tick (✓) **two** boxes.

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Some people do not like eating animals such as trout. ☐

The trout release energy when they respire. ☐

Soya bean plants release energy when they respire. ☐

Some energy will be lost in waste from the trout. ☐

Soya bean plants absorb energy during photosynthesis. ☐

(2)

(c) Suggest **one** advantage to the fish farmer of keeping the trout in a large net instead of letting them swim freely in the lake.

_____

_____

(1)

(d) Some trout die before they are large enough to be sold.
The dead trout contain carbon.

Use your knowledge of the carbon cycle to describe how this carbon is returned to the atmosphere after the trout die.

_____

_____

_____

_____

_____

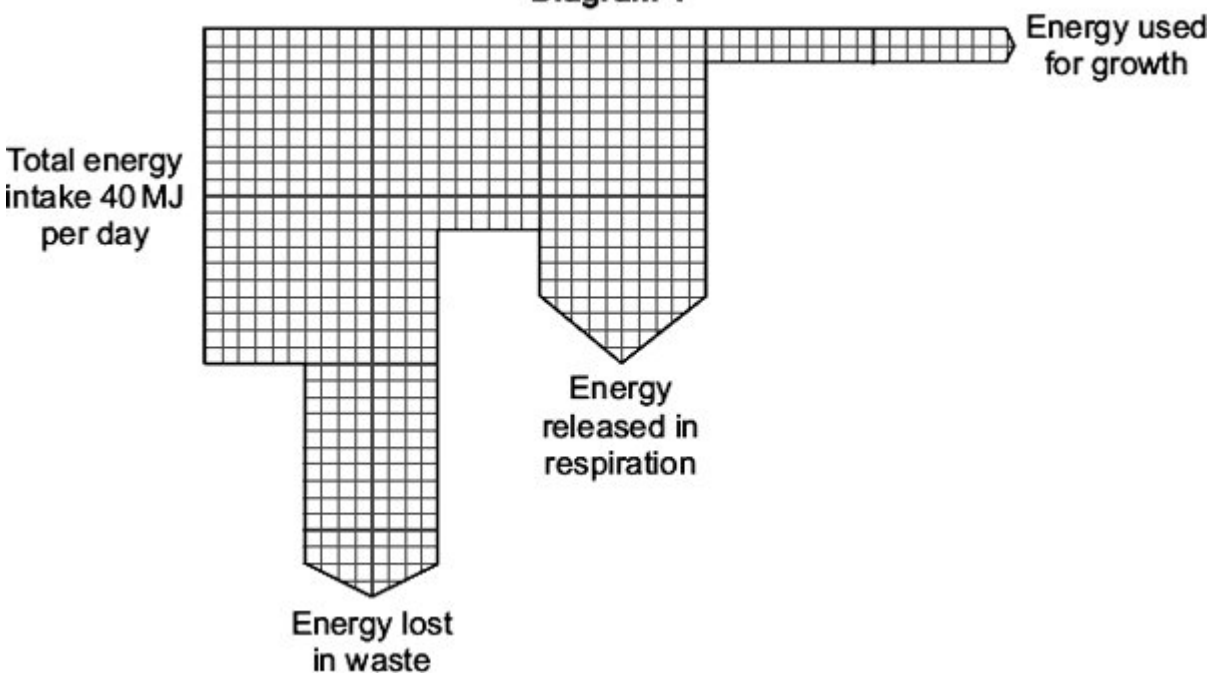
(2)
(Total 7 marks)

Q19.

(a) **Diagram 1** represents what happens to the energy in the food eaten by a herbivore (an animal that eats plants).

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Diagram 1



(i) How much energy is released in respiration by the herbivore?

_____

_____

Answer _____ MJ per day

(1)

(ii) What proportion of the total energy intake of the herbivore is used for growth?

Show clearly how you work out your answer.

_____

_____

_____

Proportion _____

(2)

(b) Give **two** ways in which the energy, released in respiration, is used by a herbivore.

