1. 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 / m^2 / 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)

2. 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)

3. **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. _____

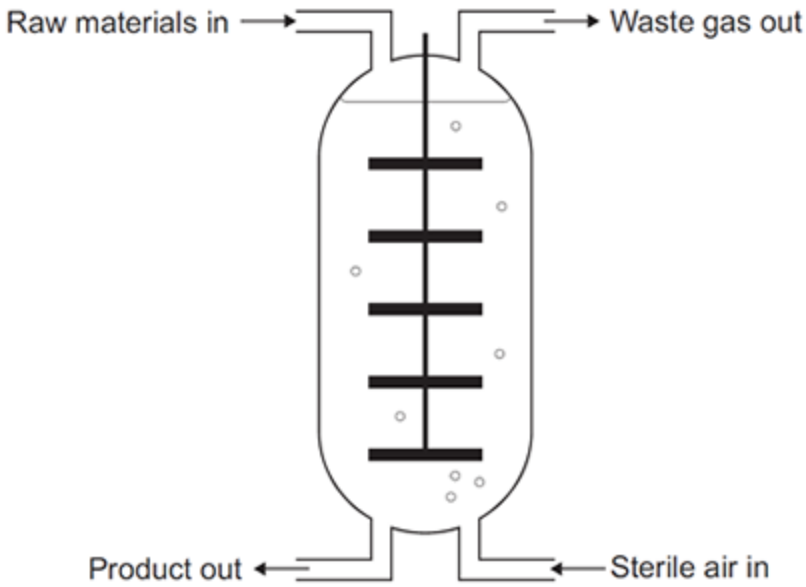
_____

(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)

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

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

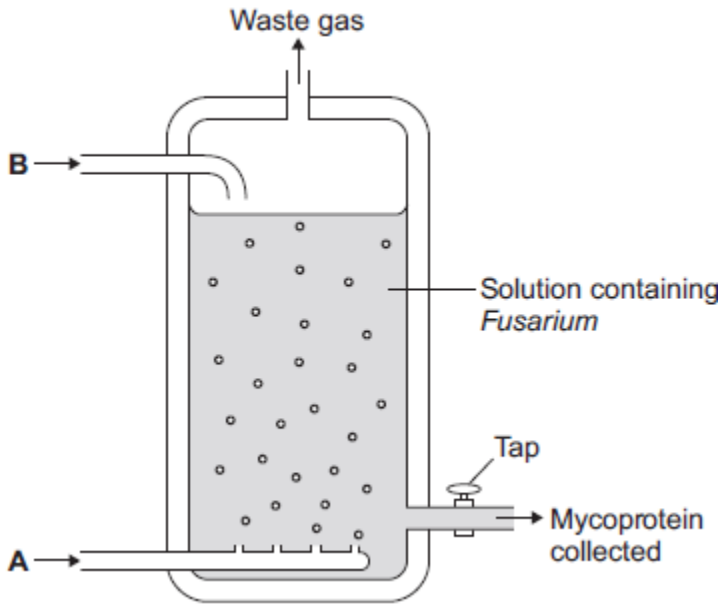
The process takes only a few weeks to produce a large amount of food.

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

Draw a ring around the correct answer.

bacterium **fungus** **virus**

The diagram below shows a fermenter used in mycoprotein production.



(1)

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

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

_____

(1)

(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. _____

_____

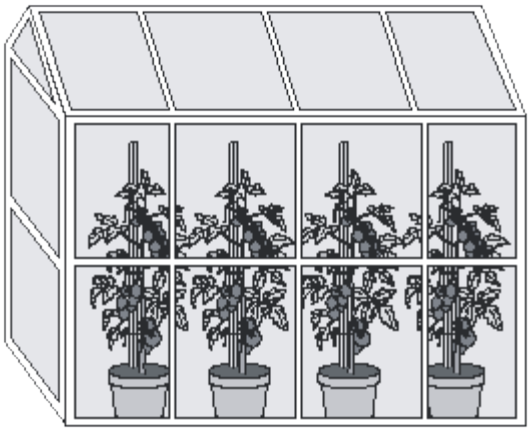
2. _____

_____

(2)

(Total 5 marks)

5. 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.

_____

_____

_____

_____

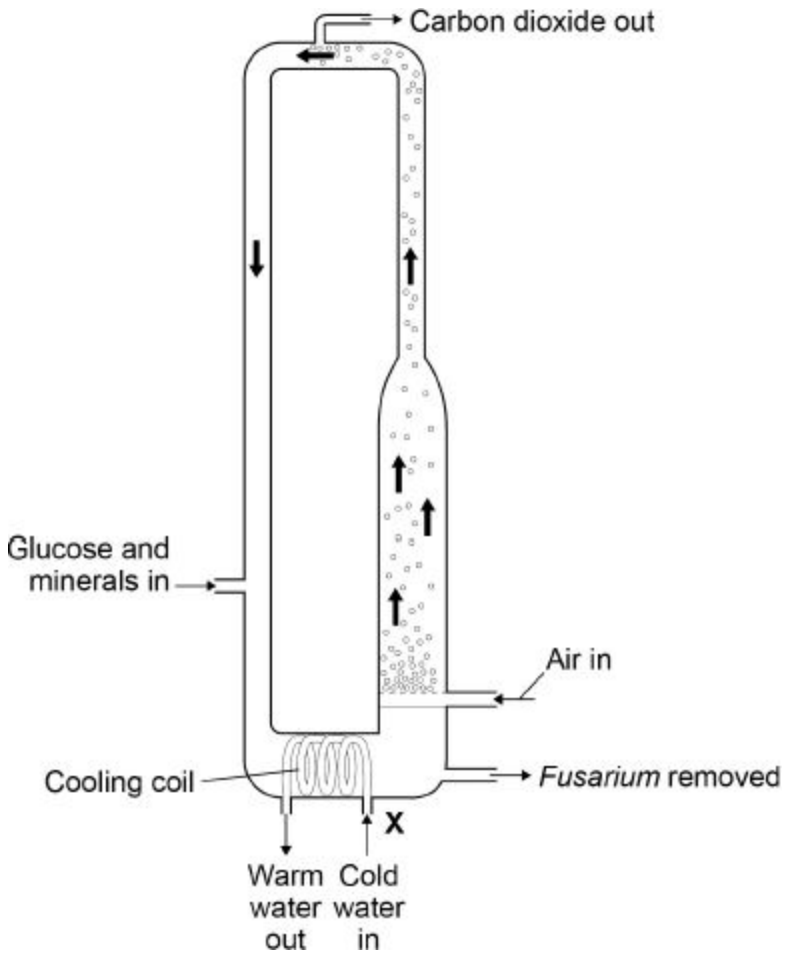
(2)

(Total 5 marks)

6. 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)