Q1.Figures 1 and **2** show battery chickens and free-range chickens.

Figure 1
Battery chickens



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Figure 2
Free-range chickens



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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.

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(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?

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(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.

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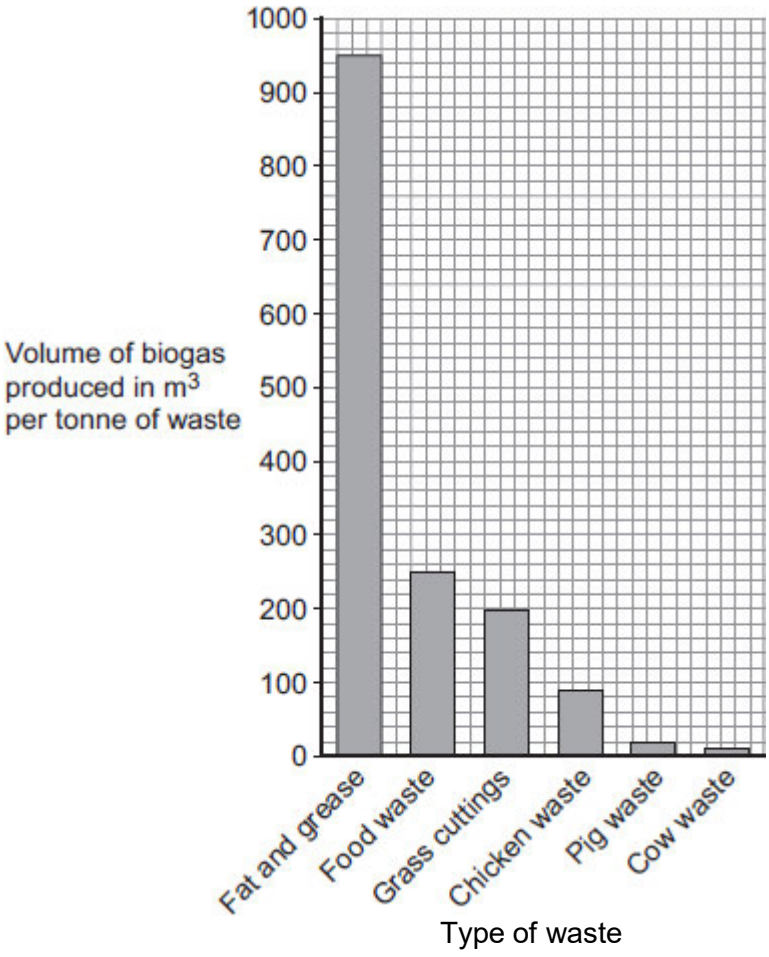
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(2)

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

Figure 3



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

..... m^3

(1)

(ii) Biogas is 60% methane.

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

..... m^3

(1)

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

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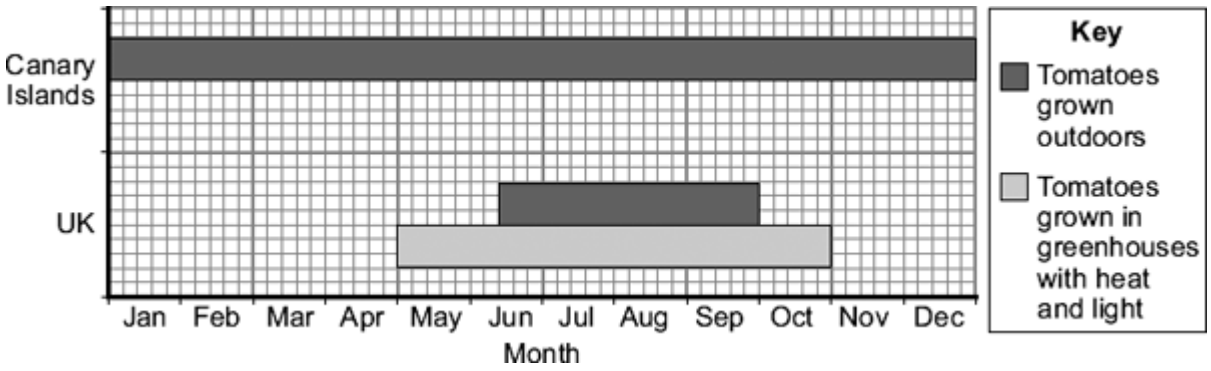
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(2)
(Total 11 marks)

Q2. 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

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Disadvantages of buying tomatoes grown in the UK

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(Total 3 marks)

Q3. 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.

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(1)

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

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(1)

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

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

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(6)
(Total 8 marks)

Q4. 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*.