1. _____

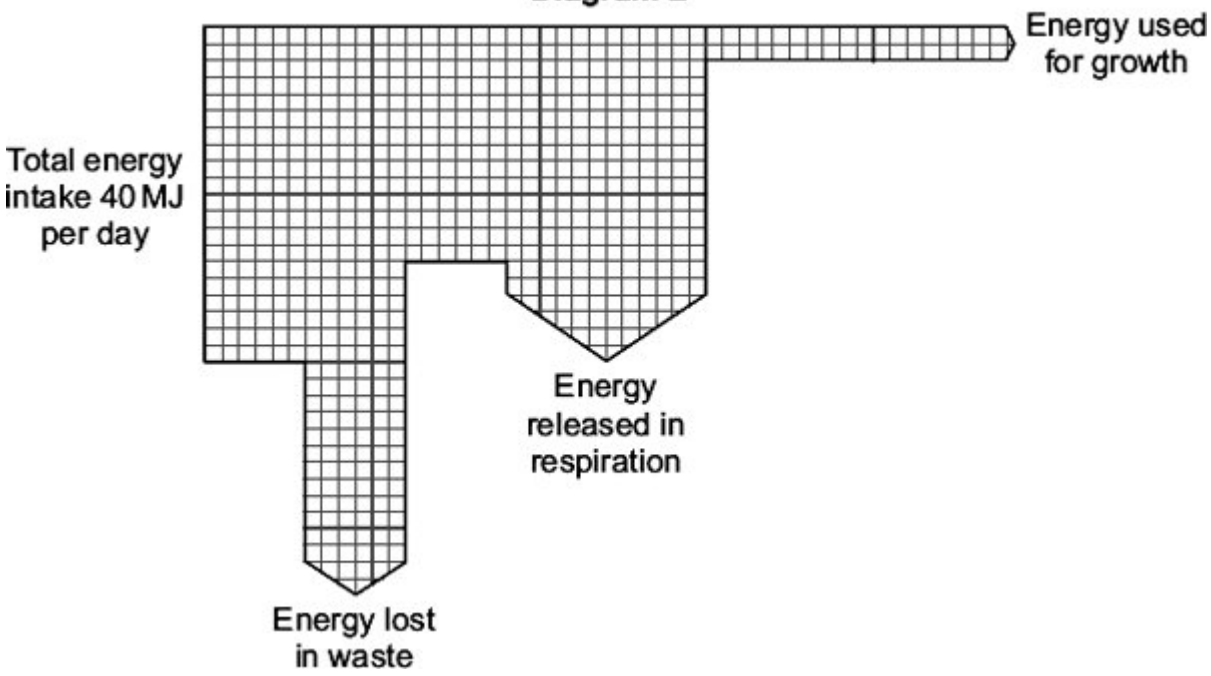
2. _____

(2)

(c) **Diagram 2** represents what happens to the energy in the food eaten by a carnivore (an animal that eats other animals).

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Diagram 2



The carnivore releases a greater proportion of energy in respiration than the herbivore.

Suggest **one** reason for this.

_____

_____

(1)

(d) Some farmers keep their animals outdoors. Other farmers keep their animals indoors.

Keeping farm animals indoors increases the proportion of energy in their food that is converted into growth.

Give **two** reasons why.

1. _____

_____

2. _____

_____

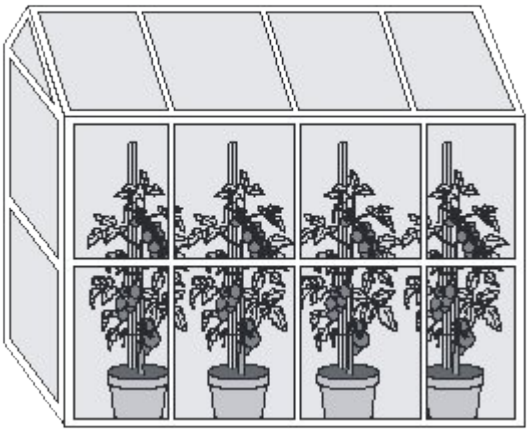
(2)

(Total 8 marks)

Q20.

In this country most tomatoes are grown in greenhouses.

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(a) Suggest **one** way in which a grower could increase the yield of tomatoes from plants growing in his greenhouse.

_____

_____

(1)

(b) Large supermarkets often import tomatoes from overseas.

(i) Suggest **two** reasons why a supermarket might decide to import tomatoes rather than buy them from British growers.

1. _____

_____

2. _____

_____

(2)

(ii) Importing tomatoes may be more damaging to the environment than selling tomatoes grown in this country.

Explain why.

_____

_____

_____

_____

(2)

(Total 5 marks)

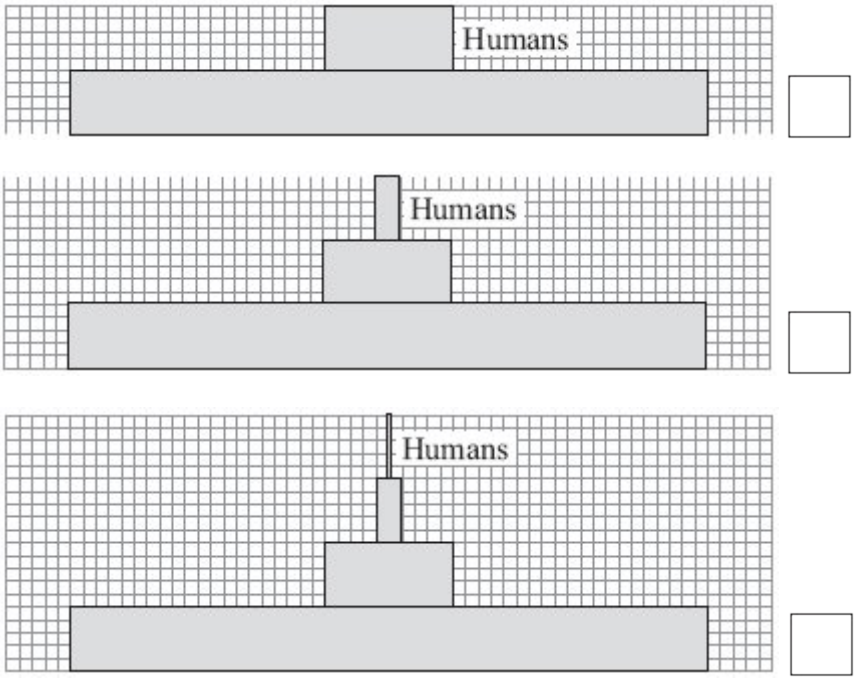
Q21.

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(a) The diagrams show three pyramids of biomass.

(i) Which pyramid would be the most efficient in providing food for humans?

Tick (✓) **one** box.



(1)

(ii) Give **one** reason for your choice.

_____

_____

(1)

(b) Pigs may be kept indoors or outdoors.

