

Food Production

These practice questions can be used by students and teachers and is suitable for GCSE AQA Biology topic Questions 8641

Level: GCSE AQA Biology 8641

Subject: Biology

Exam board: GCSE AQA

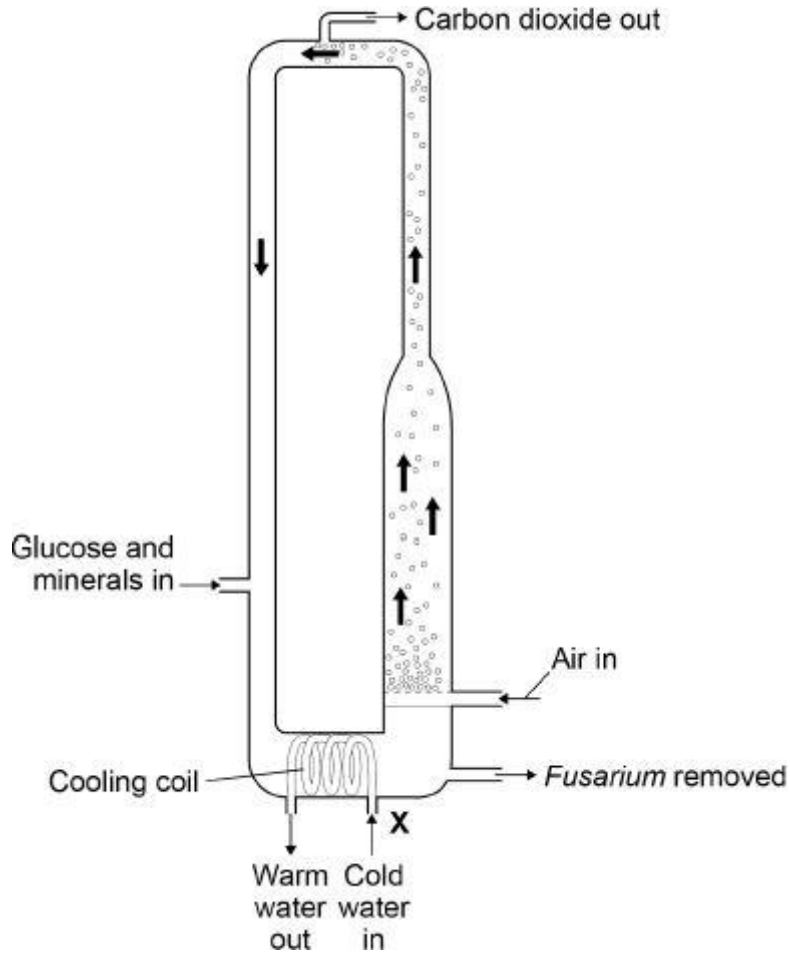
Topic: Food Production

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.

5 °C	<input type="checkbox"/>
20 °C	<input type="checkbox"/>
30 °C	<input type="checkbox"/>
85 °C	<input type="checkbox"/>

(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.

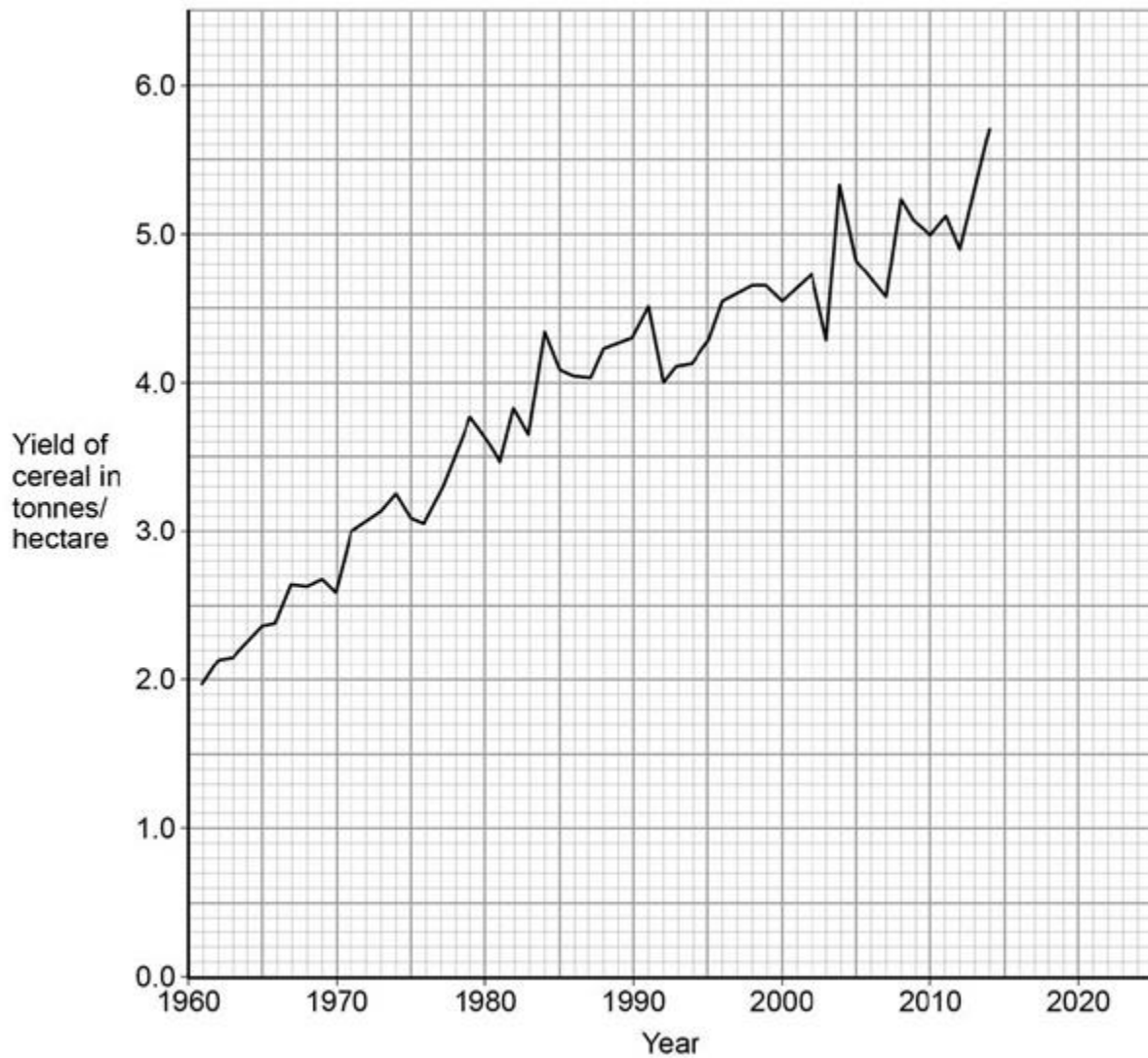
- | | |
|-----------|--------------------------|
| 100 grams | <input type="checkbox"/> |
| 110 grams | <input type="checkbox"/> |
| 200 grams | <input type="checkbox"/> |
| 220 grams | <input type="checkbox"/> |

(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.

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	<input type="checkbox"/>
Fat	<input type="checkbox"/>
Protein	<input type="checkbox"/>
Starch	<input type="checkbox"/>

(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.	<input type="checkbox"/>
A pathogenic fungus grew on the cereal in 2004.	<input type="checkbox"/>
Farmers added more nitrate to the soil in 2003.	<input type="checkbox"/>
More cereal seeds were sown in 2003.	<input type="checkbox"/>
More rain fell in spring and early summer in 2004.	<input type="checkbox"/>

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

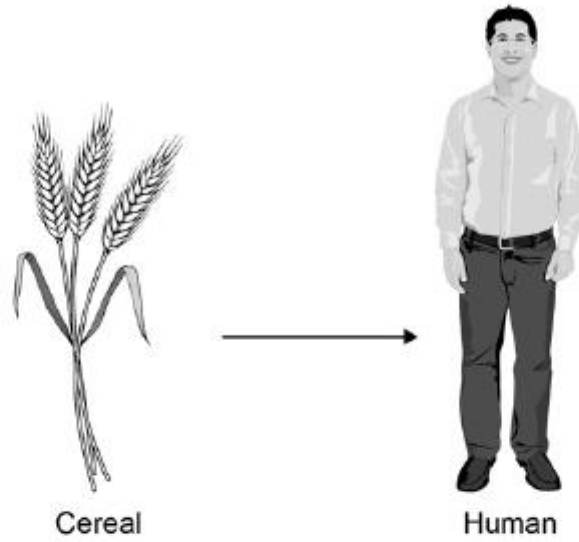
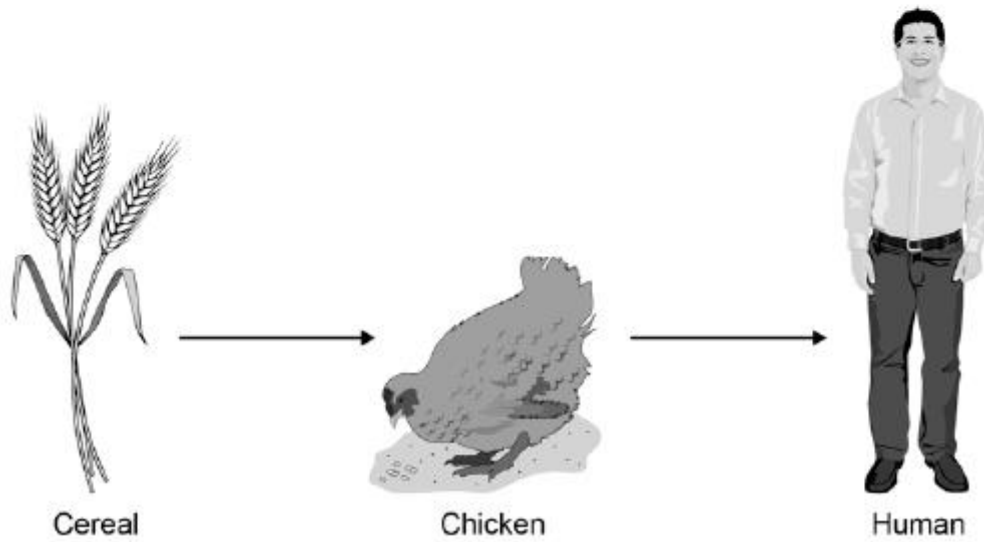
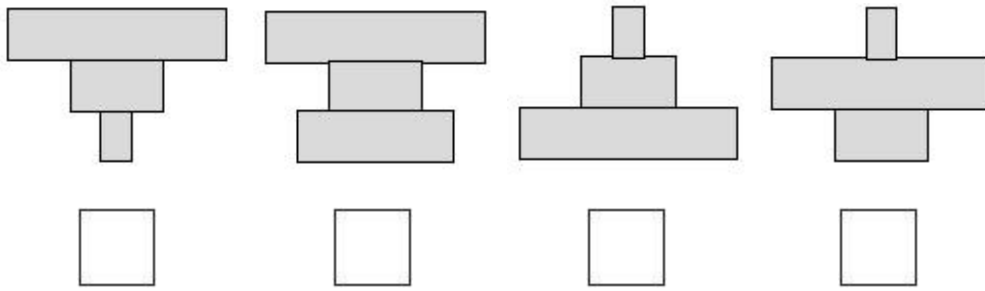


Figure 2



- (e) Which pyramid of biomass is correct for the food chain shown in **Figure 2**?
Tick **one** box.



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.

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

kJ / m ² / 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)

- (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.

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.

Decrease in seals = _____ %

(2)

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

Suggest **two** reasons why.

1.

2.

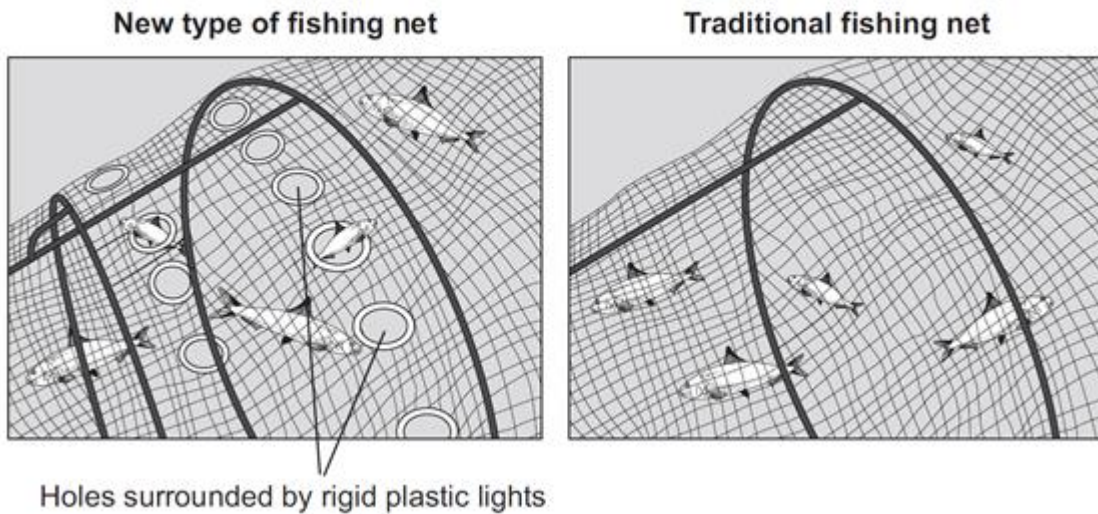
(2)
(Total 10 marks)

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)

(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)

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.

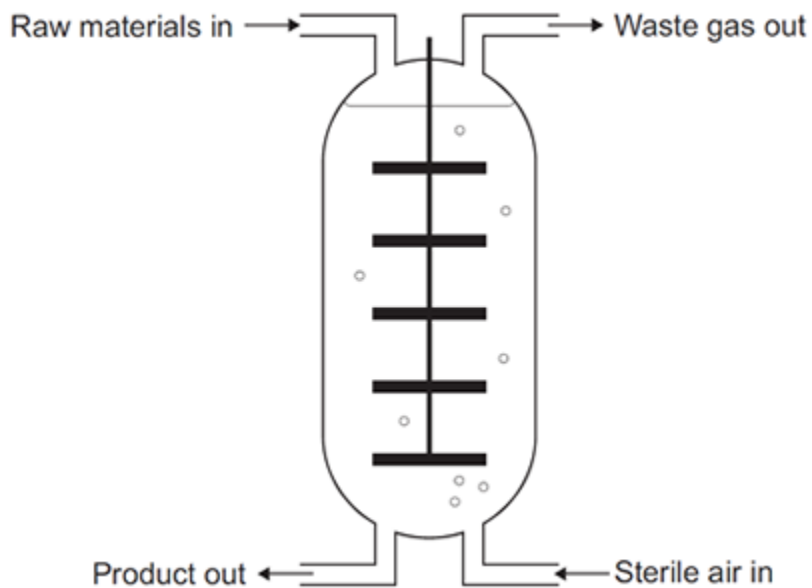
2.

