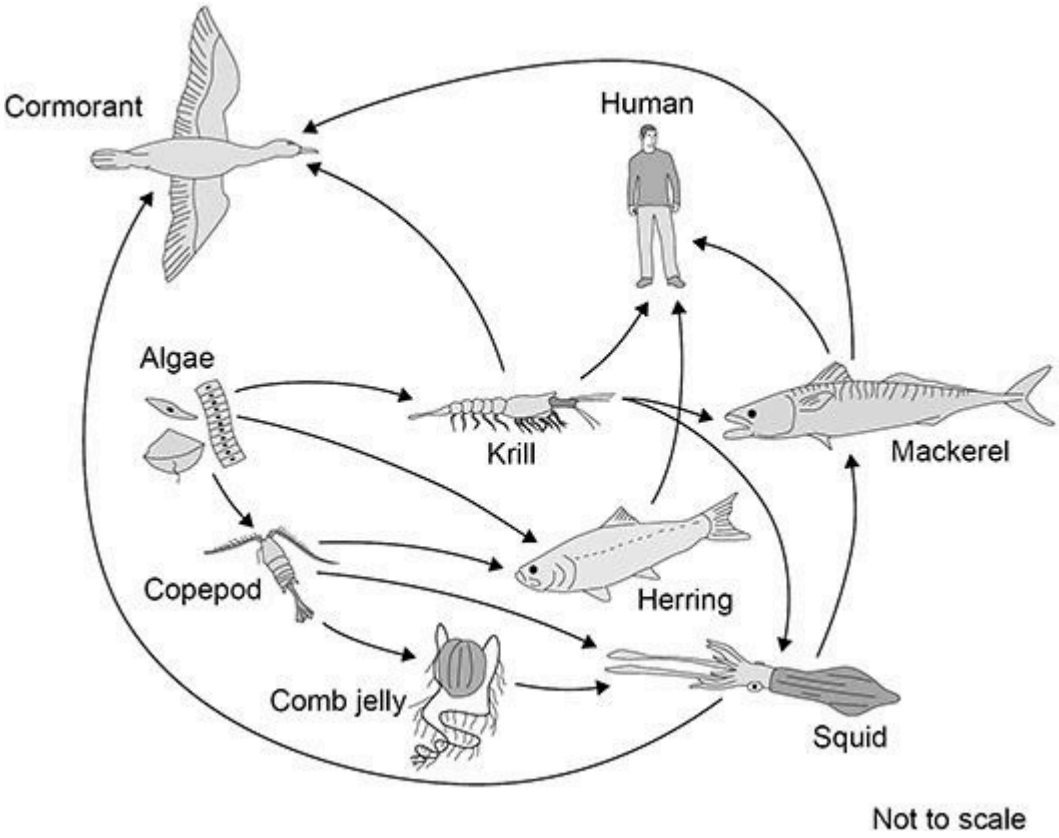
Q1.

A food web contains several food chains.

Figure 1 shows a food web.

Figure 1



(a) The animals in Figure 1 get their energy by eating other organisms.

Describe how the algae get energy.

_____

_____

_____

_____

(2)

(b) Name one primary consumer in Figure 1.

_____

(1)

(c) Name one producer in Figure 1.

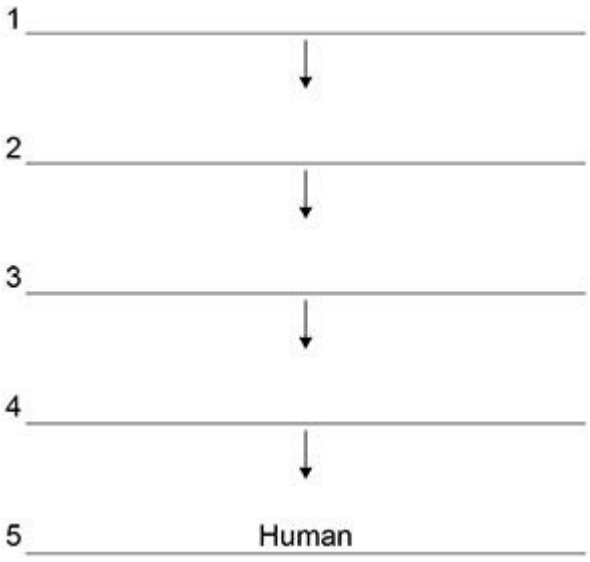
_____

(1)

(d) The different food chains in Figure 1 have different numbers of organisms.

