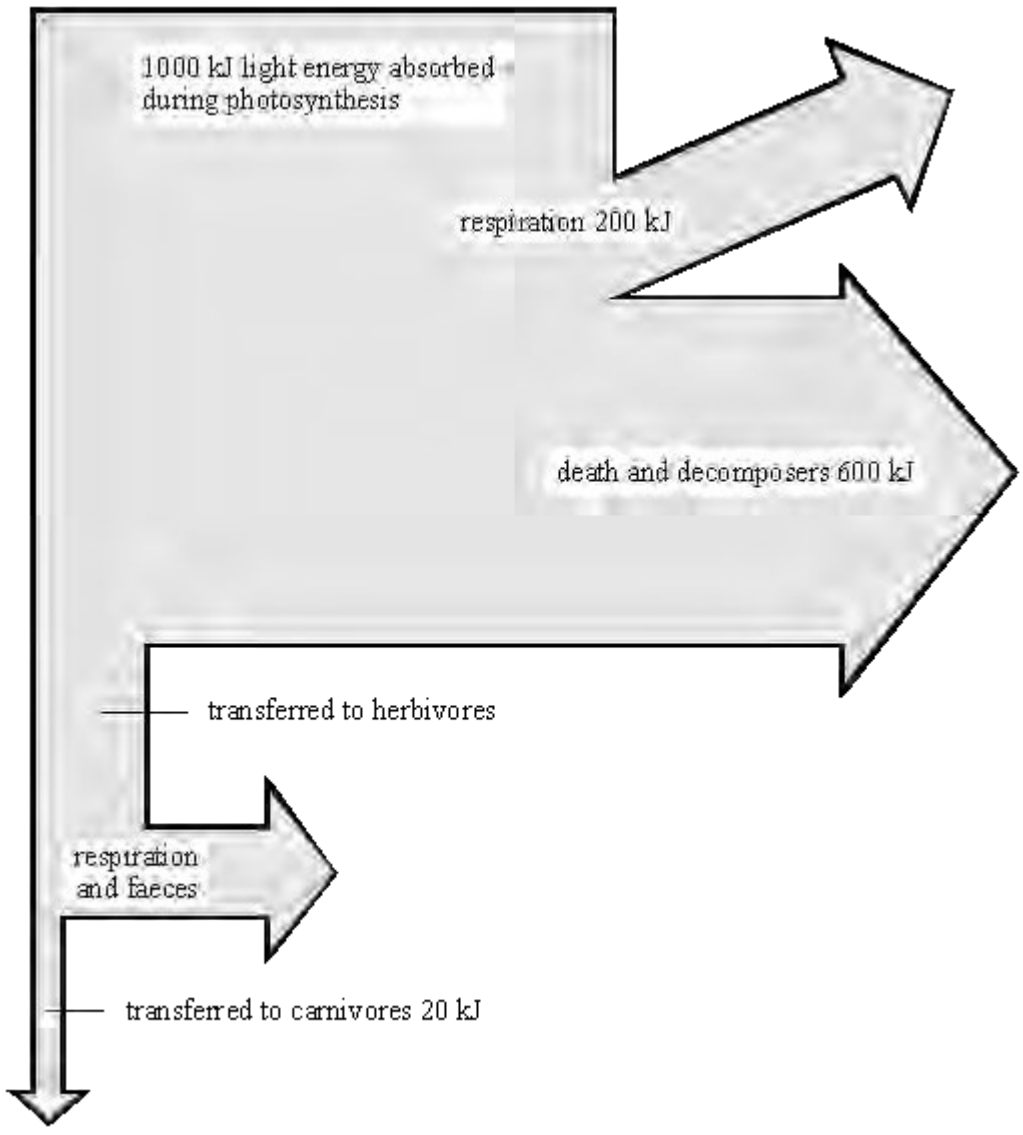
Q1. (a) The diagram shows what happens to each 1000 kJ of light energy absorbed by plants growing in a meadow.



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 ⇒ humans	800 000
cereal crop ⇒ pigs ⇒ humans	90 000
cereal crop ⇒ cattle ⇒ humans	30 000

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

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(3)

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

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

Change of condition 1 .....

Explanation .....

.....

.....

Change of condition 2 .....

Explanation .....

.....

.....

(4)
(Total 10 marks)

Q2. 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.