(2)

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

Figure 2 shows a fermenter used to produce mycoprotein.

Figure 2



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



© studiodr/iStock/Thinkstock

Figure 2
Free-range chickens



© 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)

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

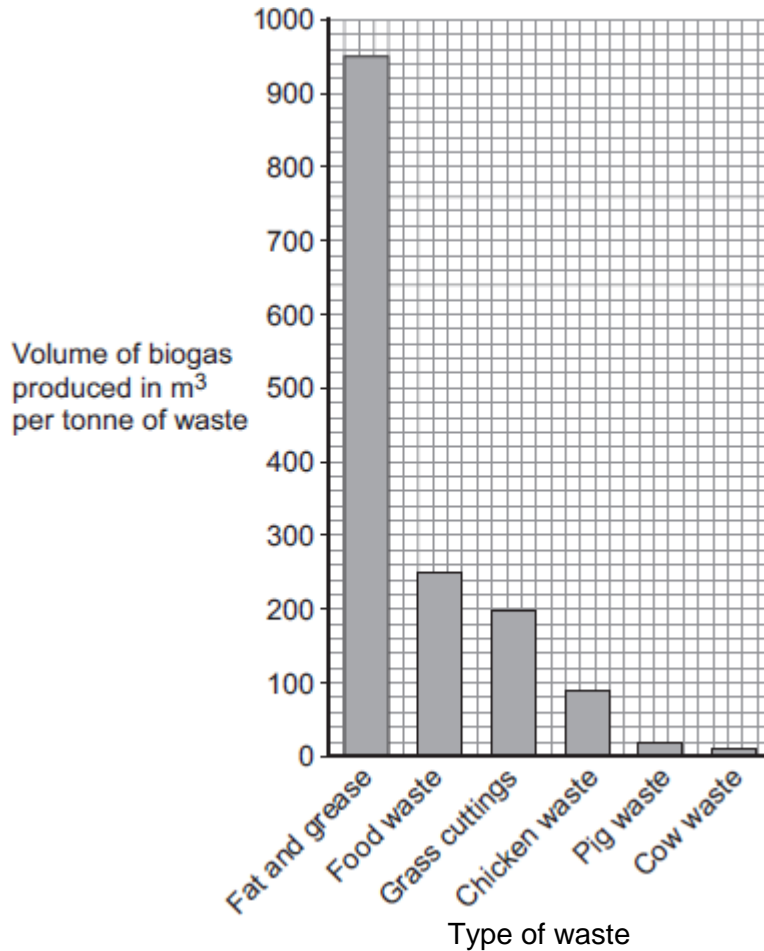
Explain why the volume of biogas produced would be **less** at higher temperatures.

(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?

_____ m³ (1)

- (ii) Biogas is 60% methane.

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

_____ m³ (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*?

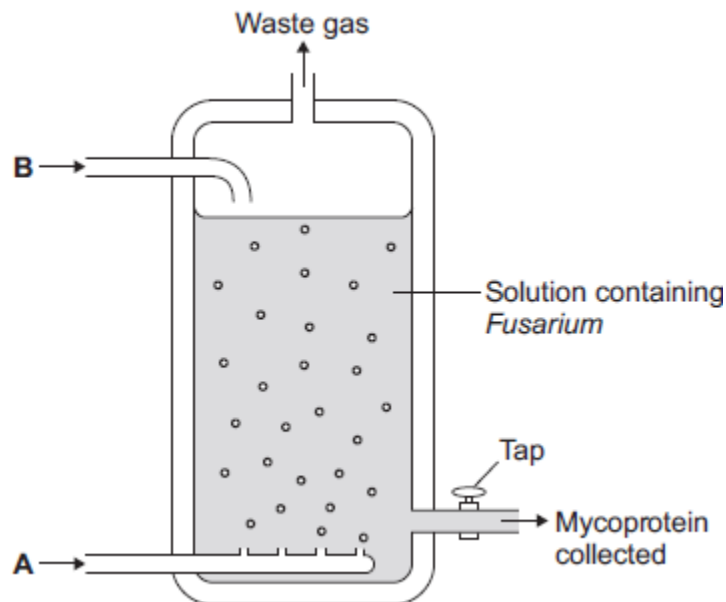
Draw a ring around the correct answer.

bacterium

fungus

virus

The diagram below shows a fermenter used in mycoprotein production.



(1)

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

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

(1)

(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.

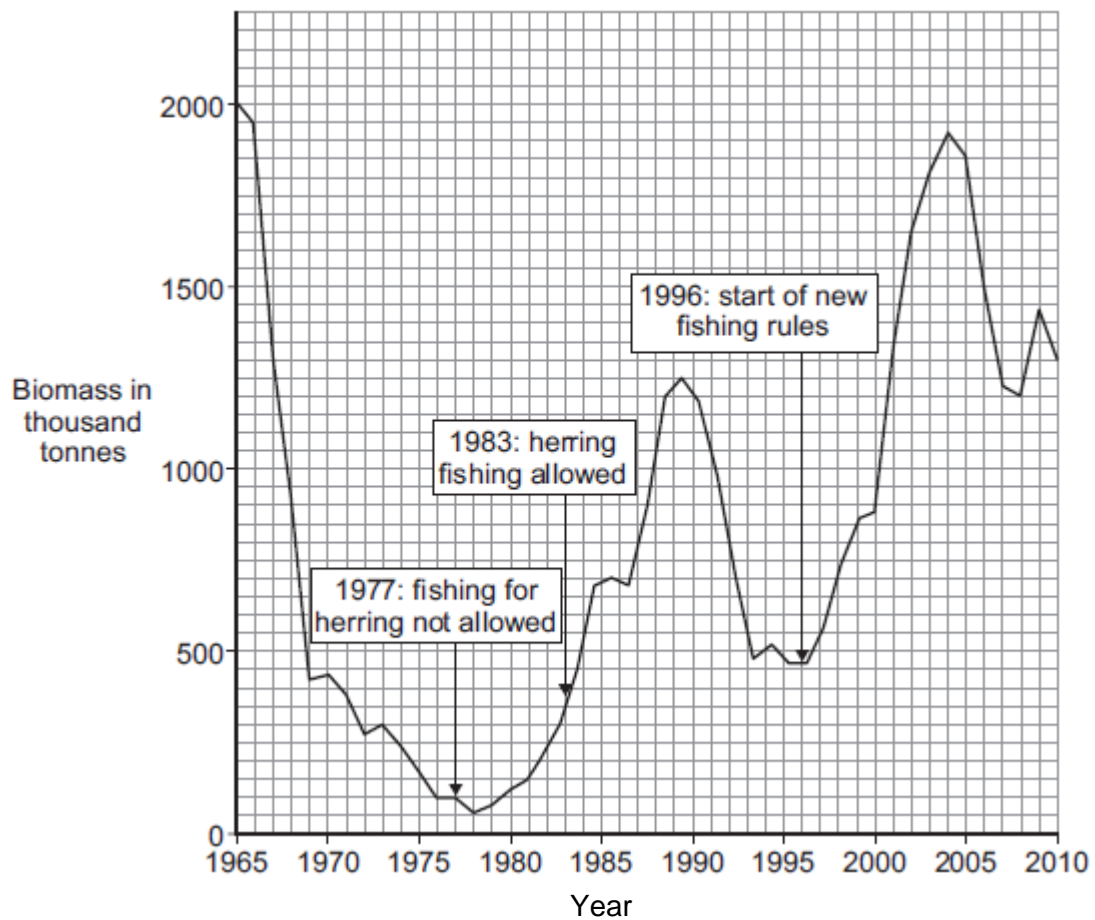
The photographs show a fishing boat and some herring.



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.



(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)

(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.

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)

- (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

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.

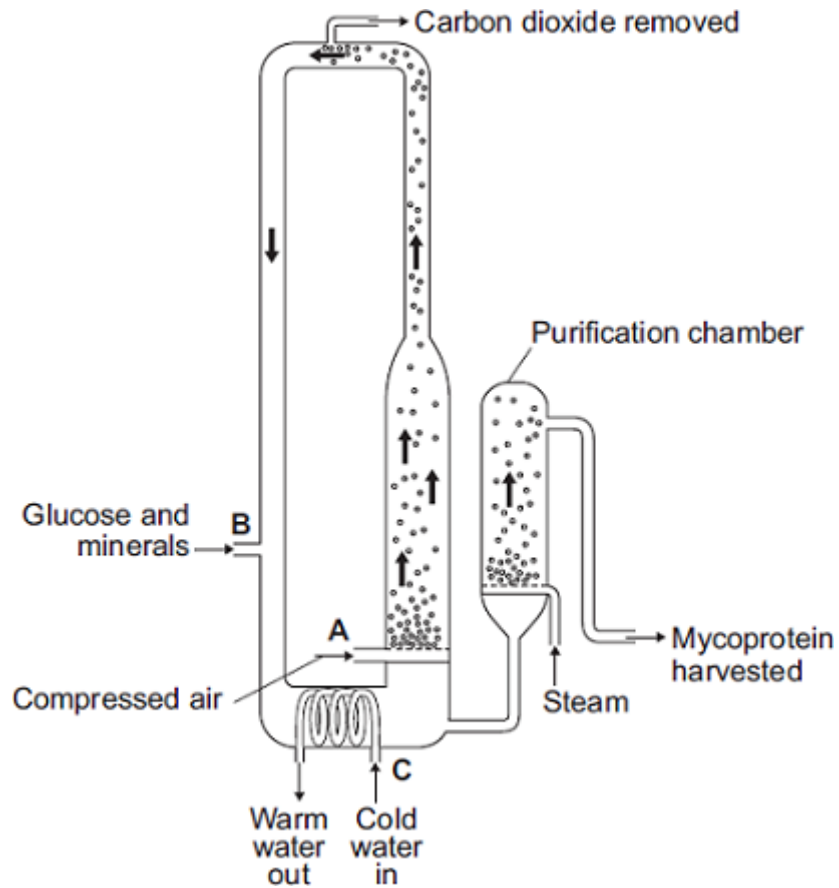


(4)
(Total 13 marks)

Q11.

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

Fusarium is used to make mycoprotein.



- (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.

- (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.

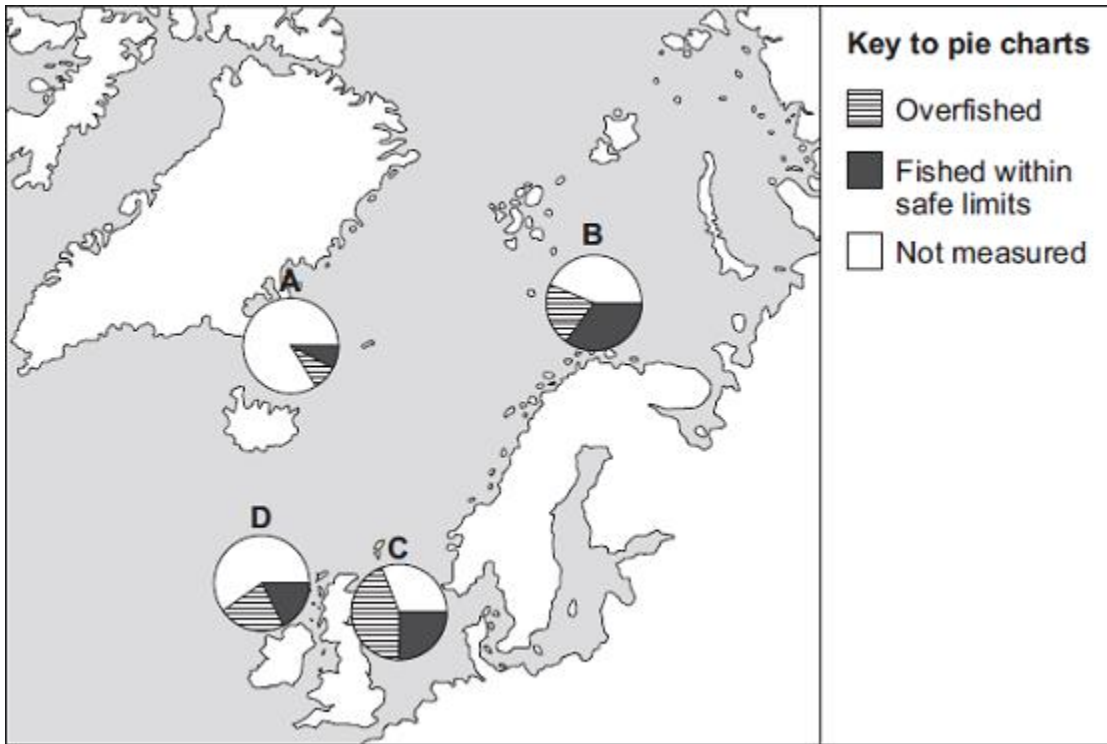
Evaluate this statement.

Remember to include a conclusion in your evaluation.

(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.

(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.

Growing wheat



Keeping sheep outside



Keeping pigs outside

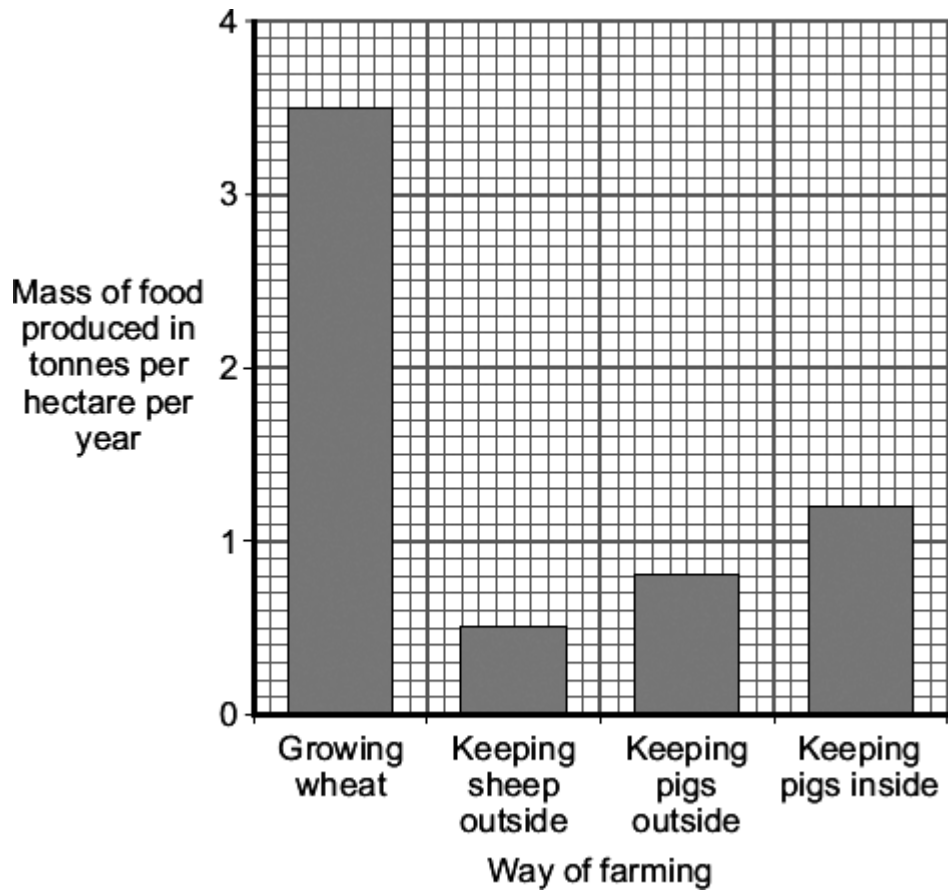


Keeping pigs inside



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.