Pigs kept indoors **Pigs kept outdoors**

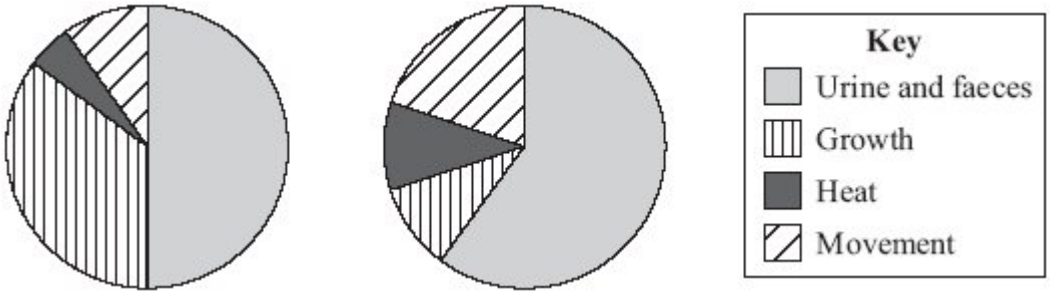




The pie charts show what happens to the energy in the food eaten by pigs kept indoors and pigs kept outdoors.

Pigs kept indoors **Pigs kept outdoors**

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(i) Farmers make more profit from keeping pigs indoors than from keeping pigs outdoors.

Use information from the pie charts to explain why.

_____

_____

_____

_____

(2)

(ii) Meat from pigs kept outdoors may cost more than meat from pigs kept indoors.

Some people prefer to buy meat from animals that have been kept outdoors.

Suggest **one** reason why.

_____

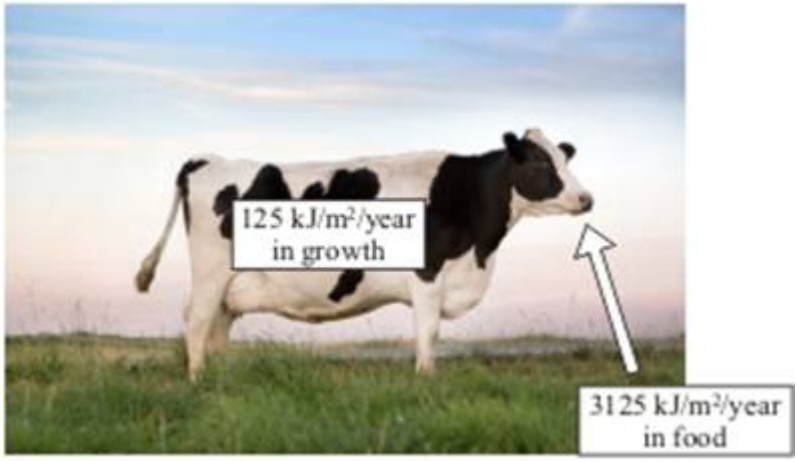
_____

(1)

(Total 5 marks)

Q22.

The photograph shows what happens to some of the energy in the food that a cow eats.



(a) Calculate the percentage of the energy in the cow's food that is transferred into new growth.

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Show clearly how you work out your answer.

_____

_____

Answer = _____ %

(2)

(b) The energy from the cow's food which is not transferred into new growth is lost.

Give **three** ways in which this energy is lost.

1. _____

_____

2. _____

_____

3. _____

_____

(3)

(c) The animals that we raise for food are usually herbivores (plant eaters) rather than carnivores (flesh eaters).

Explain why.

_____

_____

_____

_____

_____

(2)

(Total 7 marks)

Q23.

The table gives information about the growth of different types of organism.
The figures were obtained during the period of fastest growth for each organism.

Organism	**Time taken to double in mass**
Bacteria	40 minutes
Yeasts	2 hours
Fusarium	4 hours

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Algae	5 hours
Soybeans	1 week
Cattle	8 weeks

(a) (i) Which type of organism grows the fastest? _____

(1)

(ii) How many times faster than cattle do soybeans double in mass?

_____

(1)

(iii) *Fusarium* grows at its fastest rate in a fermenter.
Some scientists put **one tonne** of *Fusarium* into a fermenter.

Use data from the table to calculate how much *Fusarium* there would be in the fermenter after 8 hours.

Draw a ring around **one** answer.

2 tonnes **4 tonnes** **8 tonnes**

(1)

(b) *Fusarium* is used to make mycoprotein.

Read the information about substances found in mycoprotein.

- Protein – can be used for making cells, enzymes and antibodies.
- Fats – are rich in energy but large amounts in the diet can cause circulatory problems.
- Dietary fibre – helps to reduce the risk of colon cancer.

The table compares the composition of mycoprotein and beef.

Substance	**Percentage of dry mass**	
	Mycoprotein	**Beef**
Protein	47.2	68.3
Fat	13.5	30.1
Dietary fibre	19.2	0.0

Use the information above to answer the questions.

(i) Give **two** reasons why it would be better to eat mycoprotein instead of beef.

1. _____

_____

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2. _____

_____

(2)

(ii) Give **one** reason why it would be better to eat beef instead of mycoprotein.

_____

_____

(1)

(Total 6 marks)

Q24.

(a) Tuna fish are carnivores. In the wild they feed on smaller fish called herring. Herring feed on plankton. Tuna can be attacked by parasitic worms which feed on their flesh.

(i) In the space below sketch the appearance of a pyramid of biomass for this food chain.

Do not forget to label each section of the pyramid.

(2)

(ii) If a tuna eats 1 kg of herring, it gains about 65 g in mass.

Give **two** reasons why so little of the mass of the herring is converted into mass of the tuna.