Complete Figure 2 to show a food chain in Figure 1 with five organisms, including the human.

Figure 2



(1)

(e) Figure 1 shows that mackerel eat krill and squid.

The biomass of mackerel is much less than the combined biomass of krill and squid.

One reason for this is that the mackerel cannot digest all parts of the krill and squid.

Give two other reasons.

1 _____

_____

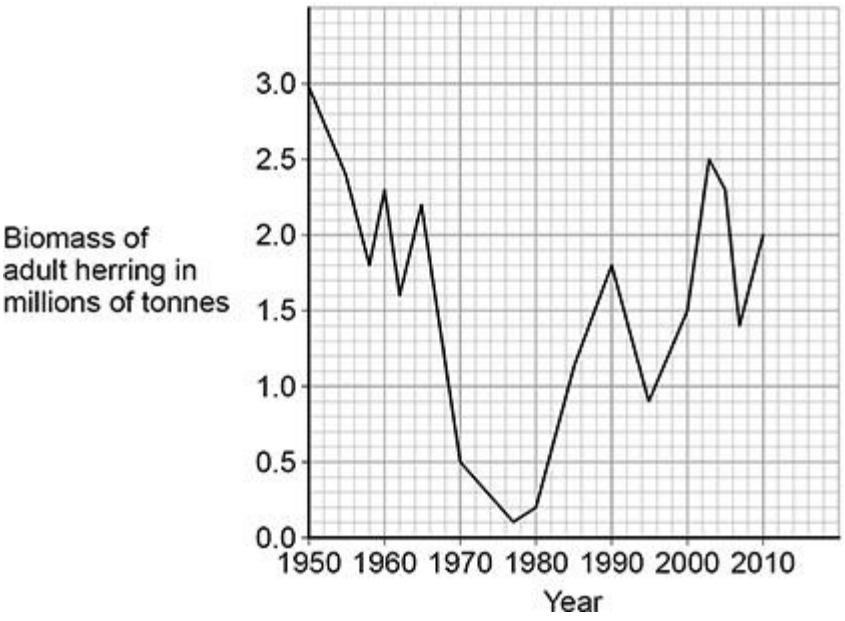
2 _____

_____

(2)

Figure 3 shows how the biomass of adult herring in the North Sea has changed between 1950 and 2010.

Figure 3



(f) Calculate the percentage decrease in the biomass of herring between 1960 and 1977.

Give your answer to the nearest whole number.

_____

_____

_____

_____

_____

_____

_____

_____

Percentage decrease = _____ %

(4)

(g) Too many herring were caught by fishermen between 1960 and 1977.

Herring can live for up to 12 years and begin to reproduce when 3 to 4 years old.

Laws have been introduced to help conserve herring:

- 1977 to 1981 – herring fishing was banned in the North Sea
- 1984 to present day – control of mesh size of fishing nets
- 1997 to present day – fishing quotas were introduced
- 1998 to present day – herring fishing was banned in breeding grounds during the breeding season.

Figure 4shows how a minimum mesh size helps to conserve herring.