- (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
- 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

Cattle factory by Pirhan [CC BY-SA 2.0], via Flickr. Traditional cattle farming by Mat Fascione[CC-BY-SA-2.0], via Wikimedia Commons

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)

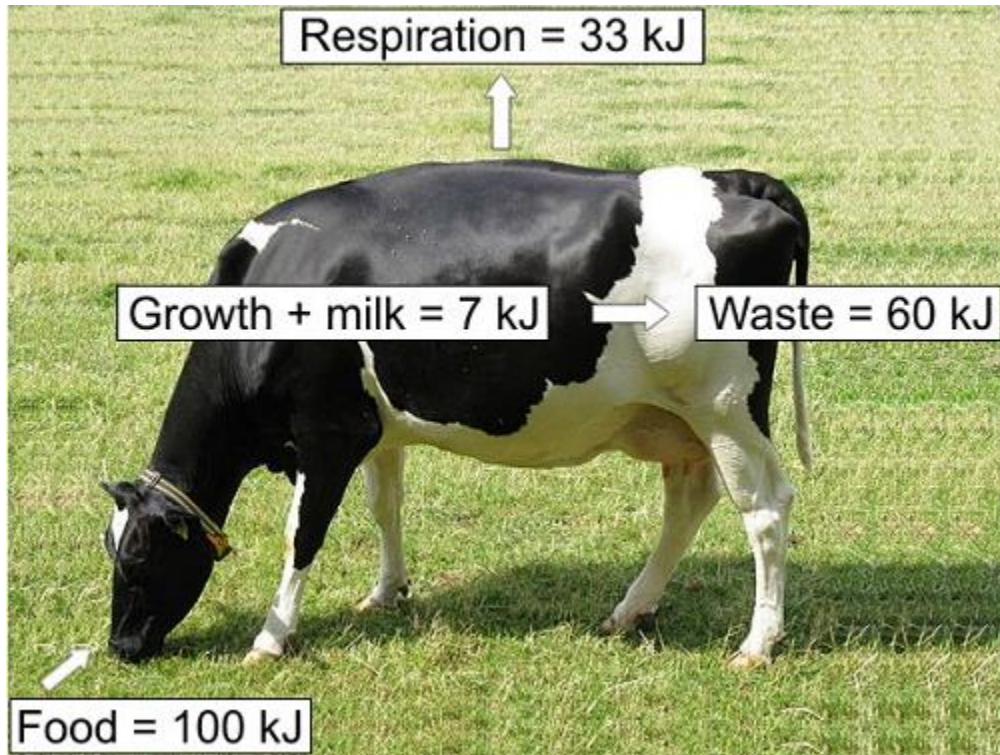
(ii) Give **two** reasons why some people think traditional farming is better than the cattle factory.

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.



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	

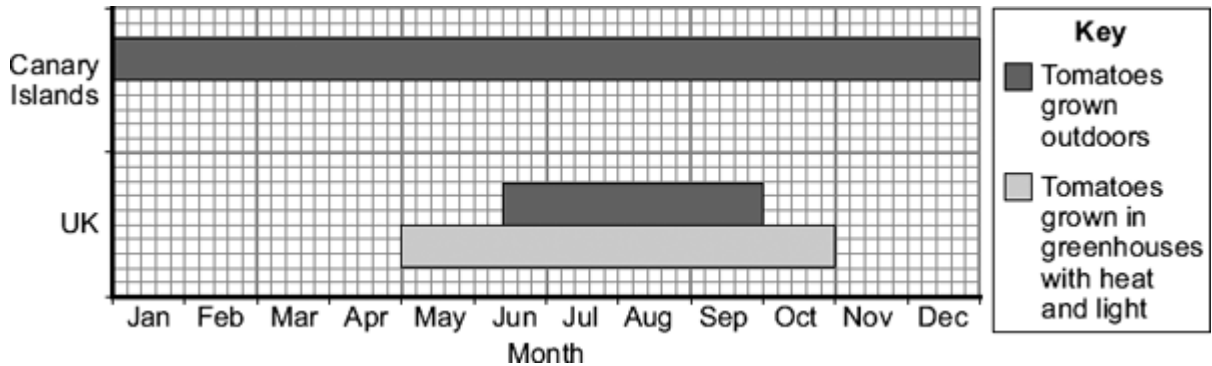
(2)

(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.



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
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.

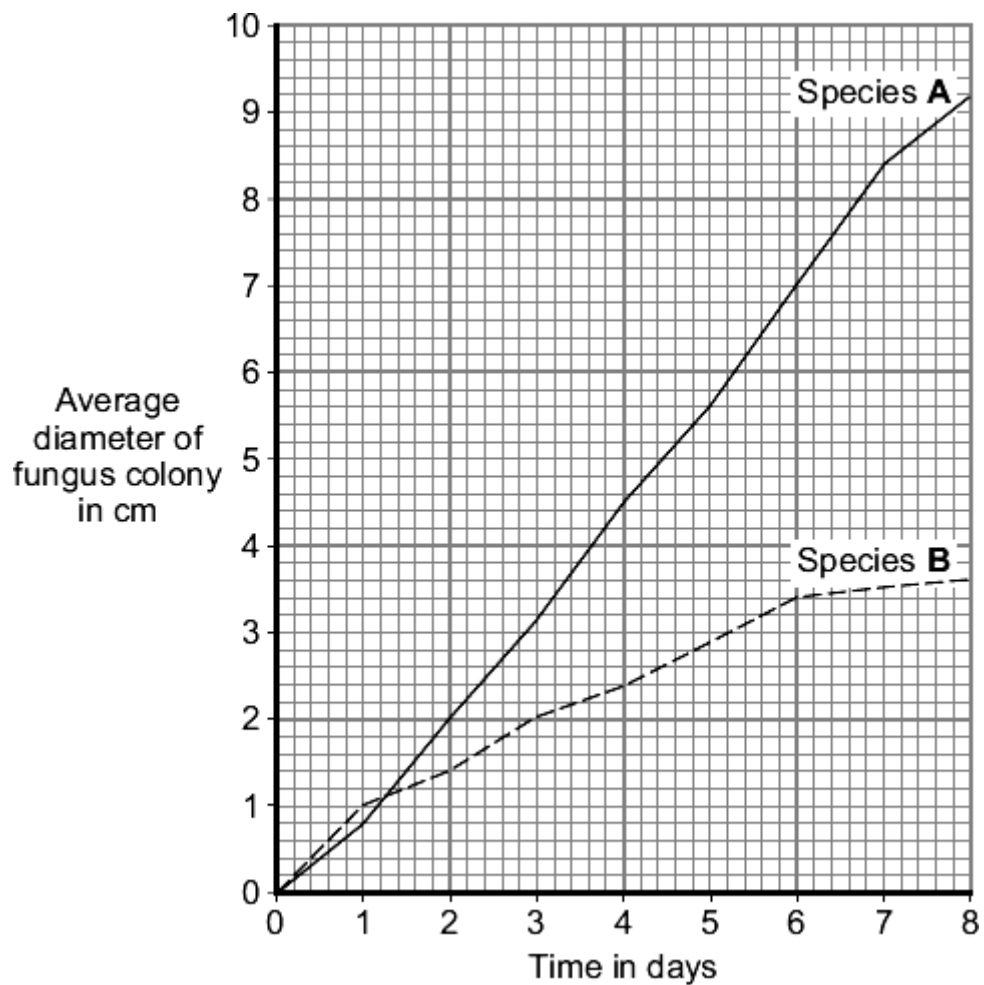
If he ate mycoprotein instead of chicken, he would need to eat about twice as much to have the same effect.

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.





- (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.

1.

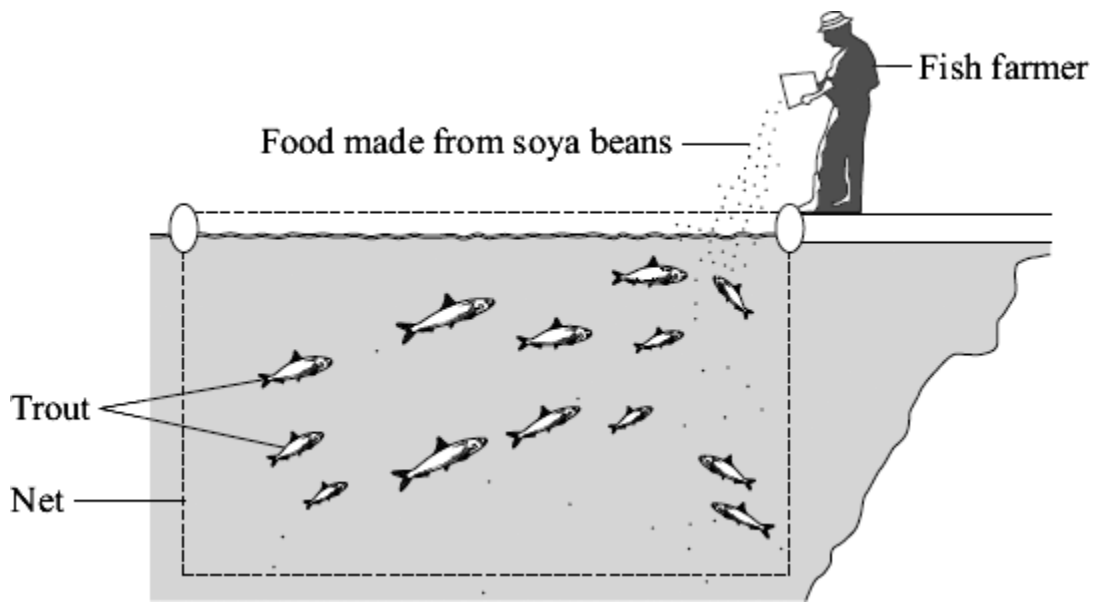
2.

(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.

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.

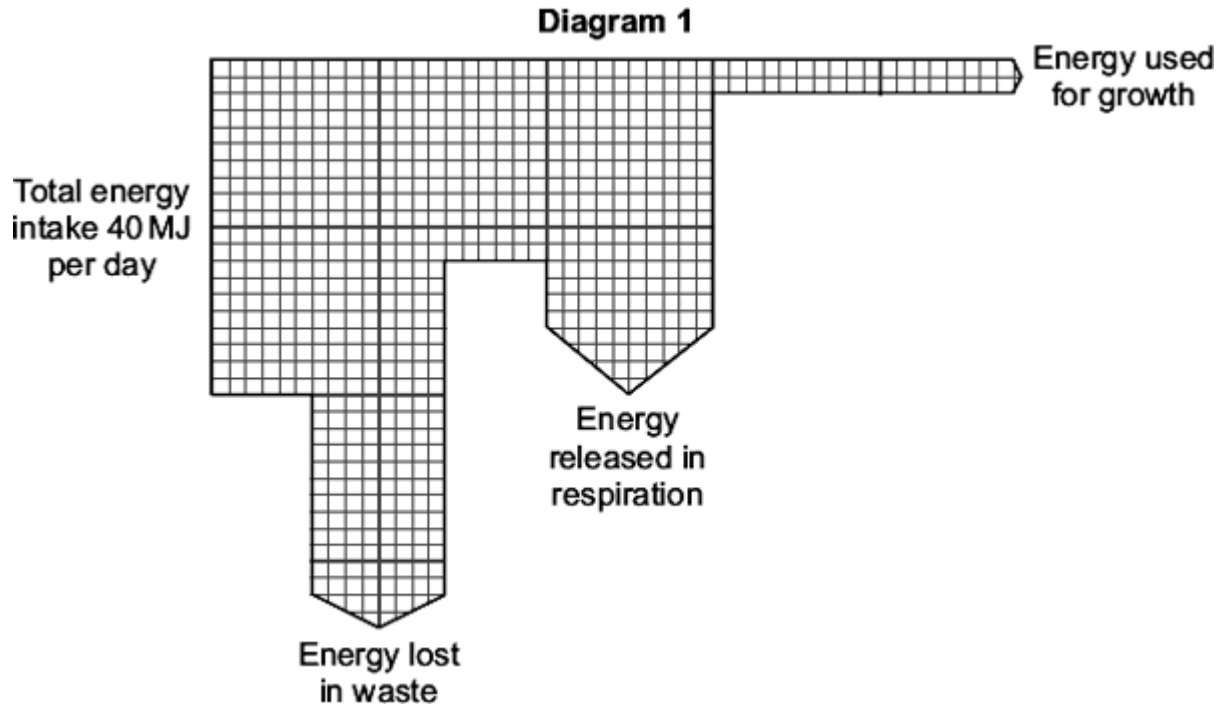
Use your knowledge of the carbon cycle to describe how this carbon is returned to the atmosphere after the trout die.

(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).