1. _____

_____

2. _____

_____

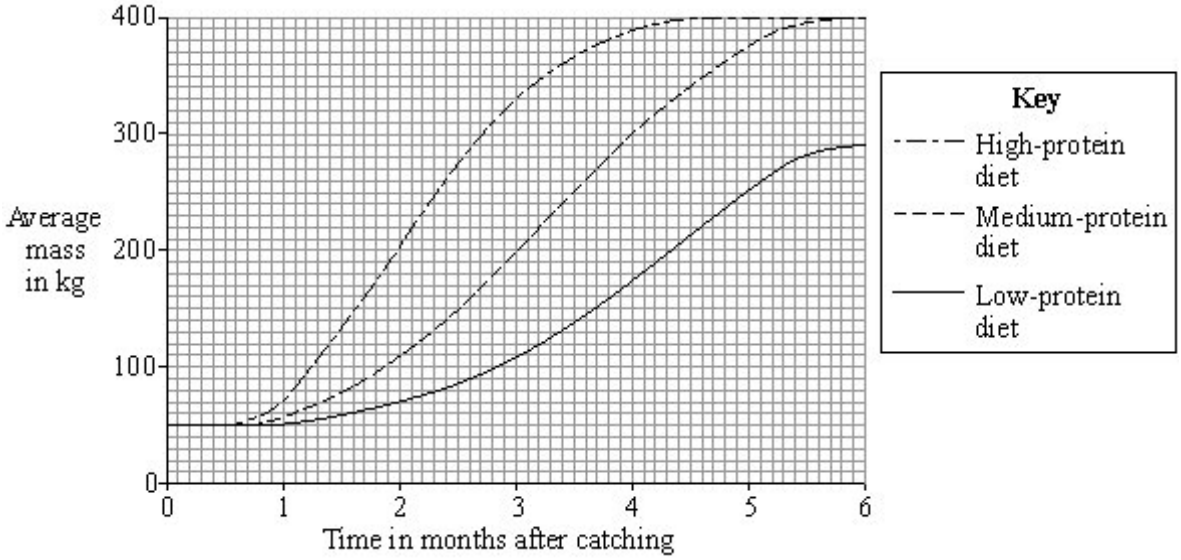
(2)

(b) Young tuna are caught by fish farmers and reared in large pens in the sea.

The fish are fed more food than they would normally catch themselves so they grow quickly. When they reach 400 kg they are sold.

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The graph below shows the effect of feeding tuna different amounts of protein in their food.



(i) Calculate the average increase in mass per month of the fish fed on the low-protein diet over the six months.

Show clearly how you work out your answer.

_____

_____

Average increase in mass per month _____ kg

(2)

(ii) There is not enough information in the graph to allow the fish farmer to decide whether to use the high-protein diet or the medium-protein diet.

Suggest **one** other piece of information that he needs in order to make this decision.

_____

_____

(1)

(c) Some consumers will not buy tuna grown in this way.

Suggest **one** reason for their decision.

_____

_____

(1)

(Total 8 marks)

Q25.

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A large supermarket chain is advertising ‘our goal is to make our business carbon neutral in the next five years’.

(i) Why does the supermarket management think that this will attract more customers?

_____

_____

(1)

(ii) One step that the supermarket chain intends to take is to obtain as much food as possible from British sources.

Explain how this will help the environment.

_____

_____

_____

_____

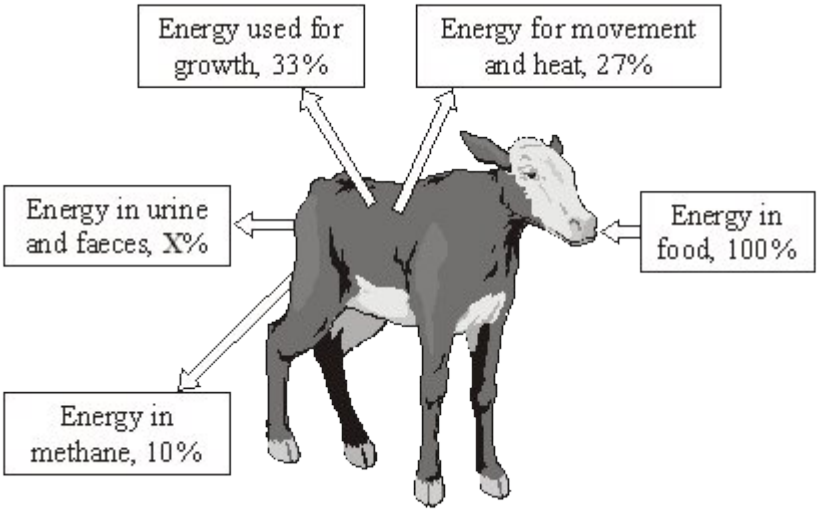
_____

(2)

(Total 3 marks)

Q26.

The diagram shows what happens to the energy in the food that a calf eats.



(a) Calculate the % energy lost as urine and faeces (**X**).
Show clearly how you work out your answer.

_____

_____

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Energy lost as urine and faeces _____ %

(2)

(b) The energy in the food eaten by the calf in one day is 6 megajoules.

Calculate the amount of this energy that would be used for growth.
Show clearly how you work out your answer.

_____

_____

Energy used for growth _____ megajoules.

(2)

(c) Which process in the body transforms energy in food into heat?