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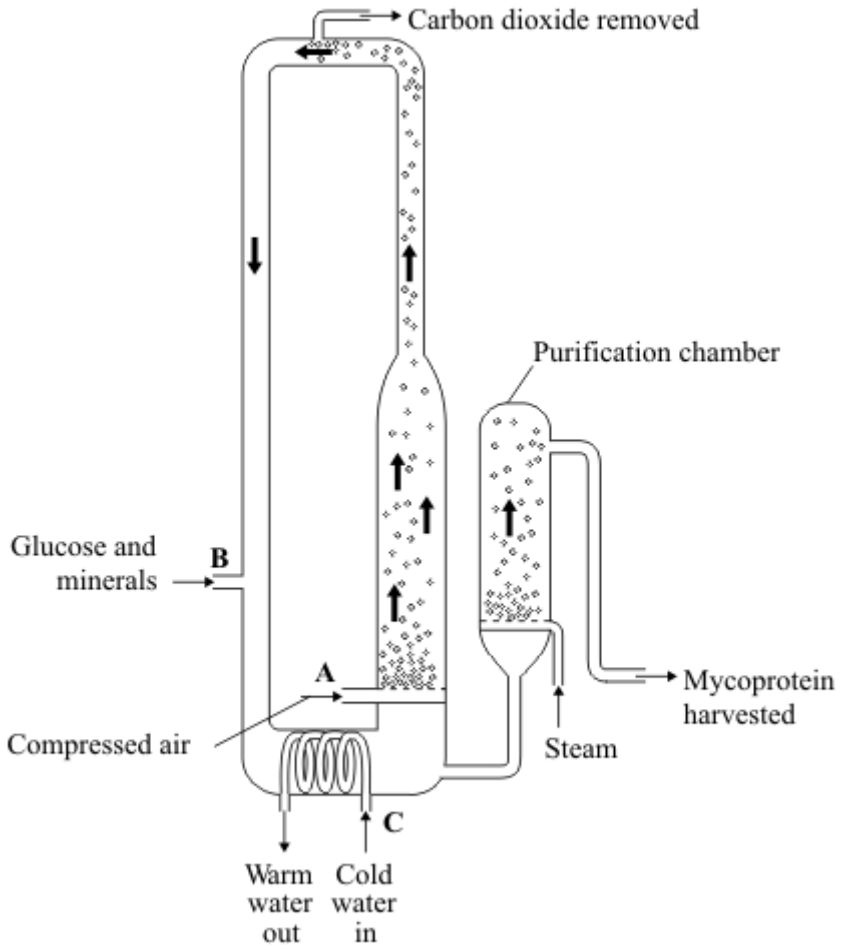
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(Total 2 marks)

Q3. 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

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.....

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.....

2

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.....

.....

.....

(2)

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

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

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

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

Evaluate this statement.

Remember to include a conclusion in your evaluation.

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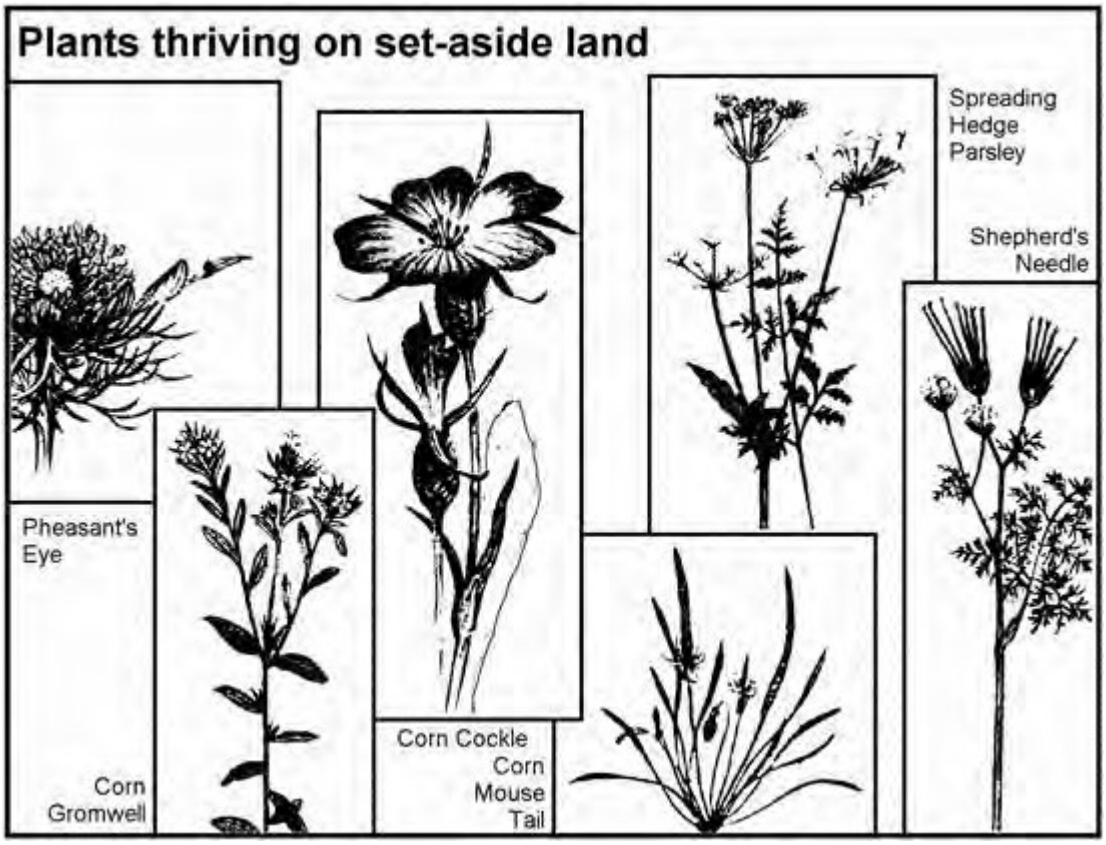
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(4)