- (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)

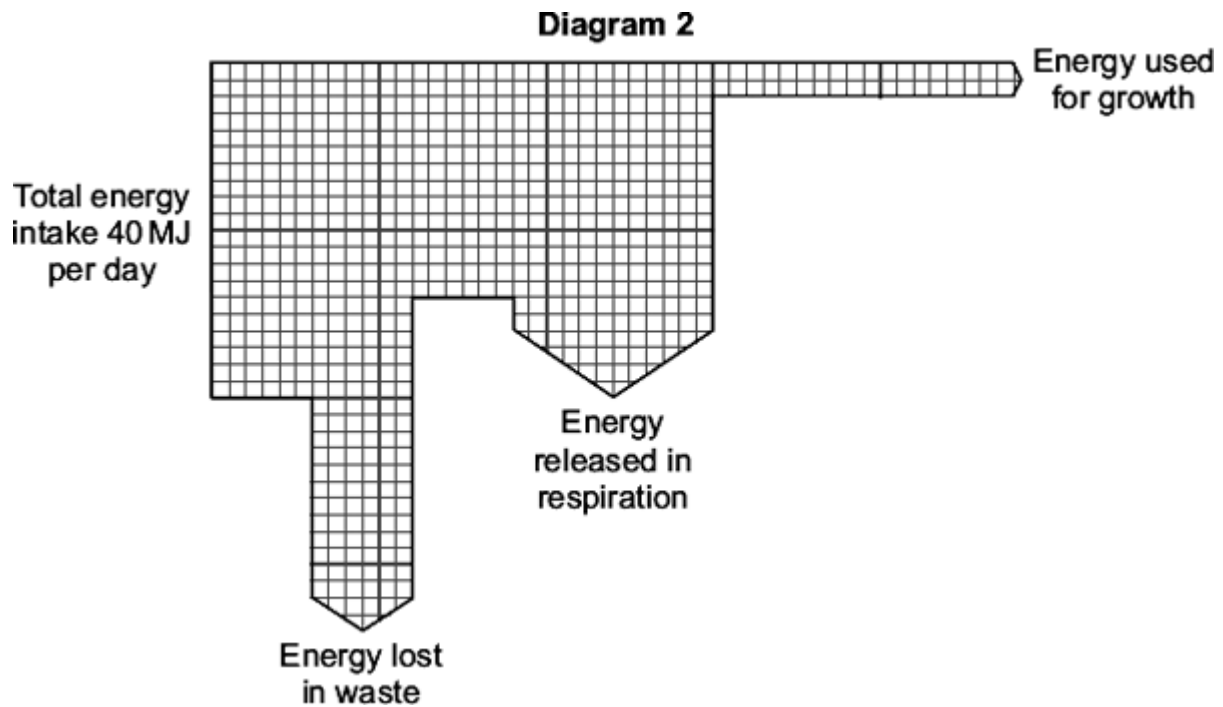
(b) Give **two** ways in which the energy, released in respiration, is used by a herbivore.

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).



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.

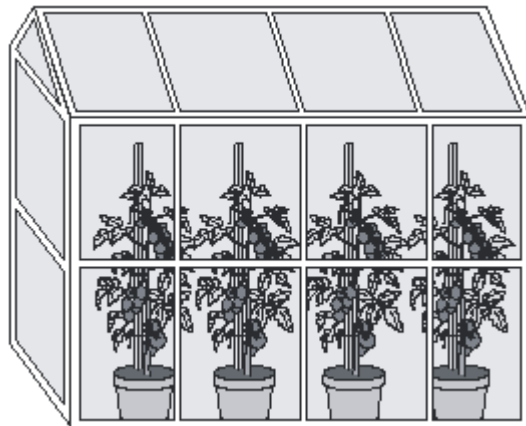
2.

(2)

(Total 8 marks)

Q20.

In this country most tomatoes are grown in greenhouses.



- (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)

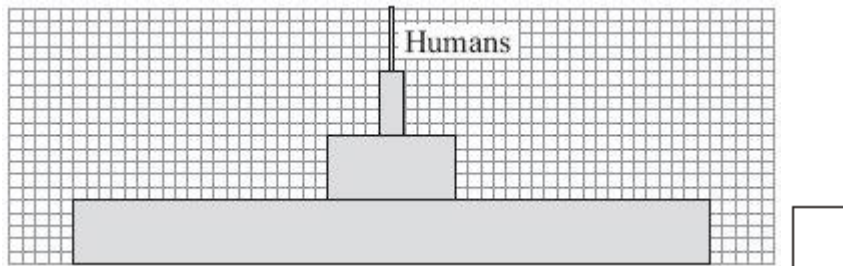
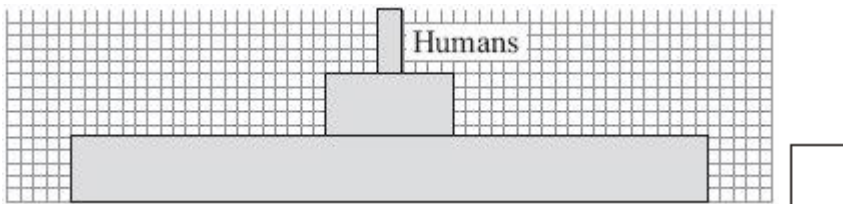
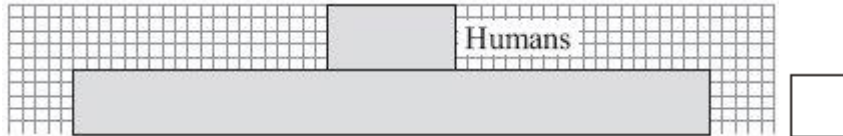
(Total 5 marks)

Q21.

(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

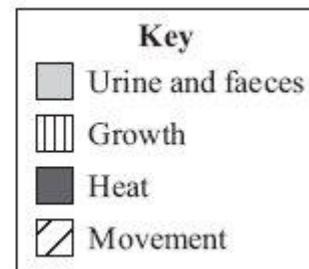
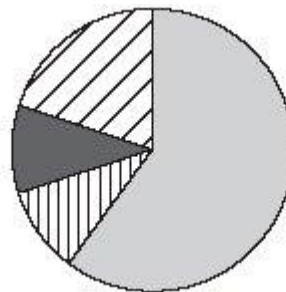
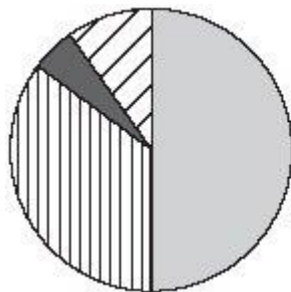
Pigs kept outdoors



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



- (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.

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
<i>Fusarium</i>	4 hours
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.

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.

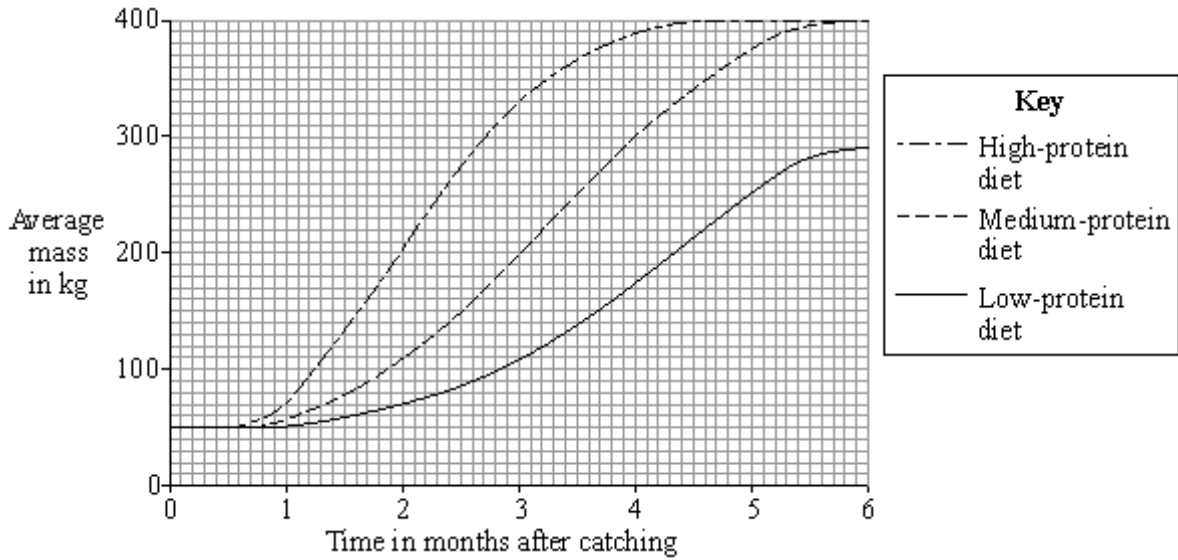
2.

(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.

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.

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)

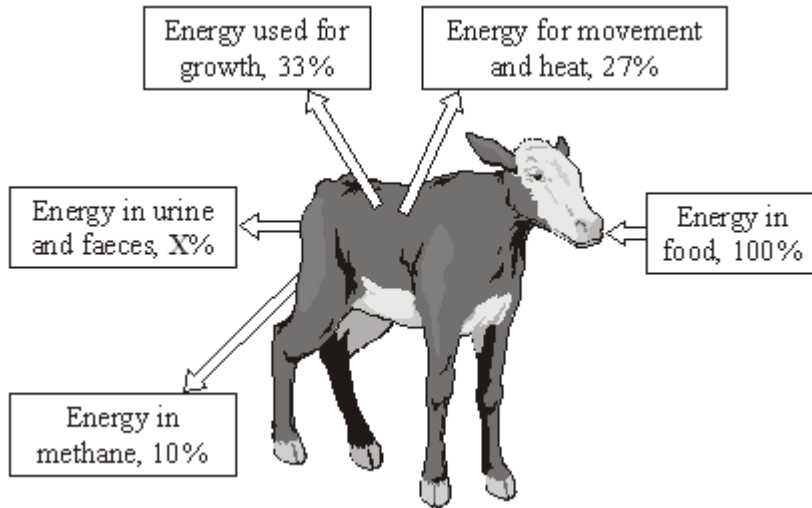
- (ii) One step that the supermarket chain intends to take is to obtain as much food as possible from British sources.

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.

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)

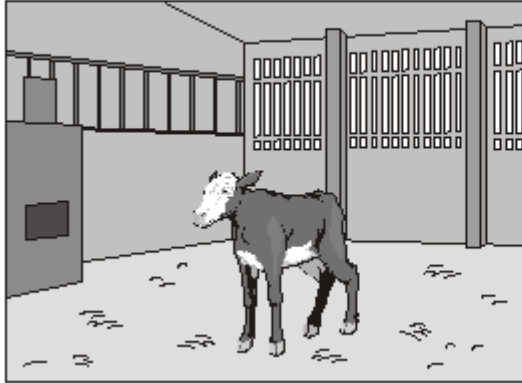
- (c) Which process in the body transforms energy in food into heat?

(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.

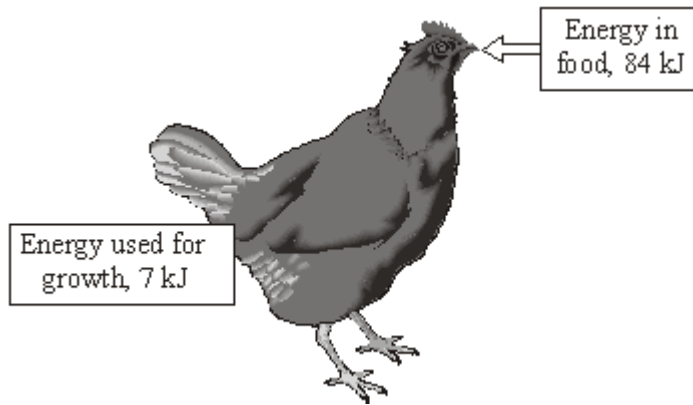
Suggest **one** reason why people campaigned against this method of rearing calves.

(1)

(Total 7 marks)

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.

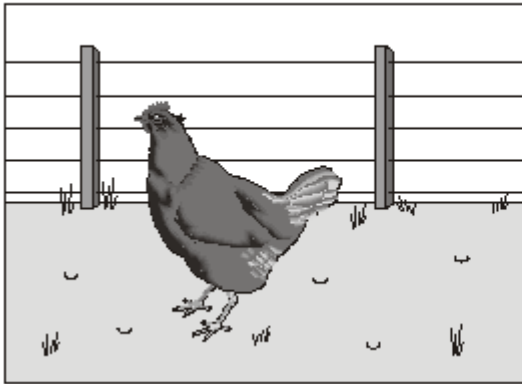
2.

3.

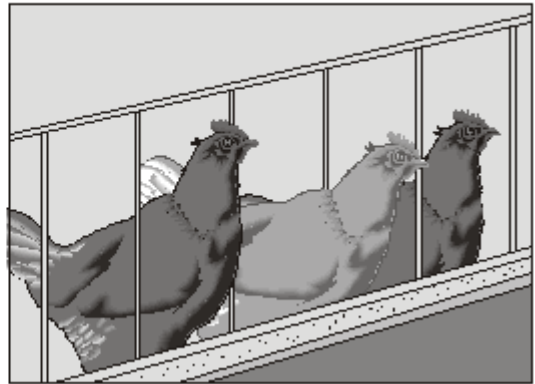
(3)

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

Chickens kept outdoors (free-range)



Chickens kept in cages (battery chickens)



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).

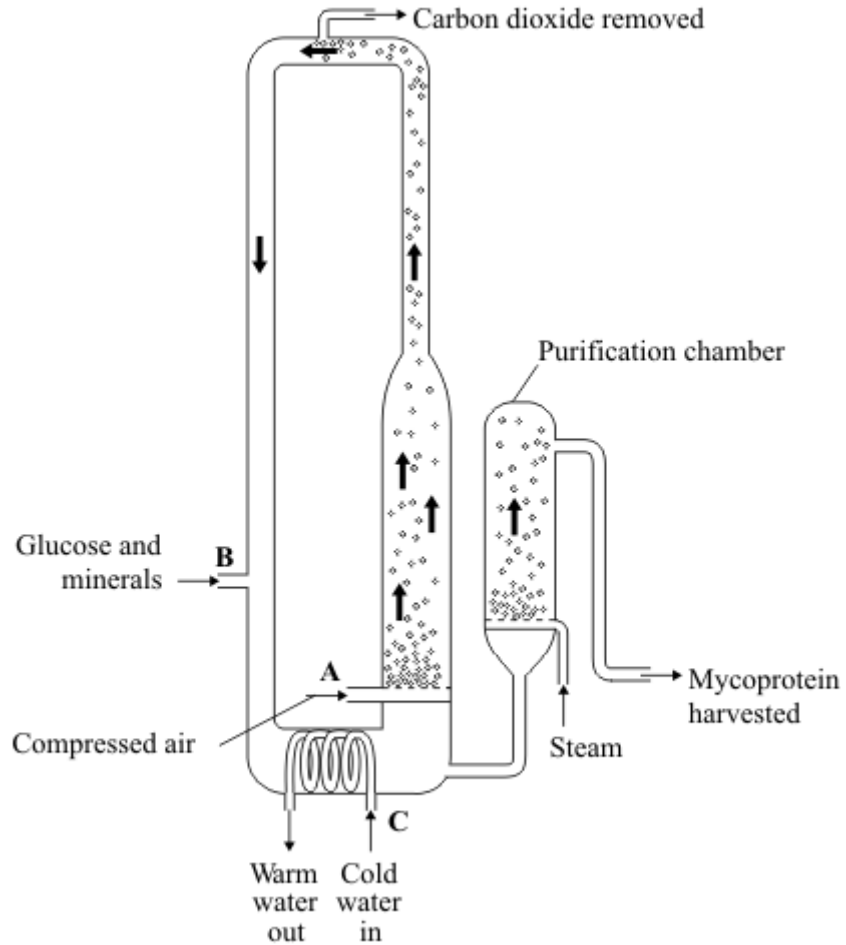
Explain why.