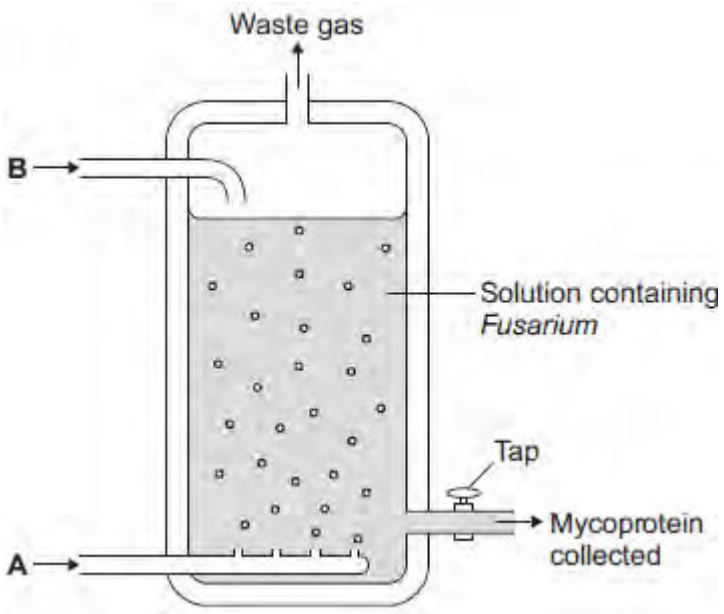
The process takes only a few weeks to produce a large amount of food.

(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**.

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(1)

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

Name this substance.

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(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.....

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2.....

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(2)
(Total 5 marks)

Q5. 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.

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..... %

(2)

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

Suggest reasons for this pattern.

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(4)

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

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(1)

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

1 .....

2 .....

(2)

(c) The image below shows a fish farm.



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

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

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(4)
(Total 13 marks)

Q6. 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.

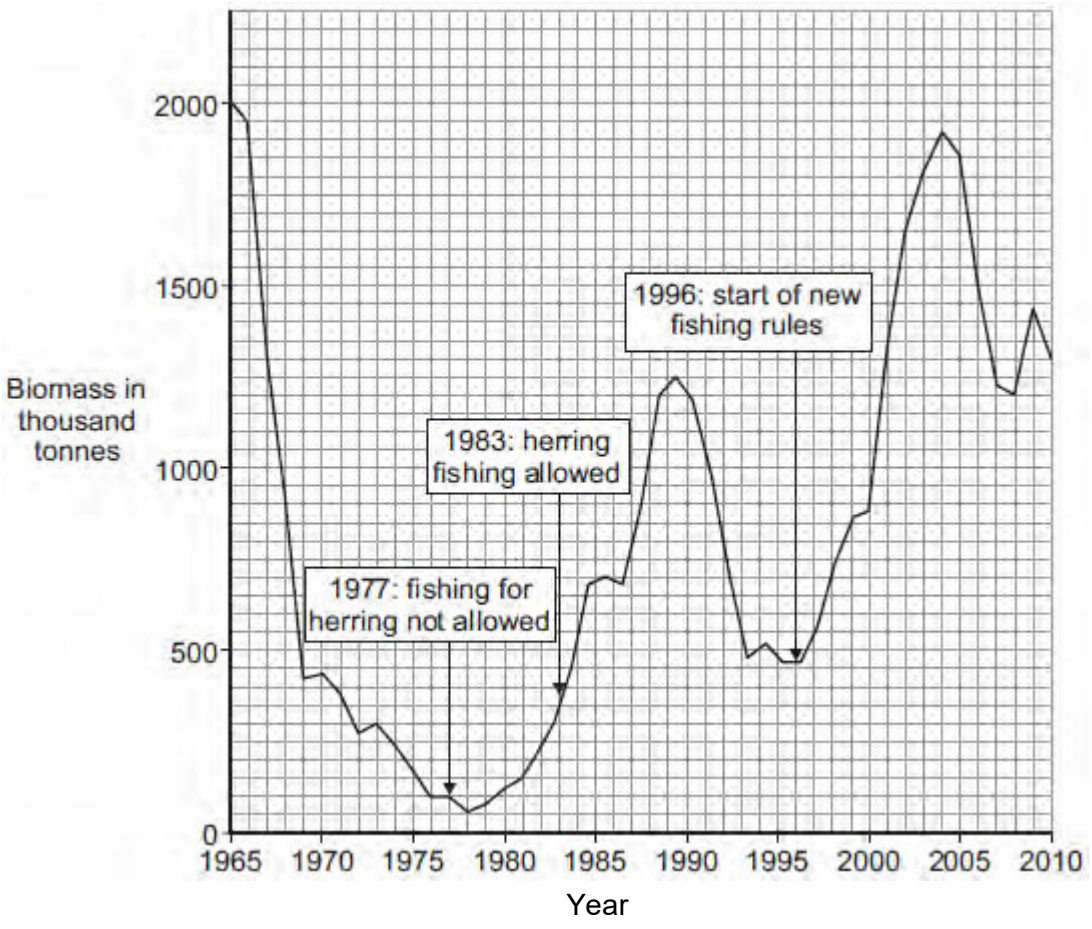




By Atle Grimsby from Utsira, Norway (Herring Catch at Utsira) [CC-BY-2.0 (http://creativecommons.org/licenses/by/2.0)], via Wikimedia Commons.

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.

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(1)

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

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(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 .....

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2 .....

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(2)

(ii) Were the Government's rules effective?

Use data from the graph to support your answer.

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(2)

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

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(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?

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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.

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(4)
(Total 14 marks)