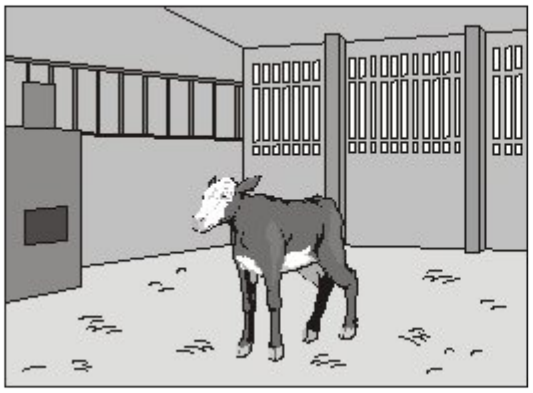
_____

(1)

(d) The pictures show two methods of raising calves indoors.

Method 2 is now banned.

Method 1



Method 2



(i) Calves raised indoors grow faster than calves raised outdoors.

Suggest **one** reason why.

_____

_____

(1)

(ii) **Method 2** was banned after public campaigns.

Suggest **one** reason why people campaigned against this method of rearing calves.

_____

_____

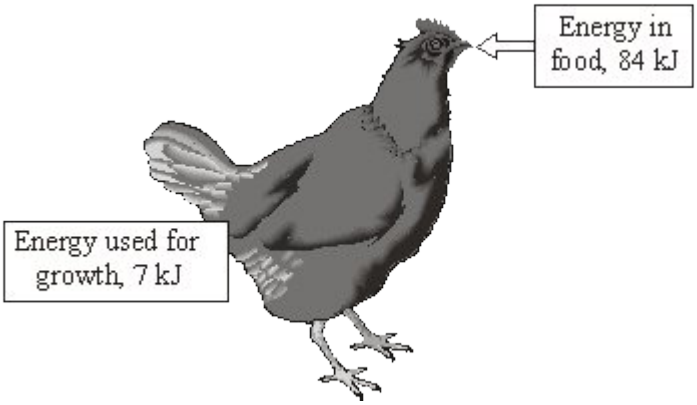
(1)

(Total 7 marks)

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Q27.

The diagram shows what happens to some of the energy in the food that a chicken eats.



(a) Calculate the percentage of energy used for growth.

Show clearly how you work out your answer.

_____

_____

Energy used for growth = _____ %

(2)

(b) The energy that is not transferred into growth is lost.

Give **three** ways in which this energy is lost.

1. _____

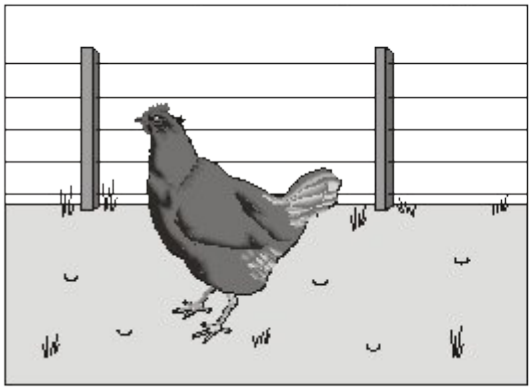
2. _____

3. _____

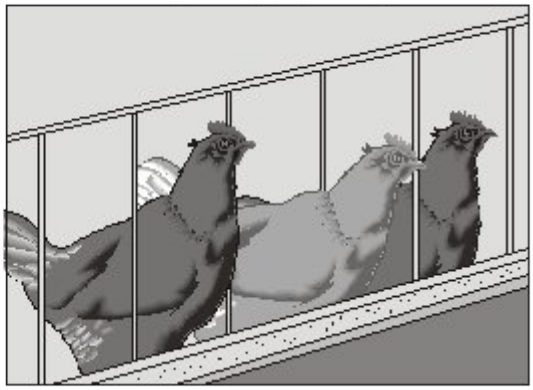
(3)

(c) The pictures show two ways of keeping chickens to produce eggs.

Chickens kept outdoors (free-range)



Chickens kept in cages (battery chickens)



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Battery chickens produce more eggs per year than free-range chickens.

Suggest **one** reason why.

_____

_____

(1)

(d) The animals that we raise for food are usually herbivores (plant eaters) rather than carnivores (flesh eaters).

Explain why.

_____

_____

_____

_____

_____

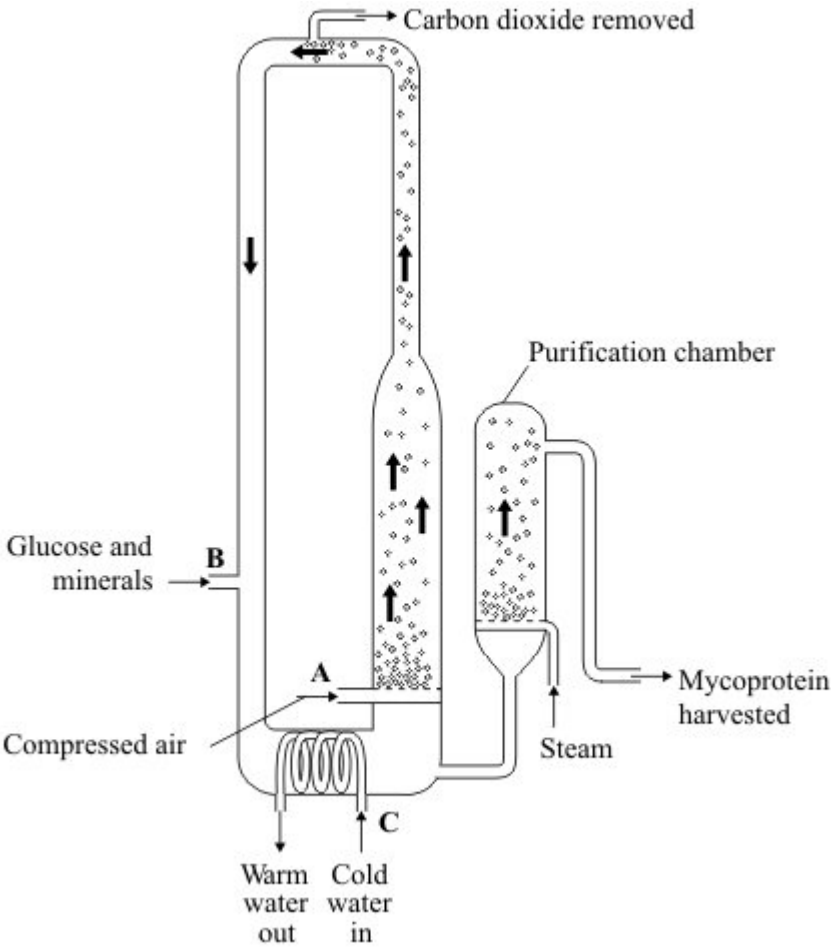
(2)