(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.



(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.

(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.

(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.

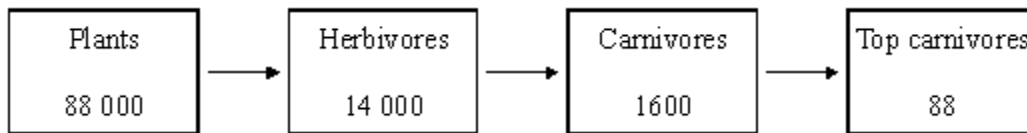
1.

2.

(2)
(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 m² 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.

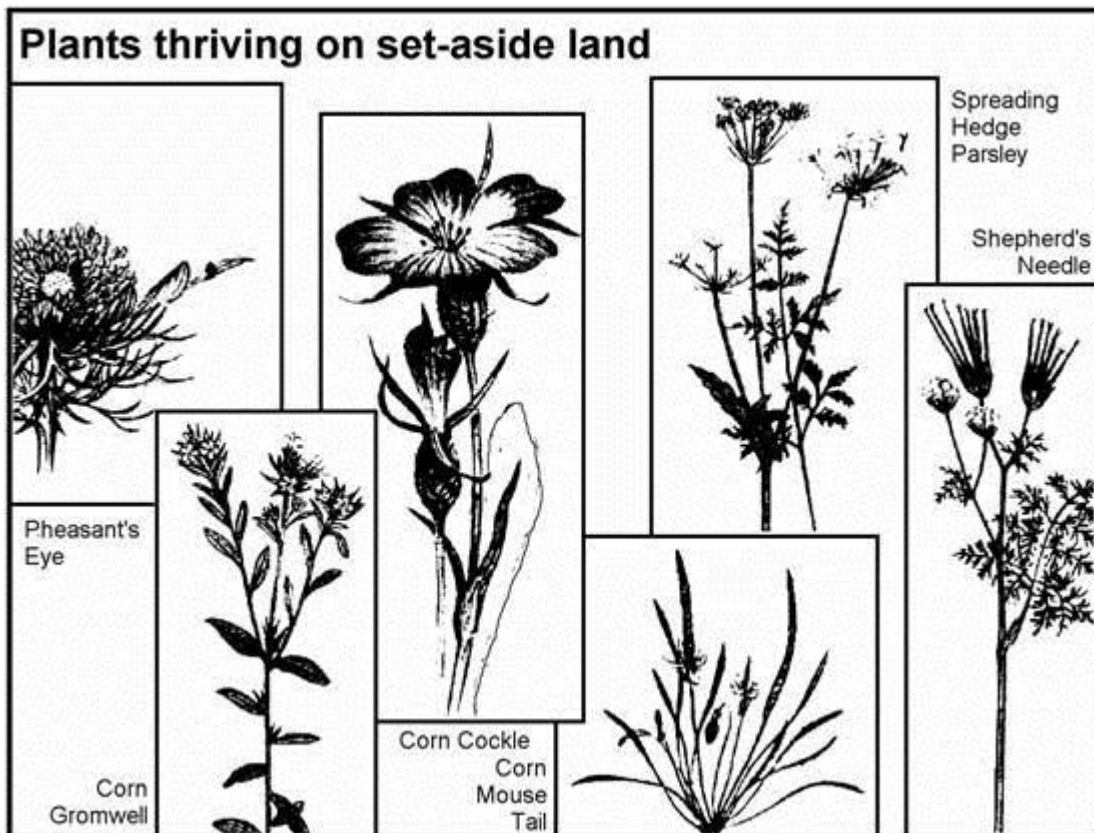
(2)

- (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.



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.

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

(4)

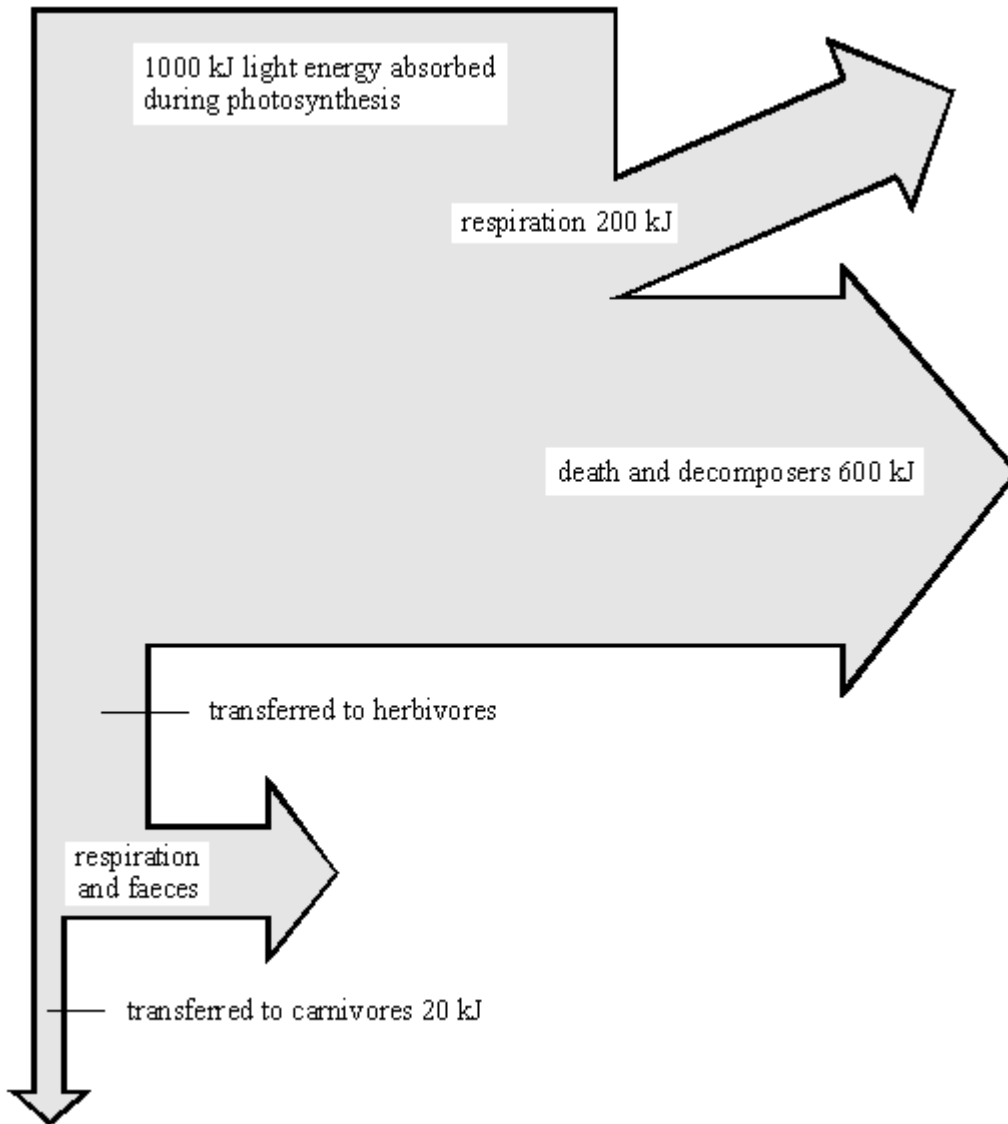
- (b) What would you recommend to ministers meeting to decide a policy involving rotational set-aside and permanent set-aside? Explain the reasons for your answer.

(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.



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

Explain why the food chain *cereal crop* \Rightarrow *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* \Rightarrow *pigs* \Rightarrow *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)

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:

(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)

Mark schemes

Q1.

- (a) kills microorganisms / bacteria / fungi / viruses / microbes
allow to remove microorganisms / bacteria / fungi / viruses / microbes
ignore germs
allow so mycoprotein is not contaminated 1
- (which) compete for food / oxygen
or
 which make toxins
allow so mycoprotein is safe to eat
- or**
 which are pathogens
or
 which might kill the fungus / *Fusarium* 1
- (b) 30 °C 1
- (c) for (aerobic) respiration
*do **not** accept anaerobic* 1
- (which) releases energy (for growth)
*do **not** accept produces energy*
allow glucose is used to make other organic substances e.g. protein 1
- (d) any **two** from:
- so *Fusarium* can
- grow faster / better
 - get sufficient food / glucose / minerals
allow more / enough
 - get sufficient oxygen
allow more / enough
 - get rid of sufficient carbon dioxide
allow more / enough
allow waste
 - be kept at a (suitable) temperature
allow to avoid 'clumping' 2

(e) 200 grams

1

[8]

Q2.

(a) correct figures from graph: 5.0 / 5 and 2.60 / 2.6

2.40 / 2.4

an answer of 2.40 / 2.4 scores 2 marks

1

allow correct answer from candidate's figures from graph for 1 mark

1

(b) $\frac{1}{3}$

1

(c) protein

1

(d) a genetically-modified variety of seed was sown in 2004

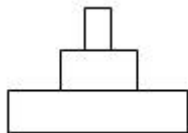
1

more rain fell in spring and early summer in 2004

1

the mean summer temperature was lower in 2003

1



(e)

1

(f) 80

1

(g) chickens use energy for movement and for keeping warm

1

much of the food eaten by chickens is wasted as faeces

1

[11]

Q3.

(a) $0.03 = \frac{\text{output}}{5950 + 50} \times 10$

an answer of 1.8 scores 3 marks

1

$$\text{output} = \frac{0.03 \times (590 + 50)}{100}$$

1

1.8

1

(b) indoor % efficiency = $\frac{40}{10000 + 6000} \times 100$

1

or
 $\frac{40}{16000} \times 100$

0.25(%)

*an answer of 8.33 scores 3 marks
 allow 8 / 8.3 / 8.333...*

1

$$\left(\frac{0.25}{0.03} = \right) 8.33 \text{ (times)}$$

1

(c) any **two** from:

- in faeces / egestion
- or**
- not all food is absorbed
- not all food is ingested
- in urine / excretion
- in respiration
- keeping warm
- movement

*do **not** accept 'for respiration'
 allow as 'heat'*

2

(d) warmer indoors so less energy wasted in keeping warm

allow less energy lost as 'heat'

1

less movement indoors so less energy wasted

*if no other mark awarded, allow it is warmer and there is less
 movement indoors for 1 mark*

1

[10]

Q4.

(a) any **two** from:

- diseases spread more rapidly
- antibiotics can build up in the food chain
- or**
- over use of antibiotics
- increased use of fossil fuels (to heat the barn)

- (b) **Level 2 (3–4 marks):**
Clear statements made identifying the farming methods which are linked to relevant explanations of how this increases the efficiency of food production.

Level 1 (1–2 marks):
Simple statements made identifying the farming methods used, but no attempt to link to explanations of how this increases the efficiency of food production.

0 marks:
No relevant content.

Indicative content

statements:

- kept inside or in a temperature controlled environment
- kept enclosed or in a restricted environment

explanations:

- less energy / heat is lost in controlling body temperature
- less energy required for movement
- so more energy is available for growth
- less energy / heat is transferred to the environment

4

- (c) $(362 - 67 = 295) / 362 \times 100$

1

81 / 81.49 / 81.5

allow 81 / 81.49 / 81.5 with no working shown for 2 marks

1

- (d) aboriginal people can eat other foods (so they may not be in food insecurity)

1

we do not know if other (traditional) food sources have declined

1

[10]

Q5.

- (a) (i) any **three** from:
- lights to help guide / attract fish (to the holes)
 - (rigid so) holes stay open
 - (holes) allow small / young fish to escape
 - (so that) they can breed

3

- (ii) (fishing) quotas / legislation

1

- (b) (i) movement is restricted

1

(in a building **or** close together so) heat is conserved

allow in heated buildings to reduce heat loss

1

(ii) any **two** from:

- it is cruel
allow descriptions of 'cruelty'
- disease spreads faster
- (meat) often has antibiotics in it

2

[8]

Q6.

(a) (i) fewer cows

1

any **one** from:

- less methane
do not allow CH₄
- less CO₂ in the atmosphere because of less deforestation **or** less plants consumed.

*allow less CO₂ released into the atmosphere because less fuel used e.g. to heat cowsheds **or** to transport meat*
do not allow CO₂

1

(ii) any **two** from:

- could be mass produced to feed an increasing population
- disease free meat
- no / low fat
- no harm to animals or less intensive farming
allow (may be) suitable for vegetarians
- antibiotic free meat
- more land available for farming crops
allow no energy loss along a food chain

2

(b) fungus / Fusarium

1

with glucose (syrup)

1

in aerobic conditions **or** in presence of oxygen

ignore air

1

mycoprotein is harvested / purified

allow ammonia added (as source of nitrogen)
ignore stirring / mixing and temperature

1

[8]

Q7.

- (a) limiting their movement
or
 controlling the temperature of their surroundings 1
- reason:
 reduces energy transfer
if no other marks awarded, allow 1 mark for: 'fit more chickens in same space' 1
- (b) (i) without oxygen
ignore 'without air' 1
- (ii) any **two** from:
 • ethanol
allow alcohol
 • carbon dioxide
 • lactic acid.
do not accept energy / ATP (apply list rule) 2
- (c) enzymes are denatured / change shape
ignore microbes are killed 1
- (enzyme) shape is vital for function **or** won't work (as efficiently) 1
- (d) (i) 200 1
- (ii) 120
allow ecf from (d)(i)
e.g.
 $\frac{60 \times}{100} (i)$ 1
- (e) causes global warming 1
- one predicted consequence of global warming
eg rising sea levels, climate change, change in migration patterns, change in distribution of species
or
 methane is flammable
 so might cause fire / damage
if no other marks awarded, allow methane is a greenhouse gas for 1 mark 1

Q8.