Figure 4

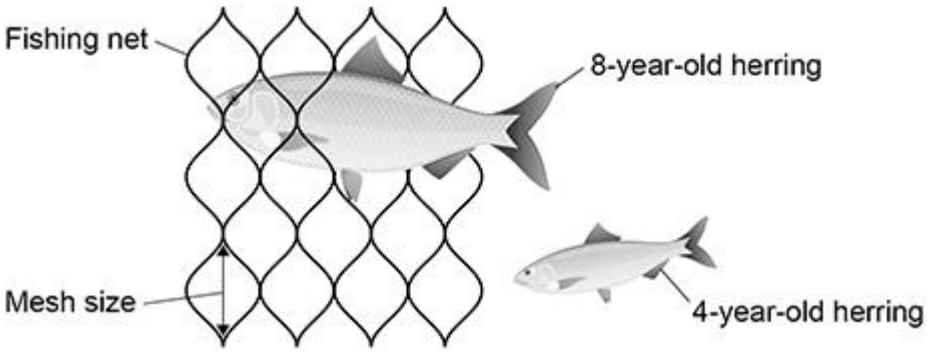
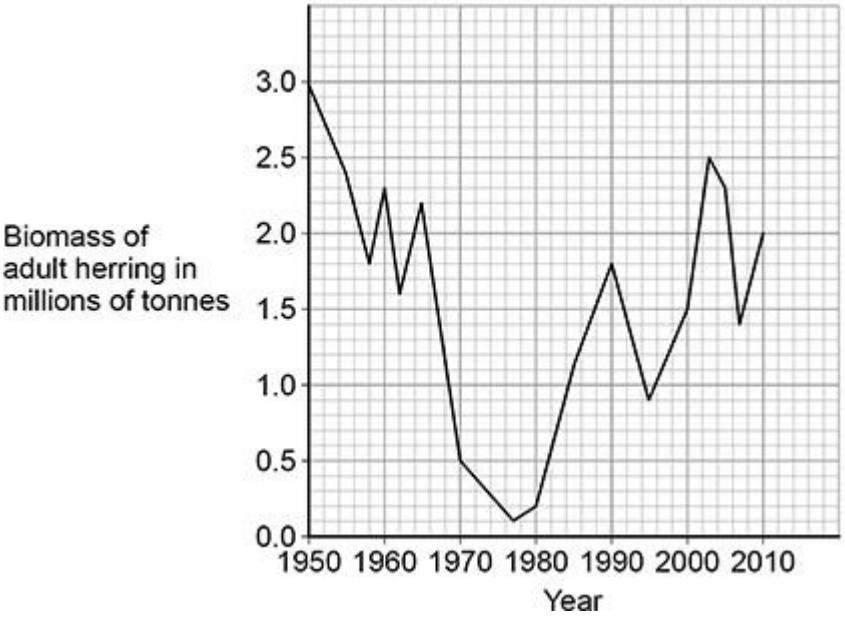


Figure 3 is repeated below.

Figure 3



Evaluate the effect of these laws on the conservation of herring stocks. Use data from Figure 3 and information from Figure 4 in your answer.

_____

_____

_____

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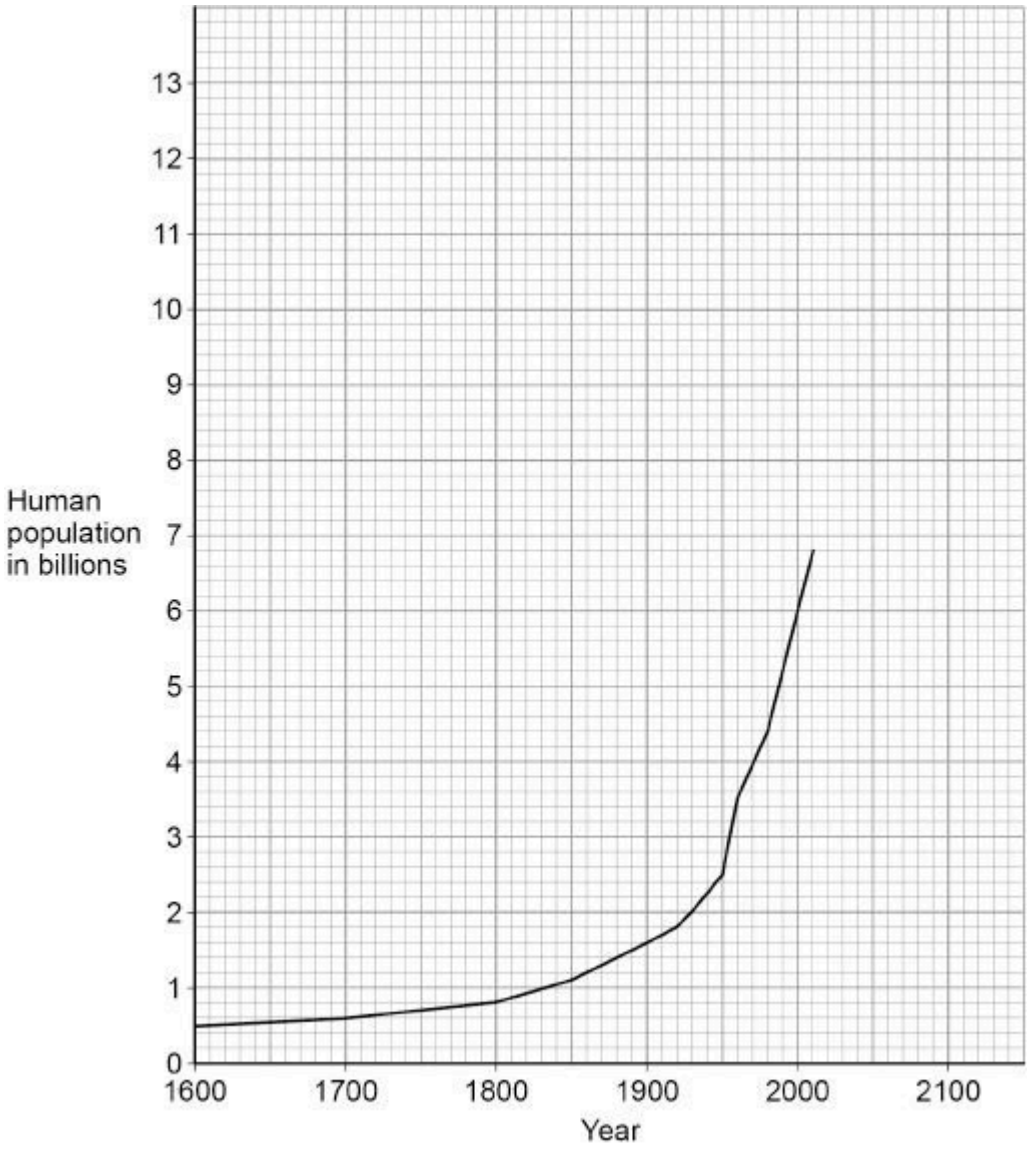
_____