(Total 8 marks)

Q28.

The diagram shows a fermenter. This fermenter is used for growing the fungus *Fusarium* which is used to make mycoprotein.

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(a) Bubbles of air enter the fermenter at **A.**

Give **two** functions of the air bubbles.

1. _____

_____

2. _____

_____

(2)

(b) Glucose is added to the fermenter at **B.**

Explain why glucose is added.

_____

_____

(1)

(c) The fermenter is prevented from overheating by the cold water flowing in through the heat exchanger coils at **C.**

Explain what causes the fermenter to heat up.

_____

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_____

(1)

(d) It is important to prevent microorganisms other than *Fusarium* from growing in the fermenter.

(i) Why is this important?

_____

_____

(1)

(ii) Suggest **two** ways in which contamination of the fermenter by microorganisms could be prevented.

1. _____

_____

2. _____

_____

(2)

(e) Human cells cannot make some of the amino acids which we need. We must obtain these amino acids from our diet.

The table shows the amounts of four of these amino acids present in mycoprotein, in beef and in wheat.

Name of amino acid	Amount of amino acid per 100 g in mg			Daily amount needed by a 70 kg human in mg
	Mycoprotein	Beef	Wheat	
Lysine	910	1600	300	840
Methionine	230	500	220	910
Phenylalanine	540	760	680	980
Threonine	610	840	370	490

A diet book states that mycoprotein is the best source of amino acids for the human diet.

Evaluate this statement.

Remember to include a conclusion in your evaluation.

_____

_____

_____

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_____

_____

_____

_____

_____

(4)

(Total 11 marks)

Q29.

Read the article about sustainable cod fishing.

> Every December the European Commission makes proposals for cod fishing quotas in European Union (EU) waters. These quotas take into account data obtained by scientists.
>
> Scientists calculate what proportion of the cod stock is being caught each year. They do this by working out the numbers in each age-group of cod.
>
> Every year the fishermen say the scientists are exaggerating the danger to the stocks in the North Sea. The scientists say the fishermen are threatening their own long-term livelihoods by ignoring their warnings of a collapse of cod populations.
>
> The scientists say that fishermen go only to parts of the sea where there are a lot of cod, so they get the wrong idea of the number of cod in the whole area.

(a) The scientists and the fishermen have different opinions about the size of the cod population.

Explain why.

_____

_____

_____

_____

(2)

(b) The final decision on how many cod the fishermen are allowed to catch may not depend entirely on the data produced by the scientists.

Suggest **two** reasons for this.

1. _____

_____

2. _____

_____

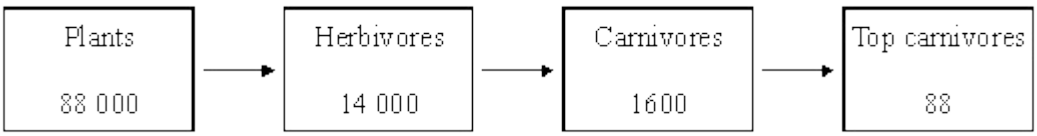
(2)

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(Total 4 marks)

Q30.

The diagram shows a food chain in a pond. The figures show the amounts of energy in each type of organism, in kilojoules per m^2 of pond per year.



(a) Calculate the percentage of the energy in the plants that is passed to the top carnivores. Show clearly how you work out your final answer.

_____

_____

_____

Answer _____ %

(2)

(b) In the space below, draw a pyramid of biomass for this food chain. Label your drawing with the names of the organisms.

(2)

(c) If humans ate organisms from this food chain, it would be more efficient to eat plants than to eat herbivores. Why is this?