- (a) (i) fungus 1
- (ii) oxygen / O₂
accept air
accept O₂
*do **not** allow O² / O / O2* 1
- (iii) glucose (syrup)
allow carbohydrate / sugar
ignore food / starch
allow oxygen if oxygen / air not given in (a)(ii) 1
- (b) any **two** from:
 - quicker
 - suitable for vegetarians
 - cheaper
 - more efficient **or** less land / methane*ignore high in protein*
ignore sustainability unqualified
ignore less pollution unqualified
allow less animals harmed / killed
*allow food chain is shorter **or** has less trophic levels*
allow less energy lost (from the food chain)
*do **not** allow no energy lost*
allow low(er) in calories (than some meat)
allow low(er) in fat / healthier (than some meat)
allow source of fibre / prevent constipation 2

[5]

Q9.

- (a) it is impossible to weigh all the fish in the sea 1
- (b) (i) increase / from 50 to 350 / by 300 thousand tonnes 1
- (ii) due to fishing ban / not allowed 1
- (c) (i) fishing quotas / limits 1
- changes to net size

- 1
- (ii) yes, biomass increases 1
- use of figures from graph eg approx 4- times **or** (was effective at first)
 but numbers decline again after 2004
must use two comparative figures for 2nd marking point 1
- (iii) so that breeding continues 1
- allow prevent extinction / limit impact of fishing on food chain
 / web*
- (iv) 95% 2
- correct answer gains 2 marks
 2000-100=1900 award 1 mark*
- (d) any **four** from:
- increase in sea / water temperature
accept ref to lower sea / water temp if shift in Gulf Stream is referred to
 - changes in migration patterns / distribution of species
 - more eggs may survive (up to 19 °C) and could lead to an increase in herring pop
 - reduction in herring pop (because eggs die if >19 °C)
accept change in other populations of fish which are alternative prey for cod
 - (appropriate) change in cod population as a result 4
- [14]**

Q10.

- (a) (i) 76.0 / 76 2
- correct answer with or without working gains 2 marks
 allow 76.04 for 2 marks
 allow 76.04 with extra decimal places eg 76.042 for 1 mark*

$$\frac{465}{761.5}$$
for 1 mark
- (ii) mass of fish declines (until 2008) 1
- ignore use of numbers
 allow number of fish decline (until 2008)*
- (due to an) increase in fishing / overfishing 1

- and then rises (until 2010) 1
- (which could be due to) quotas / net restrictions working
allow any reasonable suggestion, such as countries swapping quotas or restrictions on fishing during breeding seasons
ignore less fishing
*if no other marks awarded allow 1 mark for a decrease in mass **and** an increase in mass if answer relates to sustainable fishing* 1
- (iii) (this is due to) public awareness / demand
allow legislation / rules 1
- (b) fishing quotas / bans 1
- (small) net / mesh size
if size of net is stated then it must be smaller
if size of mesh is stated then it must be larger 1
- (c) (fish) cannot move freely / as much 1
- (therefore) less energy loss from the fish
*do **not** allow 'no energy is lost'*
ignore references to less heat loss through controlling body temperature
ignore references to respiration 1
- (there is) more food available / better quality food / fed more often
accept 'high-protein food (for making cells)' 1
- (so) there is more energy for growth **or** (more food) is converted to biomass 1
- [13]**
- Q11.**
- (a) circulating / mixing / described **or** temperature maintenance 1
- supply oxygen
or for aerobic conditions
or for faster respiration
*do **not** allow oxygen for anaerobic respiration* 1

- (b) energy supply / fuel / use in respiration
*do **not** allow just food / growth*
ignore reference to aerobic / anaerobic
or material for growth / to make mycoprotein 1
- (c) respiration
allow exothermic reaction
allow catabolism
ignore metabolism
ignore aerobic / anaerobic 1
- (d) (i) any **one** from:
 - compete (with *Fusarium*) for food / oxygen **or** reduce yield of *Fusarium*
 - make toxic waste products or they might cause disease / pathogenic **or** harmful to people / to *Fusarium*
*do **not** allow harmful unqualified*1
- (ii) steam / heat treat / sterilise fermenter (before use)
***not** just clean*
or
 steam / heat treat / sterilise
 glucose / minerals / nutrients / water (before use)
or
 filter / sterilise air intake
or
 check there are no leaks
*allow sterilisation unqualified **not** just use pure glucose* 1
- (e) any **three** from:
 - beef is best or beef is better than mycoprotein
 - mycoprotein mainly better than wheat
 - more phenylalanine in wheat than in mycoprotein
allow equivalent numerical statements
 - but no information given on other amino acids / costs / foods3

overall conclusion:

statement is incorrect because

either

it would be the best source for vegetarians

or
 for given amino acids, beef is the best source
 or
 three foods provide insufficient data to draw a valid conclusion

1
 [10]

Q12.

(a) C

1

(b) otherwise species may disappear altogether
allow to avoid extinction

1

(c) any **two** from:

- regulate net size
if mesh size specified, must be larger
- impose fishing quotas
- limit fishing during breeding seasons
- bans on discarding of fish
- bans on fishing in certain areas

2

[4]

Q13.

(a) (i) wheat → humans chain transfers 10 times more energy than wheat → pigs → humans chain

allow 10% if given as a comparison e.g. one is 10% of the other

or

wheat → pigs → humans chain transfers 810 000 (kJ per hectare) less
ignore less unqualified

1

(ii) any **one** reason for energy loss from pigs e.g :

*ignore respiration, growth
 ignore heat unqualified*

- movement
- (maintaining) body temperature
- waste materials
allow named examples

- not all parts of pig eaten by human
- because there is an extra stage (pigs) in the food chain and energy is lost at each stage
allow longer food chain so more energy lost

1

- (b) Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information in the [Marking guidance](#), and apply a 'best-fit' approach to the marking.

0 marks

No relevant content.

Level 1 (1-2 marks)

There is a basic description of at least one factory farming method
or
identification of an advantage or disadvantage of factory farming.

Level 2 (3-4 marks)

There is a description of at least one factory farming method
and
an advantage or disadvantage is explained.

Level 3 (5-6 marks)

There is a description of factory farming methods
and
advantage(s) and disadvantage(s) are explained.

Examples of Biology points made in the response:

factory farming methods e.g.:

- Kept in cramped conditions / battery hens / calf crates / pig barns / fish tanks
- Controlled temperature / heating
- Controlled feeding / modified food given / growth hormones
- Controlled lighting
- Treated with prophylactic antibiotics

Advantages e.g.:

- Increased efficiency / profit / greater food production / cheaper food / faster growth
- Farmer can have more livestock
- Less energy is lost through movement
- Less energy is used keeping warm

- (Food is high in calories / protein) so animals will grow faster / lay more eggs
- Easier to vaccinate all the animals
- Easier to protect animals from predators
- Antibiotic treatment stops infections in animals

Disadvantages e.g.:

- Stress / cruelty / inhumane / unethical
- Restricted movement / overcrowding
- Faster spread of diseases
- Antibiotics in the food chain / residual chemicals in the food chain
- Wasting fossil fuels / increasing global warming
- Increased pollution from animal waste and from additional transport

6

[8]

Q14.

(a) 3 (.0)

*correct answer, irrespective of working gains 2 marks.
if the answer is incorrect or there is no answer, award 1 mark
for use of correct figures (0.5 and 3.5) [and no other figures]*

2

(b) as faeces

*if more than two boxes ticked deduct 1 mark for each
additional tick*

1

as carbon dioxide from respiration

1

(c) (i) pigs kept inside are kept in small pens

*if more than two boxes ticked deduct 1 mark for each
additional tick*

1

pigs kept inside are kept warm in the winter

1

(ii) any **one** from:

- faster growth
ignore bigger / less flavour / fatty
- need less food

ignore references to movement / energy

- ready for market sooner
ignore ethical arguments

1

[7]

Q15.

(a) (i) any **two** from:

- more milk
(about) 50 litres milk compared to (up to) 20 litres / 30 litres more
ignore costs / profit
- electricity produced
- farmers can keep more cows in the space
answers must refer to number of cows and space

2

(ii) any **two** from:

- less stress for cow **or** not cruel to cow **or** cows have freedom to move around
ignore references to ethical / unnatural without qualification
- crops fertilised
- less disease **or** disease not as easily spread

2

(b) more

1

less

in this order

1

[6]

Q16.

any **three** from:

*maximum 2 marks if only advantages **or** only disadvantages given*
ignore references to cost unqualified

advantages: (max 2)

ignore reference to fresher

- less transport / example of transport **or** less fuel used
accept implication eg less food miles

allow no transport / fuel costs

- less pollution / example
accept eg less carbon dioxide / smaller carbon footprint
allow no pollution / example
- support of local / UK economy / farmers

disadvantages: (max 2)

- not available all year
- may require use of heat / light
- (production of) heat / light causes pollution

[3]

Q17.

- (a) (i) cholesterol 1
- fat
- in this order* 1
- (ii) mycoprotein has (approx) half amount of protein / has 11.8 (g) protein while chicken has 22.0 (g)
accept has less protein
ignore less fat 1
- (b) (i) increased 1
- (±) constant rate **or** (from 0) to 9.2 / by 9.2(cm) **or** about 1 cm a day **or** increase slower at the beginning and / or at the end 1
- (ii) species **A** grows faster / more than species **B**
or
species **A** has larger diameter **or** is bigger
or
the growth of species **B** slows down after 6 weeks
accept use of approximate figures 1
- (c) any **two** from:
- pH / acidity / alkalinity
ignore references to carbon dioxide / waste products
 - (speed of) stirring
ignore time in the fermenter

- oxygen (concentration) / aeration
ignore initial amount of Fusarium
- ion concentration / named eg -NH_4^+
allow ammonia
- pressure

2

[8]

Q18.

- (a) three layer triangular pyramid
either way up (as blocks or triangle)

1

(soya / beans / food – trout / fish – people / human (in sequence)
ignore reference to producers / herbivores / consumers
award 1 mark only for a correct food chain with 2 correct arrows showing energy flow

1

- (b) the trout release energy when they respire

1

some energy will be lost in waste from the trout

1

- (c) any **one** from eg

- easy / easier to catch / more caught
allow easy / easier to monitor
- easy / easier to feed
allow control food
- no / less predation
allow less fishing / poaching
- less energy loss
allow grow faster
- less movement
ignore less space to move
*do **not** allow easier to farm*

1

- (d) any **two** from:

- microorganisms / bacteria / decomposers / microbes / fungi / detritus feeders
- decay / rot / decompose / digest / break down
ignore biodegrade



- (microorganisms) respire
do not award this mark if response implies the trout respire
- turned into fossil fuels / named fossil fuels
- carbon dioxide / CO₂ released

2

[7]

Q19.

(a) (i) 20

1

(ii) one tenth / 0.1 / 10% / 1:9 / 1 in 10 / 1 out of 10 / $\frac{1}{10}$

for correct answer irrespective of working 2 marks

ignore any units

accept equivalent fractions eg $\frac{4}{40}$ / $\frac{2}{20}$

do not allow eg 1:10 / 1 to 10

if answer is incorrect

clear selection of 2 and 20, or equivalent or 1:4:5 / 1:5:4 gains 1 mark

2

(b) any **two** from:

do not accept sweating / cooling / excretion

- (body) heat / maintaining body temperature
allow keep warm
- movement (max 2)
allow 2 different examples of movement, internally and / or externally eg breathing / exercise / eating / circulation
allow muscle contraction if no other muscle action is credited
movement + breathing = 1 mark
- growth / cell division / repair / reproduction / building molecules
allow examples eg making proteins (from amino acids)
ignore 'chemical reactions' / digestion
- accept active transport

2

(c) more movement / have to hunt / catch food

allow converse if stated for herbivore eg herbivores food is all around

ignore reference to size or predator unqualified

1

(d) any **two** from

ignore reference to food

- less movement
allow no movement
allow less space to move
ignore less space unqualified
- less heat loss
allow no heat loss or they are kept warm
- less respiration

2

[8]

Q20.

(a) any **one** from:

- increase / give light
- increase temperature / make warmer

award marks if the method by which these could be done is given
eg leave lights on all night **or** use a heater

- increase / give CO₂
- add fertiliser / nutrients / minerals / named
allow nitrogen
ignore 'food'

1

(b) (i) any **two** from:

- cheaper
allow grow faster / more grown
- better quality / flavour
ignore size
- available all year
accept converse if clear that answer refers to use of British tomatoes
allow 'Fair Trade'

2

(ii) any **two** from:

- greater distance **or** more food miles **or** more transport

idea of more needed only once

- transport needs (more) energy / fuel
- reference to eg greenhouse effect / global warming / pollution / CO₂ release / carbon footprint
ignore ozone

2

[5]

Q21.

- (a) (i) tick in box of FIRST pyramid

1

- (ii) any **one** from:

- less energy / biomass lost / wasted
- greatest biomass / energy for humans
ignore human box is bigger
ignore .food. for humans
- shortest food chain **or** less stages **or** least number of different organisms **or** only one predator **or** only 2 boxes tall **or** least boxes
allow only one stage

1

- (b) (i) any **two** from:

- quicker / more growth **or** grow fatter
- less* urine **or** less faeces
- less* heat (lost)
- less* movement
assume for pigs indoors
allow converse if clear for pigs outdoors
() do **not** allow no for less*
ignore less space

2

- (ii) any **one** from:

- less cruelty **or** more ethical **or** better animal welfare
ignore more natural
ignore ideas referring to against God's will
- better flavour / quality (of meat)
*ignore pig health **or** free range / organic*
- less pollution / etc / less fossil fuel used for heating
ignore quality of life

*assume for pigs outdoors
allow converse if clear for pigs indoors*

1

[5]

Q22.

(a) 4

*award **both** marks for correct answer, irrespective of working.*

*allow 125/3125 ($\times 100$) **or** 0.04 for 1 mark*

2

(b) any **three** from:

- excreted / urine / urea(*)
- not digested / faeces(*)
() if neither of these marks is awarded then waste gains 1 mark*
- methane
- respiration
*do **not** allow for respiration*
- movement / named internal / external movement
allow sound
- heat / temperature control / sweating
*allow milk production
allow active transport*

3

(c) any **two** from:

- no / less biomass / energy lost (by intermediate) **or** examples of losses
herbivores contain more energy is insufficient
- shorter food chain
- cheap(er) to feed herbivores
ignore reference to carnivores being dangerous

2

[7]

Q23.