(6)

(Total 17 marks)

Q2.

The graph below shows the human population from 1600 to 2010.



In 1900 the human population was 1.6 billion.

(a) Calculate how many times greater the human population was in the year 2000 compared with the year 1900.

_____

_____

_____

Number of times greater = _____

(2)

(b) In 1950 the human population was 2.5 billion.

Calculate the mean annual increase in the human population between 1900 and 1950.

_____

_____

_____

Mean annual increase = _____ billion per year

(2)

(c) Predict the human population in 2050 if the current rate of population increase continues.

You should draw an extrapolation line on the graph above.

_____

_____

_____

Predicted human population = _____

(2)

(d) The increasing human population has caused a decline in fish stocks.

Describe how fishing quotas can help to return fish stocks to a sustainable level.

_____

_____

_____

_____

(2)

(e) Farming techniques have changed in recent years.

Describe:

- why more land is being used for farming

- how increased farming has decreased biodiversity.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

(6)

(f) Genetic modification of crop plants can help meet the demands of the increasing human population.

Golden rice is a genetically modified (GM) crop.

What is the advantage of golden rice compared with non-GM rice?

Tick (✓) one box.

Golden rice contains protein-rich mycoprotein ☐

Golden rice has improved nutritional value ☐

Golden rice produces human insulin ☐

(1)

(g) Suggest one reason why some people are concerned about the use of golden rice.

_____

_____

(1)

(Total 16 marks)

Q3.

A new dog food has been developed that does not contain meat from cows, sheep or chickens.

The new dog food contains insects.

The insects in the dog food factory are fed on waste vegetables.

(a) Sketch the pyramid of biomass for the food chain that produces food for dogs from insects.
Label the pyramid.

(2)

(b) Describe two reasons why the biomass of the insects eaten by dogs does not all become biomass of the dogs.

1 _____

_____

2 _____

_____

(2)

(c) Explain how making dog food from insects could improve human food security in the future.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

(4)

(Total 8 marks)

Q4.

Ragwort is a weed that grows on farmland.

Ragwort is poisonous to horses.

(a) Plan an investigation to estimate the size of a population of ragwort growing in a rectangular field on a farm.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