_____

_____

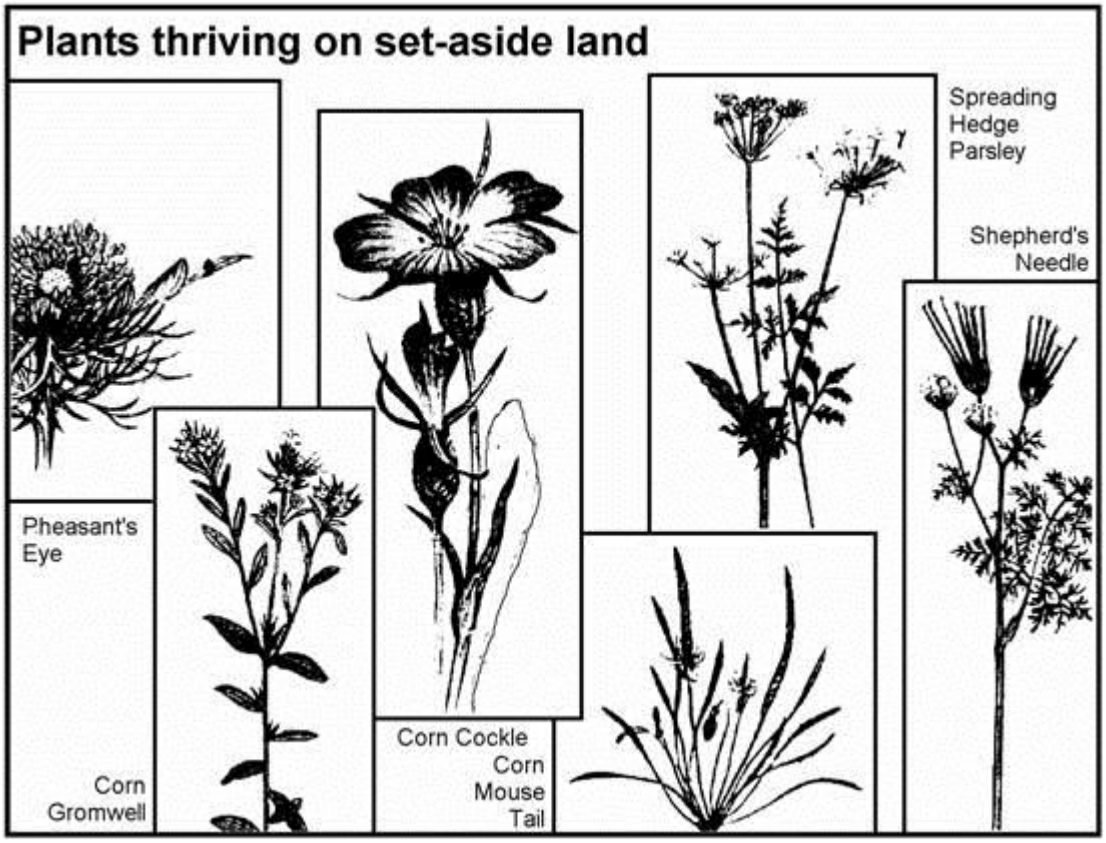
_____

(1)

(Total 5 marks)

Q31.

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The drawings and text for this question are based on an article from The Independent newspaper.

Some of Britain's rarest wild flowers are likely to make a come-back thanks to an EC set-aside regime in which 15 per cent of arable land has been taken out of production.

As a result of this set-aside, shepherd's needle, pheasant's eye, corn gromwell, corn cockle, spreading hedge parsley and corn mouse tail are now thriving once again. They were once common in and around cereal fields and were even regarded as weeds, but were swept to near extinction by the intensification of agriculture after the Second World War. Their small, pale flowers are hardly seen. These plants cannot compete in fields where modern cereal crops are cultivated. Nor, however, do they flourish in semi-natural or wild habitats where nature is left to its own devices. They need farmland which is lightly tilled and cut once a year.

Dr Nick Sotherton, lowland research manager with the Game Conservancy Council, says that these species will flourish under the new rotational set-aside regime, in which farmers are compensated for taking land out of production in an attempt to end crop surpluses.

EC agriculture ministers are meeting to decide how much land should be used for rotational set-aside – in which a field is taken out of production for just one year before being replanted – and how much should be set-aside permanently. The ultimate set-aside is a wood, and Britain is seeking a forestry option.

The Game Conservancy Council says that the rotational scheme can benefit ground nesting birds as well as rare flowers that will not be helped by longer-term set-aside. But Richard Knight of the Wildlife Advisory Group, says "Non-rotational is better because it gives flora and fauna a chance to get well established".

"Intensification of agriculture" has led to the creation of artificial ecosystems.

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(a) Explain how the creation of artificial ecosystems may have led to the near-extinction of the plants seen in the picture above.

_____

_____

_____

_____

_____

_____

(4)

(b) What would you recommend to ministers meeting to decide a policy involving rotational set-aside and permanent set-aside? Explain the reasons for your answer.