(a) (i) bacteria

1

(ii) 8

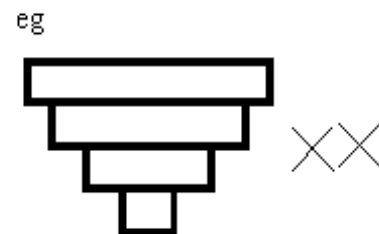
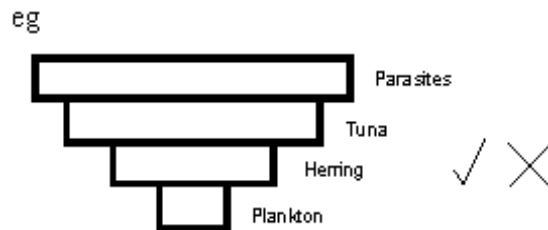
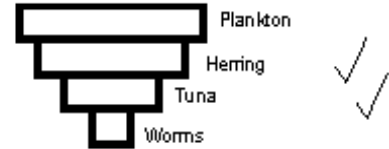
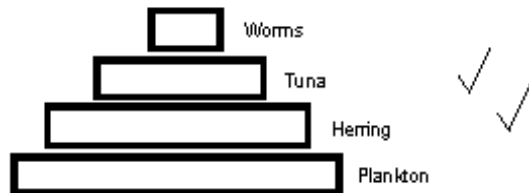
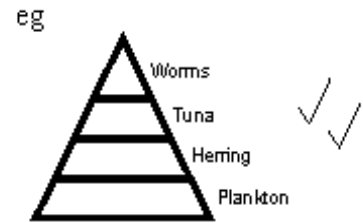
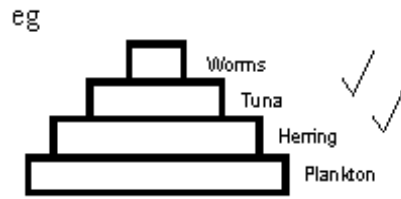
1

- (iii) 4 tonnes 1
- (b) (i) mycoprotein contains less fat 1
- or**
- less circulatory problems
- mycoprotein contains (more) fibre
- or**
- reduces colon cancer
it = mycoprotein
fat must be comparative 1
- (ii) beef contains more protein
it = beef
must be comparative
- or**
- better for growth / making cells /
 enzymes / antibodies 1

[6]

Q24.

- (a) (i) a triangular-shaped pyramid, with 4 layers – widest at the bottom
either in blocks or as a triangle 1
- labels in food chain order (from widest part)
 ie plankton – herring – tuna – parasitic / worms
- upside down labelled pyramid with producer at top gains 2 marks*
- upside down labelled pyramid with producer at bottom gains 1 mark for labels*
- unlabelled upside down pyramid = 0 marks*
- accept separate boxes*
- correct food chain with correct arrows if given gains 1 mark* 1



(ii) any **two** from:

- waste / excreted / urine / faeces / CO₂ (from tuna)
from / of tuna not required but do not accept if of / from other organisms
- respiration (of tuna)
ignore used in reproduction
- movement (of tuna) / hunting
if a mark is not awarded for respiration / movement / heat allow 1 mark for energy (unqualified)
- used for heat (production) (of tuna)
- not digested / absorbed

2

(b) (i) 40

*award **both** marks for correct answer, irrespective of working
allow (290 – 50) / 6 or 240/6 for 1 mark*

allow $\frac{1}{3}$ / 48³ / 48 for 1 mark

2

(ii) cost of food / protein

1

(c) any **one** from:

- concern about animal welfare **or** examples **or** cruel to tuna
or unethical **or** lack of space
allow immoral
ignore not natural
- poorer flavour / quality

1

[8]

Q25.

(i) customers concerned with the environment / green issues (will be attracted) owtte
allow idea of helping the world

1

(ii) reduces transport of food

1

less carbon dioxide / greenhouse gas / emissions / harmful gases / lower carbon footprint (from transport)

allow less fuel used
ignore pollution unqualified

1

[3]

Q26.

(a) 30

*award **both** marks for correct answer, irrespective of working*
100 – (33 + 27 + 10) or equivalent for 1 mark

2

(b) 2 **or** 1.98

*award **both** marks for correct answer, irrespective of working*
(33 / 100) × 6 or equivalent for 1 mark

2

(c) respiration

1

(d) (i) less / no heat loss / movement

*do **not** accept 'energy' / warmth unqualified*

1

(ii) any reference to cruelty eg stress to calf / cramped conditions
ignore references to disease / hygiene

1

[7]

Q27.

- (a) 8.3 **or** 8.3 recurring **or** 8
*award **both** marks for correct answer, irrespective of working
 7 / 84 × 100 or equivalent for 1 mark* 2
- (b) any **three** from:
- heat
allow keeping warm
 - respiration
***not** for respiration*
 - movement **or** example of movement eg exercise / kinetic
 - faeces / waste / urine / excretion / urea
ignore eggs / sound 3
- (c) any **one** from:
- less / no movement
allow examples of movement
 - less / no heat loss
 - reference to selective breeding
 - reference to controlled / better / more feeding 1
- (d) any **two** from:
- less steps in food chain
 - less losses of biomass / energy / examples of losses
 - cheaper to feed herbivores
*allow dangerous to keep carnivores
 herbivores contain more energy is insufficient* 2

[8]

Q28.

- (a) circulation / mixing / described 1
- or**
- temperature maintenance
- supply oxygen
*do **not** allow oxygen for anaerobic respiration*

or

for aerobic conditions

or

for faster respiration

1

(b) any **one** from:

- energy supply / fuel
or use in respiration
do not allow just food / growth
ignore reference to aerobic / anaerobic
- material for growth
or to make mycoprotein

1

(c) (heat / energy) from respiration

allow exothermic reactions
allow description eg breakdown of glucose / catabolism
ignore metabolism
ignore aerobic / anaerobic

1

(d) (i) any **one** from:

- compete (with Fusarium) for food / oxygen
or reduce yield of Fusarium
- make toxic waste products
or they might cause disease / pathogenic
or harmful to people / Fusarium
do not allow harmful unqualified

1

(ii) any **two** from:

- steam / heat treat / sterilise fermenter (before use)
not just clean
allow sterilisation unqualified for 1 mark
- steam / heat treat / sterilise glucose / minerals / nutrients / water (before use)
not just use pure glucose
- filter / sterilise air intake
- check there are no leaks

2

(e) any **three** from:

- beef is best **or** beef is better than mycoprotein(*)
- mycoprotein mainly better than wheat(*)
- more phenylalanine in wheat than in mycoprotein(*)
allow equivalent numerical statements()*
- but no information given on other amino acids / costs / foods

3

overall conclusion:

statement is incorrect

or

it would be the best source for vegetarians

or

for given amino acids, beef is the best source

or

three foods provide insufficient data to draw a valid conclusion

1

[11]

Q29.

- (a) scientists figures based on research / calculations / data

or

scientists sample whole area

ignore reasons based on bias

1

fishermen based on impression / hearsay / experience

or

fishermen fish in well-stocked / limited areas

scientists sample a wider area = 2 marks

fishermen only fish in well-stocked areas = 2 marks

*if no marks gained fishermen's opinion **and** scientists' opinion gains 1 mark*

1

- (b) any **two** from:

- economic considerations
eg fear for jobs, profits, big demand for cod
- political impact
eg allow EU / government decide or laws will be passed

- pressure groups **or** fears of extinction 2

[4]

Q30.

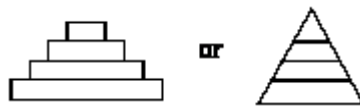
- (a) 0.1

ignore working or lack of working

$$\frac{88 \times 100}{88\,000} \text{ for 1 mark}$$

2

- (b) shape: pyramid with 4 tiers



1

labels:

Plants + Herbivores + Carnivores + Top carnivores
(in sequence – largest to smallest)

allow suitable named examples

inverted pyramid correctly labelled = 1 mark

1

- (c) more energy / biomass / materials / matter available or less energy lost or energy used up (by herbivores)
not just plants

1

[5]

Q31.

- (a) 4 of:
intensification due to need to improve efficiency of energy transfer;
has led to developing fast growing crop varieties;
native plants cannot compete with these;
for e.g. light/water/minerals;
effect of herbicides;
pesticides killing pollinating insects

each for 1 mark

4

- (b) recommend a variety of measures; (can be implied)
because rotational will allow these species to continue;
permanent will allow others;
leading to conservation of a wide range of species

each for 1 mark

4

[8]

Q32.

- (a) (i) 200 kJ

for 1 mark

1

- (ii) 2

gains 2 marks

(if answer incorrect, 20 / 1000 × 100 gains 1 mark)

2

- (b) *ideas that*

energy lost by animal (pig / cattle) / extra stage / extra trophic level
in waste materials e.g.

in muscular activity / movement

in keeping body temperature higher than surroundings / lost as heat

any three for 1 mark each

references to respiration regarded as neutral

3

- (c) *ideas that*

controlling (high) temperature of surroundings / keeping indoors / insulating

reduces energy transferred from animal as heat / animal uses body heat to maintain
temperature restricting movement (e.g. caging or keeping in darkness)

reduces muscular contraction / muscular activity

each for 1 mark

*accept respiration as explanation once only if neither
explanation point has received credit*

reject give more food / different food

4

[10]

Q33.

to reduce energy 'lost' (by movement)

accept need less energy

so more energy is available for growth

accept prevents loss of body mass to provide energy

accept so need less food

accept get fatter

accept so weight gain

accept so more growth

[2]

Q34.

indication that carbon dioxide emissions contribute to global warming

accept 'greenhouse effect' for global warming

1

argument for:

in terms of decreases carbon dioxide emissions because less (fuel / energy used for)
transport / imports

1

argument against:
in terms of increases carbon dioxide emissions because of (fuel / energy used for)
heating and lighting greenhouses

1

[3]

Q35.

use less nitrate / fertiliser

accept use none

use a different fertiliser is neutral

prevent nitrate fertiliser run off is neutral

1

any **two** from:

explanation that with less or none the crops still grow

make more land available to grow more crops

monitoring of water

legislation

organic farming / manure

genetically modified crops

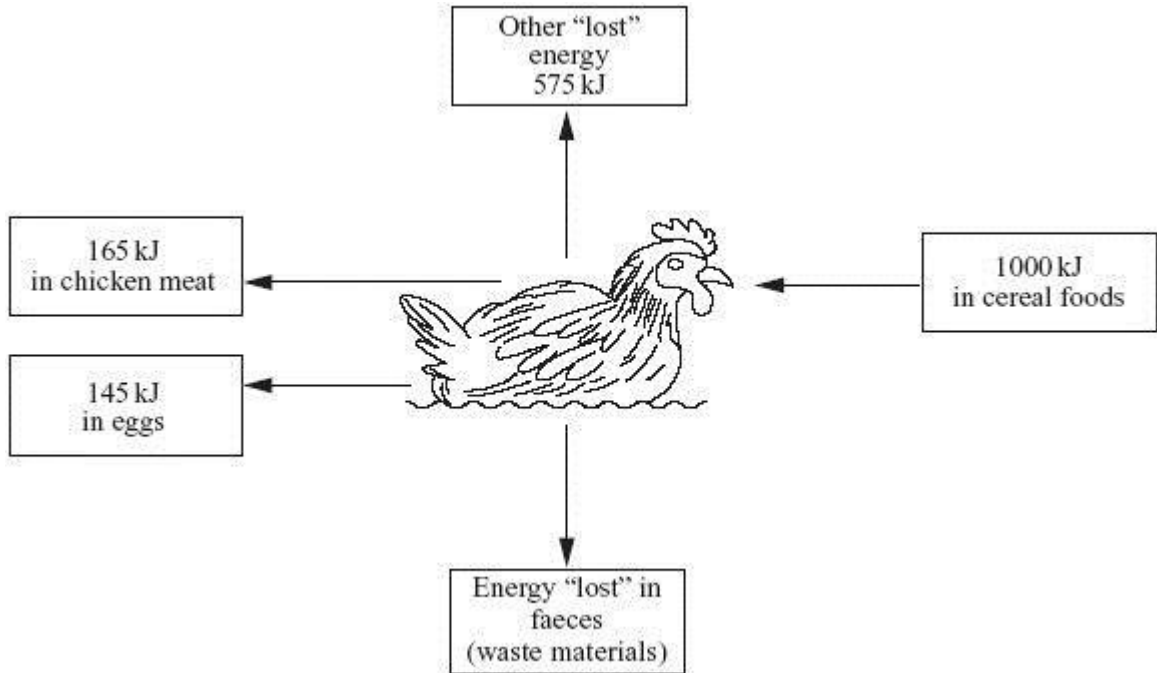
give babies bottled water

2

[3]

Q1.

Chickens are kept as farm animals to produce food. Free-range chickens are allowed to feed in a large space outside. The diagram shows how energy supplied in food to a free-range chicken is transferred.



(a) Calculate the amount of energy “lost” in faeces.

Energy “lost” = _____ kJ

(1)

(b) Some farmers use the battery method. They keep large numbers of chickens in a small indoor space. The food yield from these chickens is higher than that from free-range chickens. Explain why, as fully as you can.

(4)

(Total 5 marks)

Q2.

The information in the table compares two farms. Both are the same size, on similar land, close to one another and both are equally well managed.

Name of farm	Activity	Energy value of food for humans produced in one year	Number of people whose energy requirements can be met by this food
Greenbank Farm	Grows food for humans	3285 million kJ	720
Oaktree Farm	Grows food for animals on the farm which become food for humans	365 million kJ	80

- (a) Use this information to work out the average daily human energy requirement in kilojoules (kJ) per day.

Energy requirement = _____ kJ/day

(2)

- (b) The figures show that farms like Greenbank Farm can be nine times more efficient at meeting human food energy requirements than farms such as Oaktree Farm.

- (i) The food chain for Greenbank Farm is:

vegetation → humans

What is the food chain for Oaktree Farm?

(1)

- (ii) Explain why Greenbank Farm is much more efficient at meeting human food energy requirements.

(3)

- (c) The human population has been increasing rapidly throughout this century. It is now

about 6 billion and is still growing. What does the information in this question suggest about likely changes in the human diet which may need to occur during the coming century? Explain your answer.