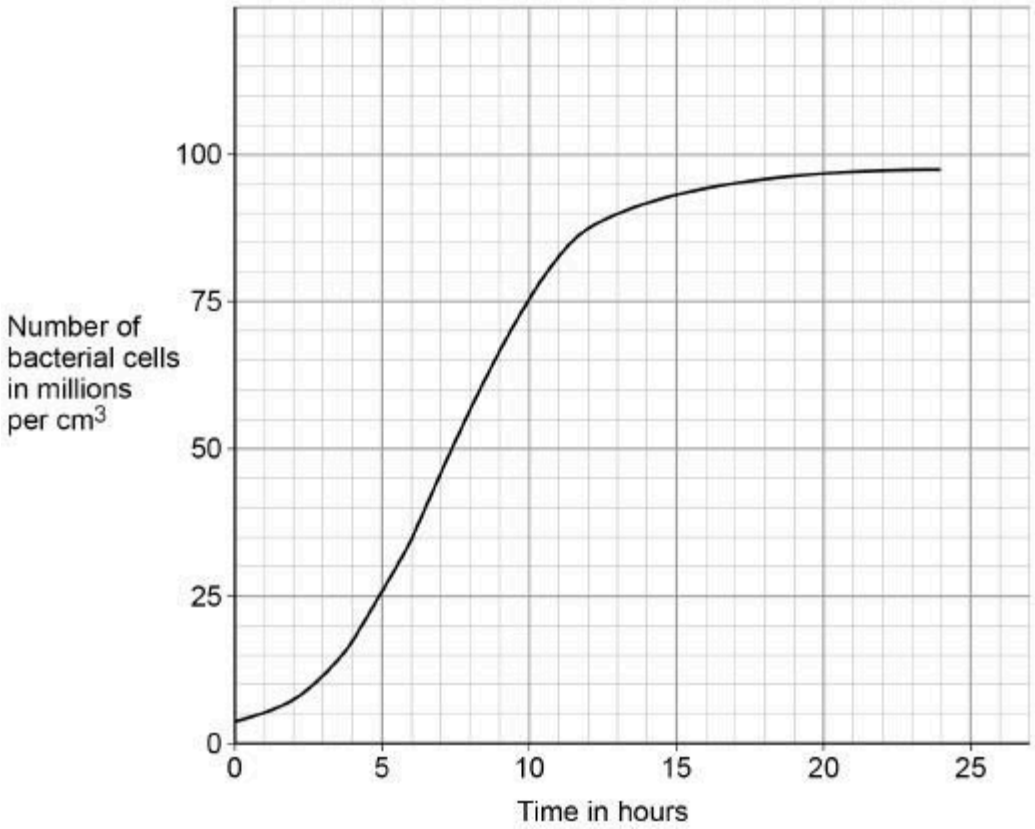
(4)

The herbicide glyphosate will kill ragwort and other weeds.

Scientists use bacteria for the genetic engineering of crop plants to make the crops resistant to glyphosate.

Figure 1 shows the growth of a culture of the bacteria in a solution of nutrients at 25 °C

Figure 1



(b) Why did the rate of reproduction increase between 2 hours and 7 hours?

_____

_____

(1)

(c) After 12 hours, the rate of reproduction decreased.

Suggest three ways the scientists could maintain a high rate of reproduction in the bacterial culture.

1 _____

_____

2 _____

_____

3 _____

_____

(3)

(d) The rate of reproduction of the bacteria is fastest at 7 hours.

How many times faster is the rate of reproduction at 7 hours than the rate at 12 hours?

_____

_____

_____

_____

_____

_____

_____

_____

Rate at 7 hours is _____ times faster.

(4)

(e) Scientists transferred a gene for resistance to the herbicide glyphosate into the bacteria.

The genetically-modified (GM) bacteria can then transfer the glyphosate-resistance gene to a crop plant.

Explain the advantage of making crop plants resistant to glyphosate.

_____

_____

_____

_____

_____

_____

_____

_____

(3)

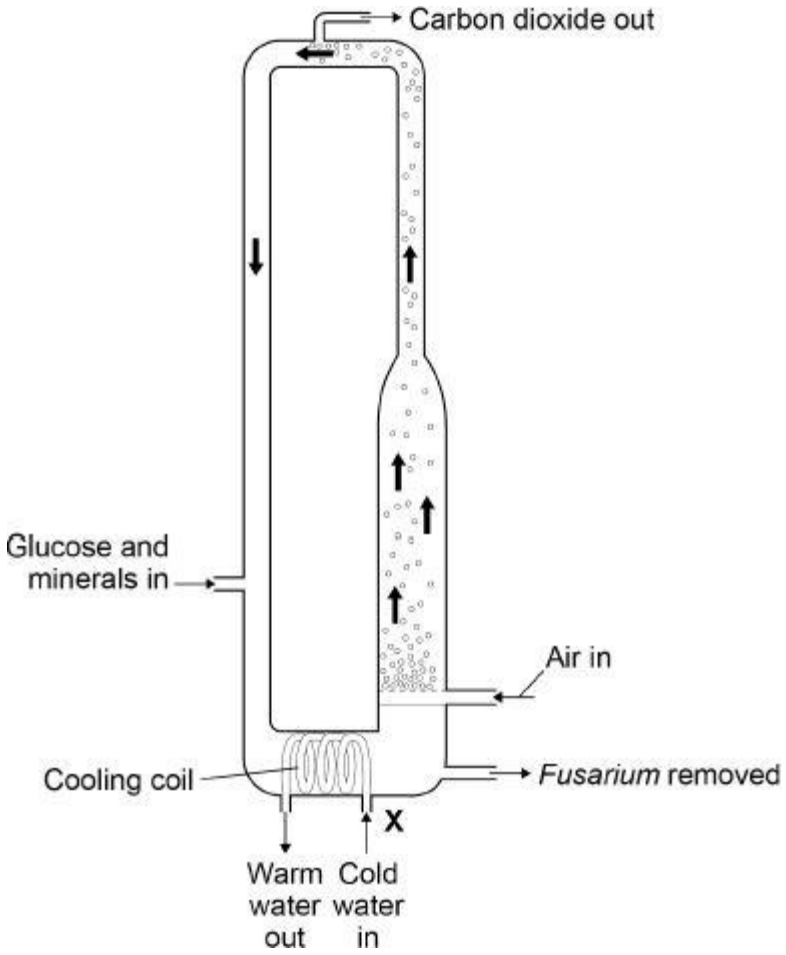
(Total 15 marks)