_____

_____

_____

_____

_____

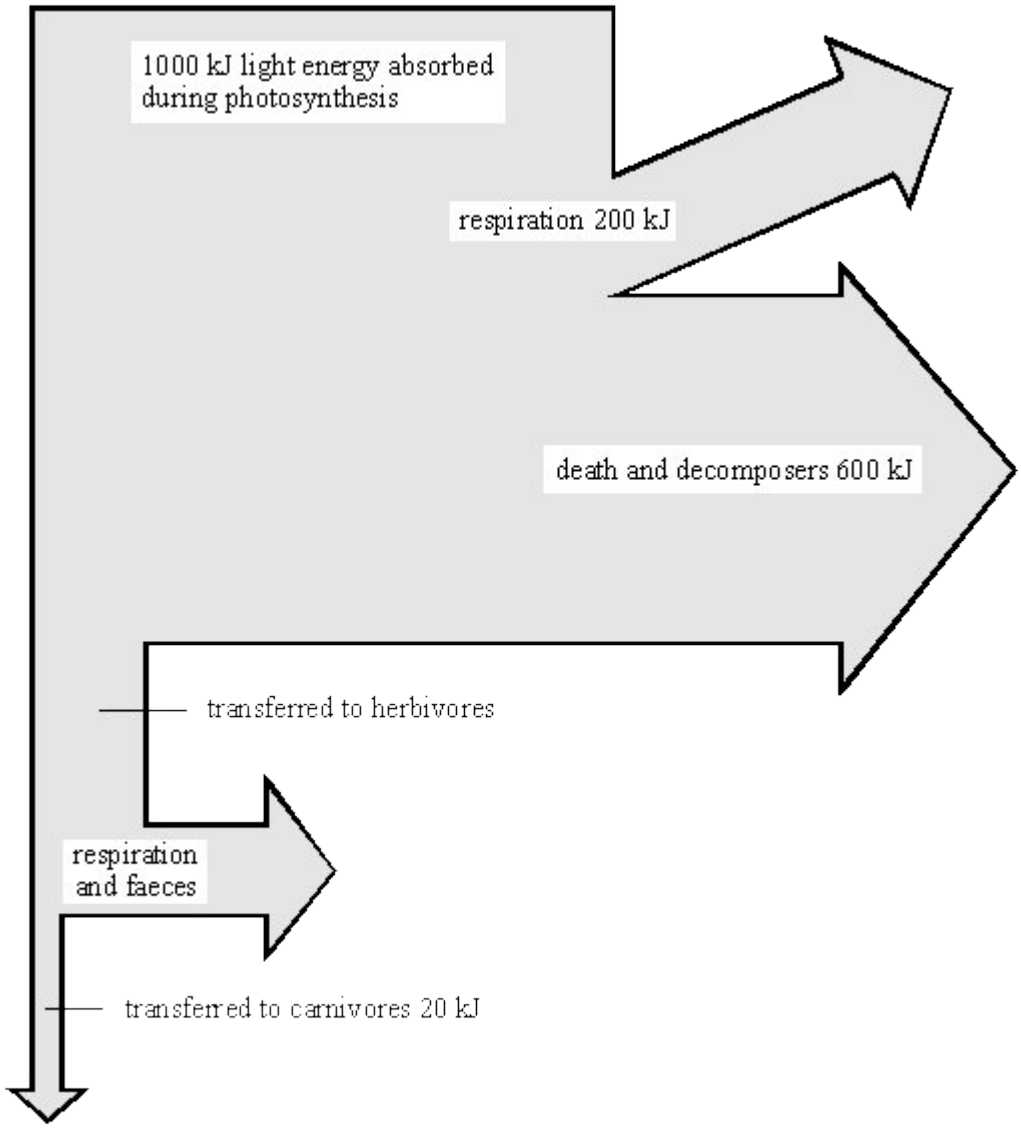
(4)

(Total 8 marks)

Q32.

(a) The diagram shows what happens to each 1000 kJ of light energy absorbed by plants growing in a meadow.

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Use the information from the diagram to calculate:

(i) how much energy was transferred to herbivores;

_____ kJ

(1)

(ii) the percentage of the energy absorbed during photosynthesis that was eventually transferred to carnivores. Show your working.

_____ %

(2)

(b) The table gives the energy output from some agricultural food chains.

FOOD CHAIN	ENERGY AVAILABLE TO HUMANS

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	FROM FOOD CHAIN (kJ PER HECTARE OF CROP)
cereal crop ⇒ humans	800 000
cereal crop ⇒ pigs ⇒ humans	90 000
cereal crop ⇒ cattle ⇒ humans	30 000

Explain why the food chain *cereal crop* ⇒ *humans* gives far more energy than the other two food chains.

_____

_____

_____

_____

_____

_____

_____

_____

(3)

(c) The amounts of energy available to humans from the food chain
cereal crop ⇒ *pigs* ⇒ *humans*
can be increased by changing the conditions in which the pigs are kept.

Give **two** changes in conditions which would increase the amount of energy available. In each case explain why changing the condition would increase the available energy.

Change of condition 1 _____

Explanation _____

_____

_____

Change of condition 2 _____

Explanation _____

_____

_____

(4)

(Total 10 marks)

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Q33.

Battery Pigs!

Some countries have battery pigs! Large numbers of pigs are kept indoors and have limited living space which restricts their movement. The temperature of their environment is carefully controlled.



This is a way of producing food efficiently.

These pigs have their movement restricted. Explain why.

_____

_____

_____

_____

(Total 2 marks)

Q34.

Many of the plants that we eat as fruits and vegetables in the UK are imported. The transport used to import foods accounts for about 2.5% of the UK's carbon dioxide emissions. During winter, it is necessary to import foods because most of the UK's fresh vegetables have to be grown in greenhouses. Energy is needed to heat and light these greenhouses.

Give **one** argument for and **one** against growing all of our vegetables in the UK. These arguments should consider the environmental effect of carbon dioxide emissions.

Argument for:

_____

_____

_____

_____

Argument against:

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_____

_____

_____

_____

(Total 3 marks)

Q35.

Nitrate fertilisers are important in agriculture. They help to increase crop yields and so make food cheaper to buy. Some of the nitrate fertilisers run off into rivers and get into drinking water. The problem is that the nitrates can react with iron in our blood. This reduces the blood's ability to carry oxygen. If the amount of nitrate in drinking water is too high, it can cause 'blue baby syndrome', in which babies look blue due to lack of oxygen.

The table shows the amount of nitrate fertilisers used and the crop yield.

Nitrate fertilisers in kilograms per hectare of land	0	150	250
Crop yield in tonnes per hectare of land	5	8	7

Use the information above to suggest what should be done, by farmers and government, to prevent 'blue baby syndrome'. Explain the reasons for your suggestions.

_____

_____

_____

_____

_____

_____

_____

_____

(Total 3 marks)

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