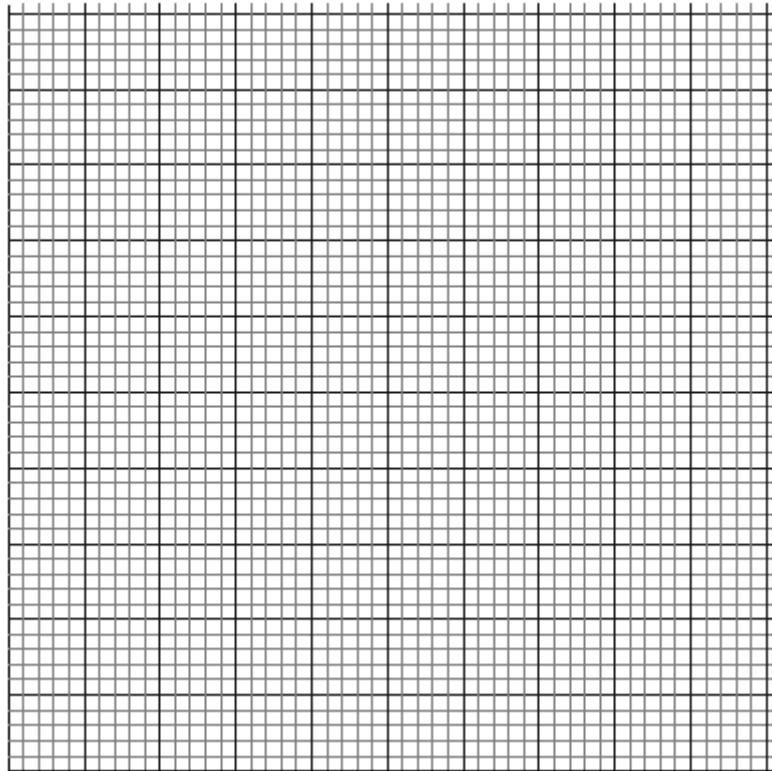
(4)
(Total 10 marks)

Q3.

The figures below show how the yield of a wheat crop is affected by adding nitrogen fertiliser.

Nitrogen fertiliser added (kg/hectare)	Yield (tonnes/hectare)
0	26
50	28
75	31
100	34
125	40
150	43
175	44
200	44

- (a) Display these results on the graph paper in the most suitable way.



(4)

(b) What conclusions can you draw from the graph?

(3)

(Total 7 marks)

Q4.

(a) 1m^2 of a field gets about 1050MJ of light energy per year.

Only 21 500kJ of energy is stored in the new grass.

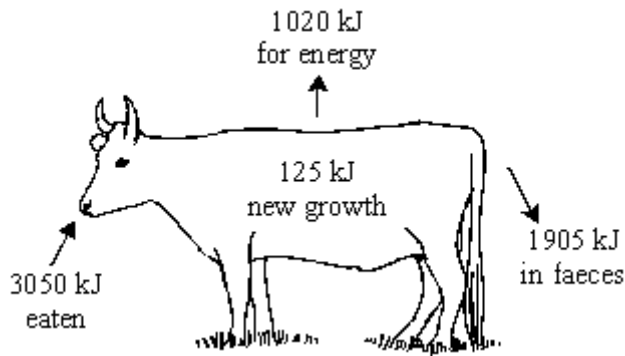
(i) How is the energy stored in the new grass?

(1)

(ii) What is the % of light energy stored in the grass?

(1)

(b)



The diagram shows what happens to the energy from grass in part of a field which is grazed by a bullock.

Using information in the diagram suggest why food chains are usually short.

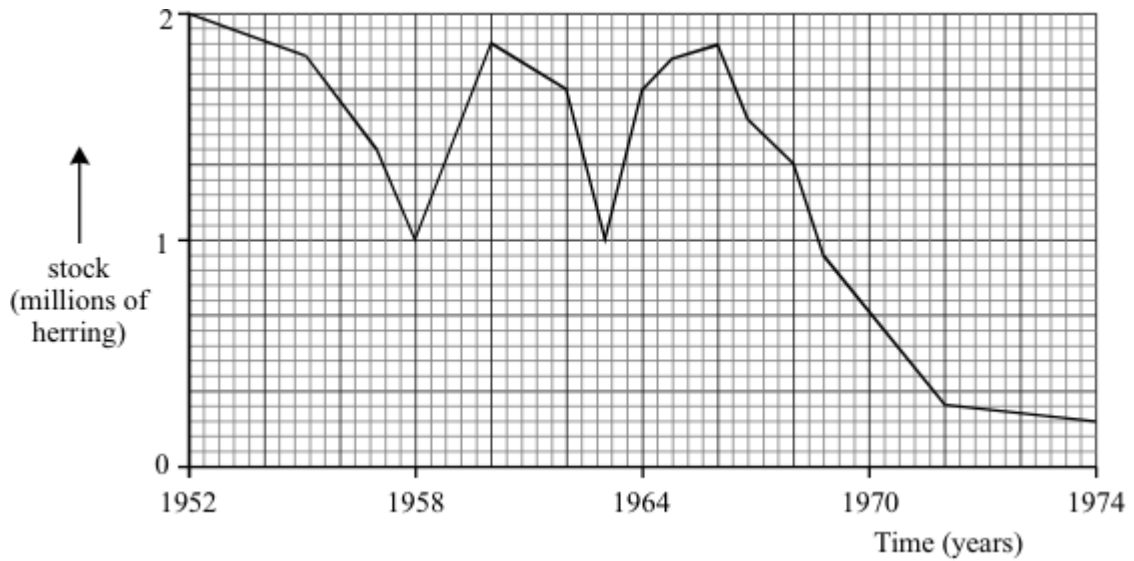
(3)

(c) Many of the animals which form part of our diet are herbivores rather than carnivores. Explain why as fully as you can.

(3)

(Total 8 marks)

Q5.



The graph shows the variations in the North Sea herring population between 1952 and 1974. These fish were formerly caught in large numbers by fleets of trawlers but fishing has been restricted since 1974 as a conservation measure. Herrings lay about 20 000 eggs per year but do not reproduce until they are about 3–5 years old, when they are about 25cm long. It takes 11 years for a herring to reach its mature adult length.

The following measures have been suggested to prevent overfishing:

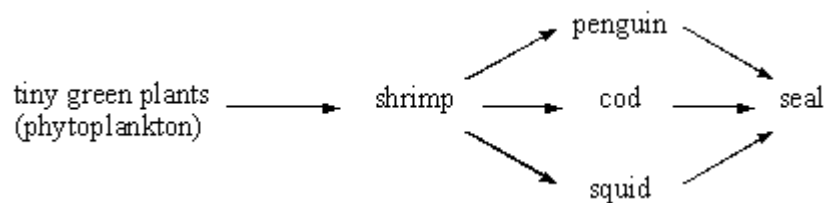
- limiting mesh size of nets,
- specifying maximum catch by each boat per year.
- prohibiting fishing in herring breeding grounds.
- prohibiting fishing at certain times of the year.

Evaluate their probable effects on both fish stocks and the fishermen, using the information given above.

(Total 9 marks)

Q6.

Scientists have found the following food web in the cold Antarctic Ocean.



- (a) Humans are removing large numbers of the cod.

Some scientists argue that this could lead to a decrease in the numbers of squid and penguins.

Others argue that the numbers of squid and penguins will stay the same.

Carefully explain each argument.

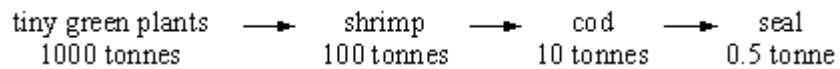
Why they might decrease.

(1)

Why they might stay the same.

(2)

- (b) The following information is about the biomass of the organisms in one of the food chains in the web.



Draw and label a pyramid of biomass for this chain.

(2)

- (c) Explain, as fully as you can, why the conversion of shrimp biomass into cod biomass is more efficient than that of cod biomass into seal biomass in the cold Antarctic Ocean.

(3)

(d) Boats from many countries fish the Antarctic Ocean. The cod are being overfished. If the numbers of cod are to increase, the population must be carefully managed.

(i) Suggest **two** control measures which would prevent a further drop in numbers,

(2)

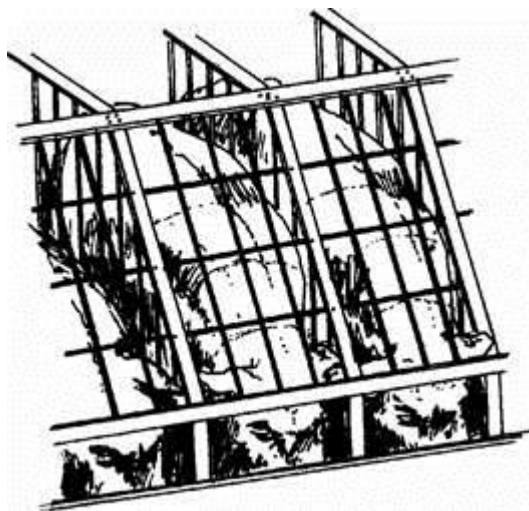
(ii) Suggest why **one** of your control measures would be difficult to put into practice.

(1)

(Total 11 marks)

Q7.

To produce cheap meat, animals must be grown (reared) efficiently. When pigs are reared intensively they are kept indoors. Their surroundings are closely monitored to make sure they have even ventilation and the correct temperature. The risk of infection is high but is reduced by feeding them antibiotics and removing their faeces. The pigs live in cages and cannot move around much.



(a) Explain why farmers control the temperature.

(2)

(b) Explain why farmers want to stop the pigs moving about.

(2)

(c) Give two arguments **against** rearing pigs indoors instead of rearing them outdoors.

1. _____
2. _____

(2)

(Total 6 marks)

Mark schemes

Q1.

- (a) 115 1
- (b) any **four** from
- less energy lost / used
 - as heat lost to the atmosphere
 - since warm indoors
accept temperature controlled
 - (less energy lost) in movement
 - since movement restricted
 - more growth / eggs
accept prevents loss of body mass or gets fatter / weight gain
- 4

[5]

Q2.

- (a) 12 500
- 2
- incorrect numerical answer but clear evidence of correct working e.g. 365 million ÷ 365 ÷ 80 or 3285 million ÷ 365 ÷ 720 credit with (1)*
- (b) (i) vegetation
→ (farm) animals → humans
*accept any correct variation on this theme
e.g. grass → lambs → humans*
- 1
- (ii) any **three** linked points from
- * less links in the food chain
or only one link in the food chain
 - * energy 'wasted' or 'lost' or 'used' at each link
 - * energy 'wasted' or 'lost' in (the process of) respiration
 - * energy 'used' to maintain body temperature
 - * energy 'used' by the animals in movement

3

- (c) people will eat more/greater proportion of food from plants

accept people will eat less/smaller proportion of food from animals
do not credit 'everyone will stop eating meat'

1

any **three** linked points from

these marks are independent of the 'prediction' mark
do not credit 'food from plants will become less expensive'

- * meat will become more expensive
 - * only a limited area of land available on the planet (for food production **or** otherwise)
 - * more people means less land available for food production because some used for housing etc.
 - * land will become more expensive
 - * land will have to be used more efficiently
- or more people will go hungry*
or people will (each) eat less
- * livestock farmers will try to improve efficiency
 - * (leading to) growth of 'factory farming'
 - * demand for food will rise (total)

3

[10]

Q3.

(a) both axes labelled
both axes appropriate scale
plotting 7 correct
good attempt at line graph
each for 1 mark

4

- (b) more fertiliser added more yield increased
gains 1 mark

but
yield increases with fertiliser up to maximum
gains 2 marks

yield **increase** slows down above 125/150 kg/ha
either for 1 further mark

(do **not** allow yield falls)
 maximum yield with 175 kg/ha

3

[7]

Q4.

(a) (i) carbohydrate*/fat/protein in cell
 (or example e.g. glucose/starch)
for 1 mark

1

(ii) $\frac{21500 \times 100}{1050000}$ or 2.(05)%
for 1 mark

1

(b) *ideas that:*
 little energy used for growth/most wasted/lost
gains 1 mark

but
 only 4% used for new growth
gains 2 marks

evidence/idea that this is repeated at each stage
 idea of diminishing return/less energy at each stage
for 1 mark each
(maximum of 3)

3

(c) *idea:*
 plants at the start of all food chains
 shorter food chain
 more efficient/less energy lost/more food
 cheaper/more economic
 (must bear consequence of at least one of earlier marks)
any three for 1 mark each

3

[8]

Q5.

ideas that:

large mesh
 allows small fish to escape so they live long enough/grow big enough to breed
 maintains stocks

close season
 maintains stocks
 unless catch more in rest of time

especially important in breeding season

closed areas

maintains stocks
 especially important for breeding grounds
 but can't make fish stay inside area

quotas

maintains stocks
 plus difficulty of enforcement of any/all of above

any 7 for 1 mark each

fisherman (effect of controls on)

reduced catches/less income ∴ controls
 harder to catch fish
 but will ensure their future

any 3 for 1 mark each

to max. of 9

(credit other good but unanticipated reasons)

[9]

Q6.

(a) Decrease: seals will eat more squid and penguins

for 1 mark

1

Stay the same:

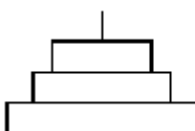
- more shrimp/food for squid and penguins


ideas that

- increase in squid and penguins balances the extra eaten by seals
- seals find other prey (allow start to eat shrimps)

any two for one mark each

2

(b)  seal
 cod
 shrimp
 plants

credit  *for seal*

allow



- correct shape (doesn't need to be to scale)
- correctly with organisms

*(if wholly correct but inverted then credit 1 mark)
each for 1 mark*

2

- (c)
- seals are mammals
 - *idea that seals have (to maintain) a constant body temperature [allow warm blooded]*
 - heat losses to cold seas
 - more of food eaten used to replace heat loss

*(credit use of figures i.e. 95% loss compared to 90%
or 5% efficient compared to 10%
or 20 : 1 conversion ratio compared to 10 : 1
with 1 mark)*

any three for 1 mark each

3

- (d) (i) *ideas that*
- reduce number of fishing boats allowed
 - breed in captivity and then release
 - agree quotas [not an unqualified 'ban']
 - avoid breeding areas
 - avoid breeding seasons
 - increase size of net mesh/don't catch small fish
 - limit catches of shrimps
 - cull seals
- any two for 1 mark each
[allow any other reasonable answer]*

2

- (ii)
- breeding areas closer to some countries than others
 - difficult to police/easy to cheat/'poach'
 - difficult to agree quotas
 - some countries eat more fish than others
 - best weather for fishing maybe in breeding seasons
 - fisherman/trawlers need employment
 - big demand for cod
- any one for 1 mark*

[allow any other sensible response]

1

[11]

Q7.

(a) *idea that*

- so they don't get too hot / cold
for high temperatures
- don't lose condition / weight **or** don't become ill
- don't lose too much water / become dehydrated
(allow don't sweat too much)
for low temperatures
- reduce heat loss from pigs
- less energy wasted in maintaining body temperature
for 1 mark each

2

- (b)
- reduce energy loss by movement
 - so more is available for growth*
*(*credit this point if given in (a) but only credit once)*
 - don't use body mass to provide energy
 - easier to handle / monitor
for 1 mark each

2

(c) *idea that*

- less humane / not natural / cruel / no room to exercise / stressful
- more intensive labour
- increased risk of disease / (often) in contact with faeces
- antibiotic residues in meat
any two for 1 mark each

2

[6]