Q5.

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 ☐

20 °C ☐

30 °C ☐

85 °C ☐

(1)

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

The bubbles of air supply oxygen. Explain why *Fusarium* needs glucose and oxygen.

_____

_____

_____

_____

(2)

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

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

_____

_____

_____

_____

(2)

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

100 grams of mycoprotein contains 11 grams of protein.

A man ate 100 grams of chicken in one meal.

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

100 grams ☐

110 grams ☐

200 grams ☐

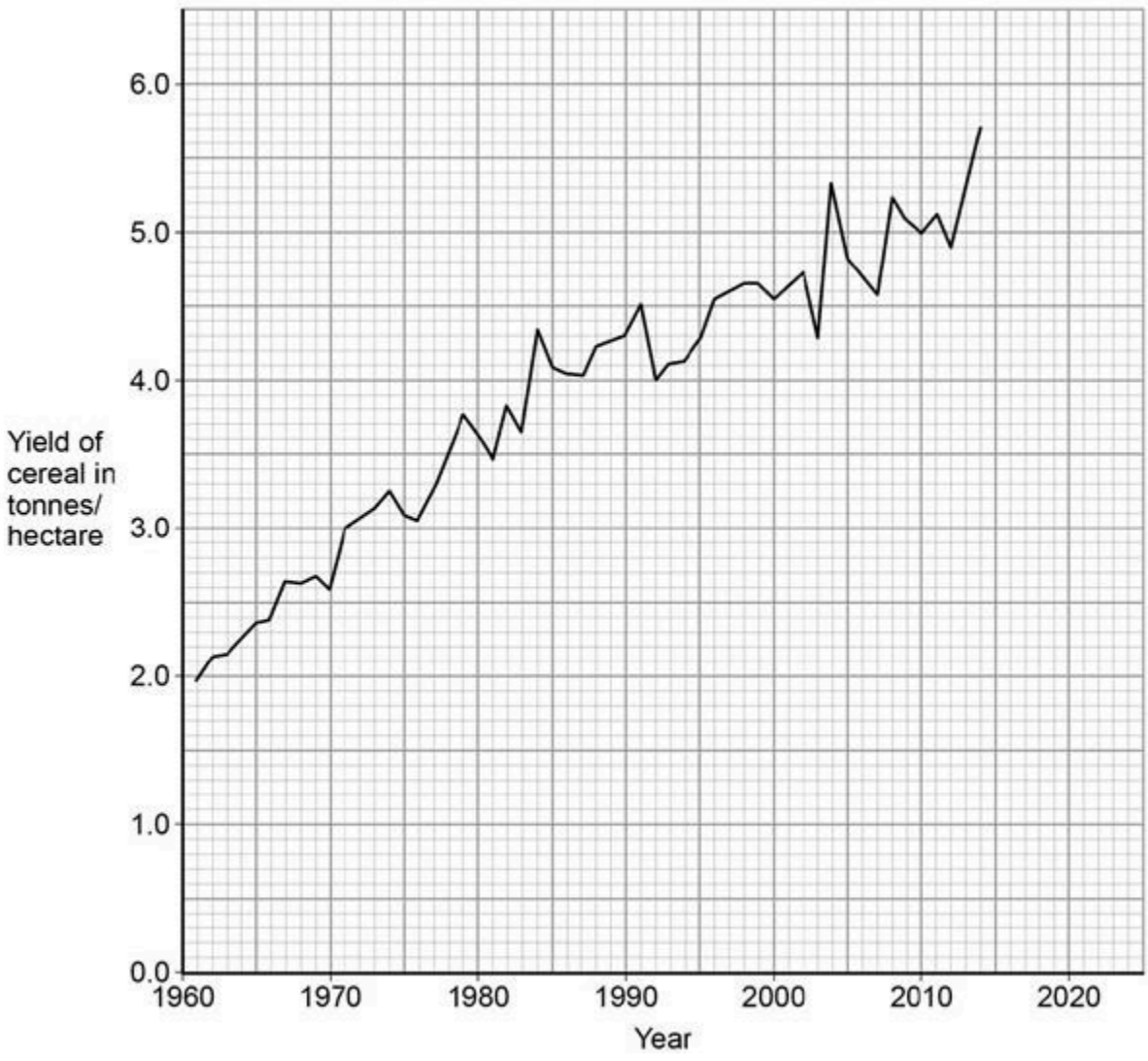
220 grams ☐

(1)

(Total 8 marks)

Q6.