(Total 11 marks)

Q4.



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.

.....

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(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.

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(4)
(Total 8 marks)

Q5. 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.

.....

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(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 .....

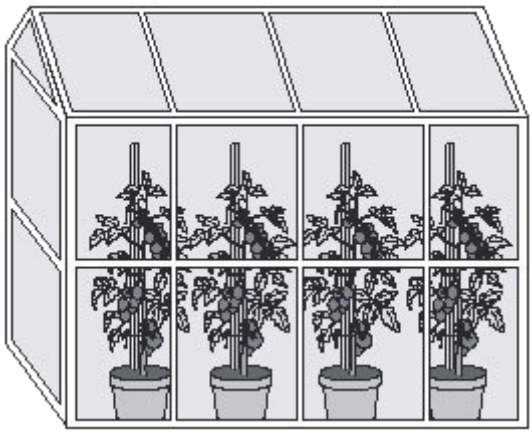
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2 .....

.....

(2)
(Total 10 marks)

Q6. 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 .....

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2 .....

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(2)

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

Explain why.

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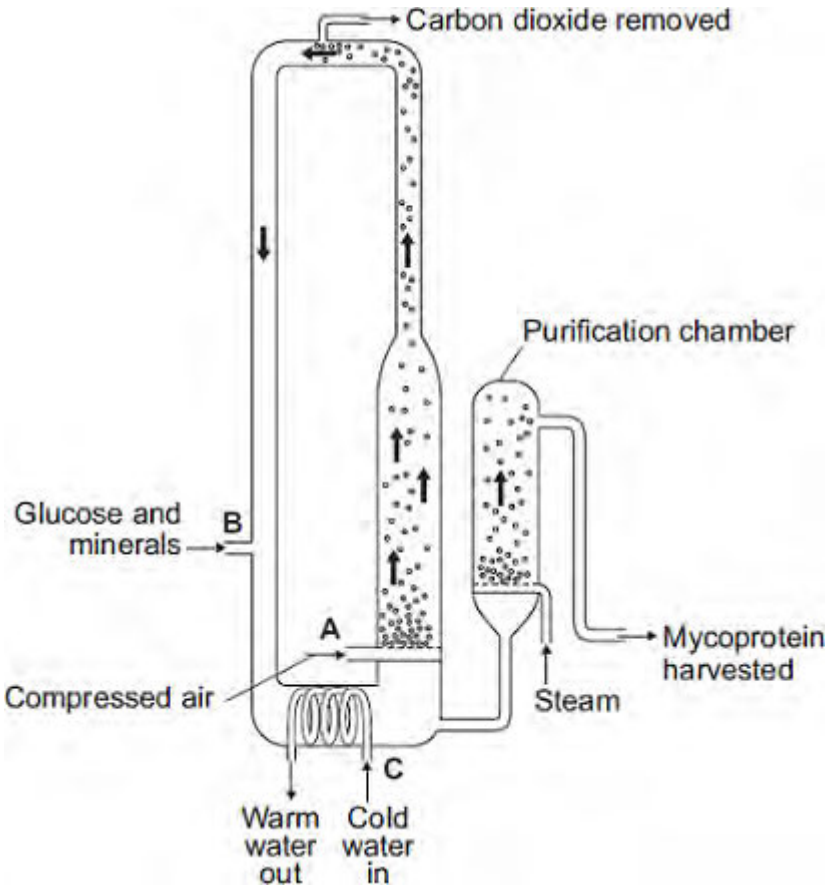
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(2)
(Total 5 marks)

Q7. 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.....

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

Evaluate this statement.

Remember to include a conclusion in your evaluation.

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(4)
(Total 10 marks)