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 ☐

Fat ☐

Protein ☐

Starch ☐

(1)

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

Suggest three possible reasons for the increased yield in 2004.

Tick three boxes.

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

A pathogenic fungus grew on the cereal in 2004. ☐

Farmers added more nitrate to the soil in 2003. ☐

More cereal seeds were sown in 2003. ☐

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

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

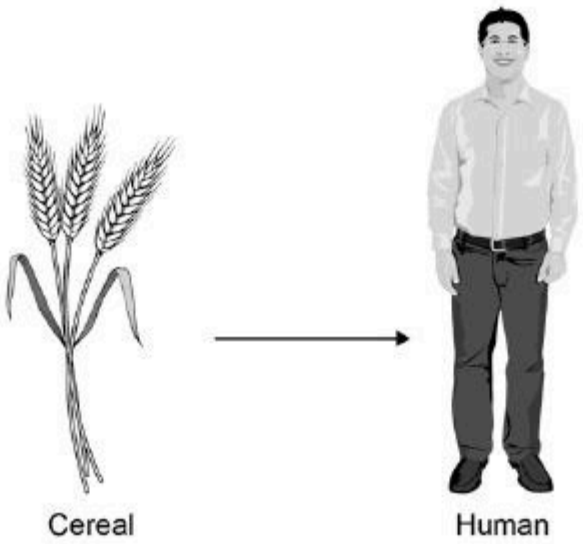


Figure 2

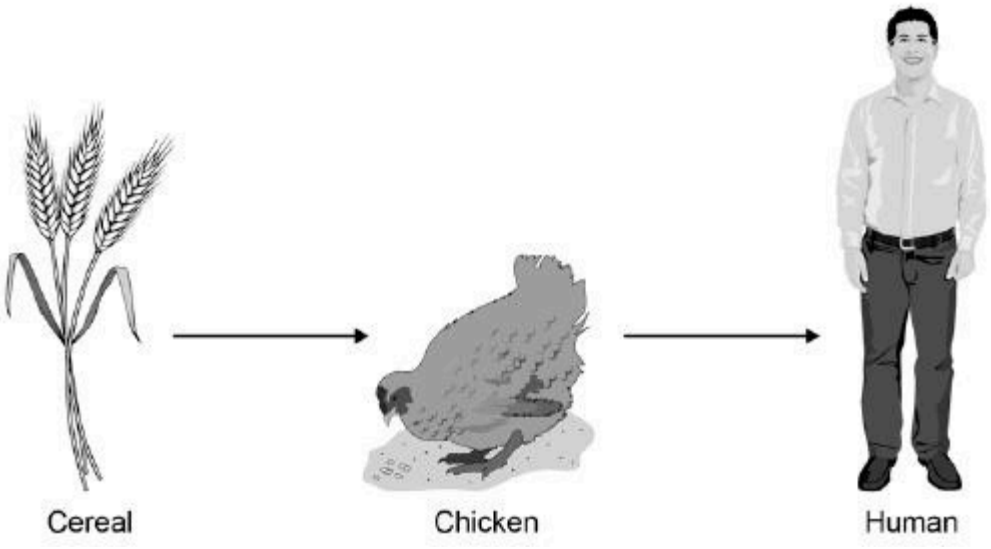
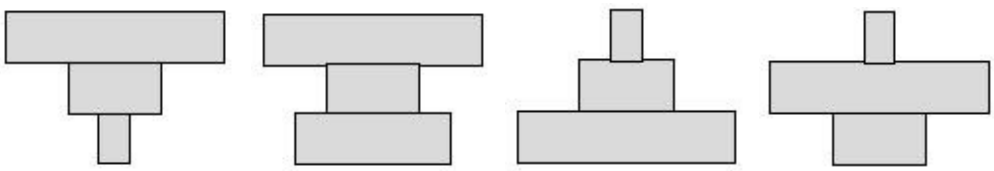


Figure 2

(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)

Q7.

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

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

Calculate the energy output value X.

Use the equation:

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

_____

_____

_____

_____

_____

_____

_____

Energy output value X = _____ kJ / m2 / year

(3)

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

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

Use the equation from (a).

_____

_____

_____

_____

_____

Answer = _____ times

(3)

(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)

Q8.

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.

(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
200	362
4	316
2005	348
200	224
6	215
200	91
7	67

200

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

8

200

_____200_____

9

_____

2010

Decrease in seals = _____ %

(2)

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

Suggest two reasons why.

1.

_____

_____

2.

_____

_____

(2)

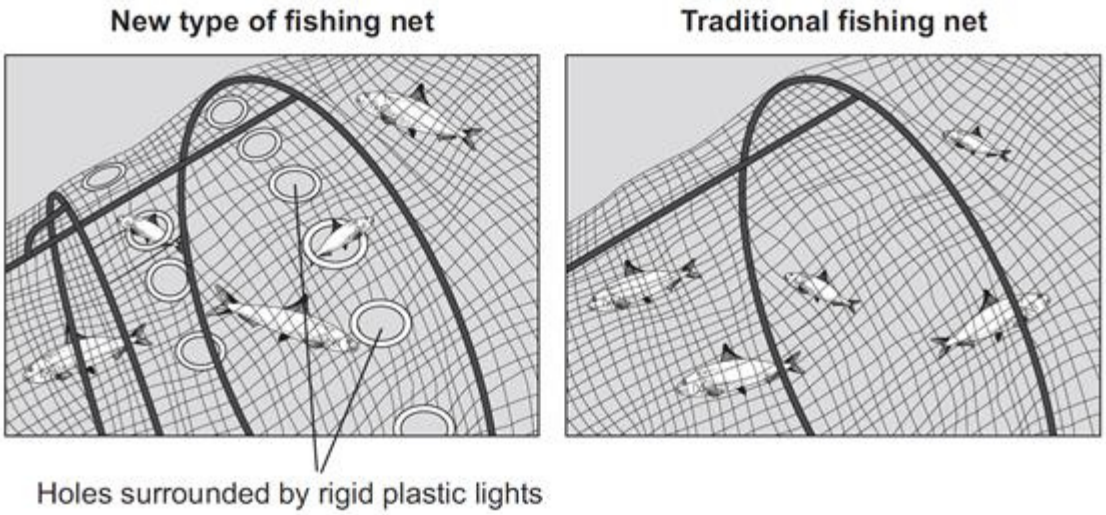
(Total 10 marks)

Q9.

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

(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)

Q10.

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. _____

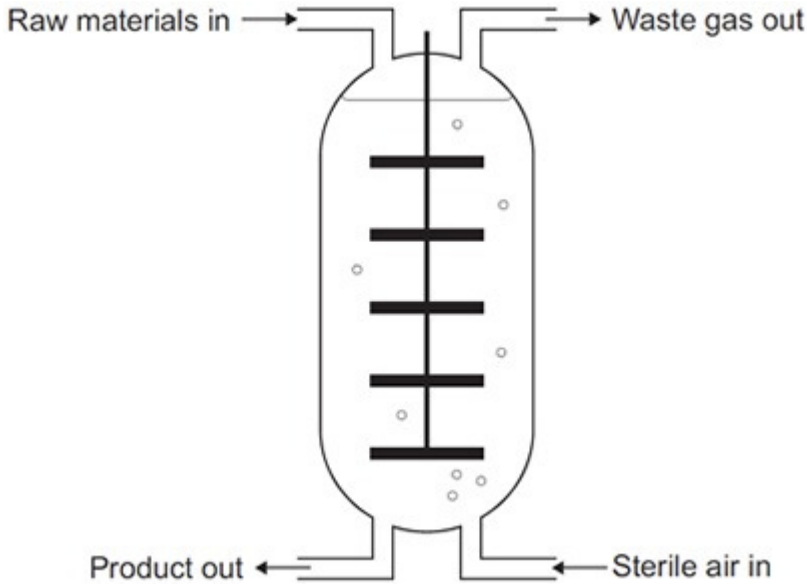
_____

(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)