

**GENERAL CERTIFICATE OF SECONDARY EDUCATION  
TWENTY FIRST CENTURY SCIENCE  
ADDITIONAL APPLIED SCIENCE A**

**A334/02**

Agriculture and Food  
(Higher Tier)

**Friday 12 June 2009  
Morning**

**Duration: 45 minutes**

Candidates answer on the question paper  
A calculator may be used for this paper

**OCR Supplied Materials:**  
None

**Other Materials Required:**

- Pencil
- Ruler (cm/mm)



Candidate Forename		Candidate Surname	
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Centre Number						Candidate Number				
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**MODIFIED LANGUAGE**

**INSTRUCTIONS TO CANDIDATES**

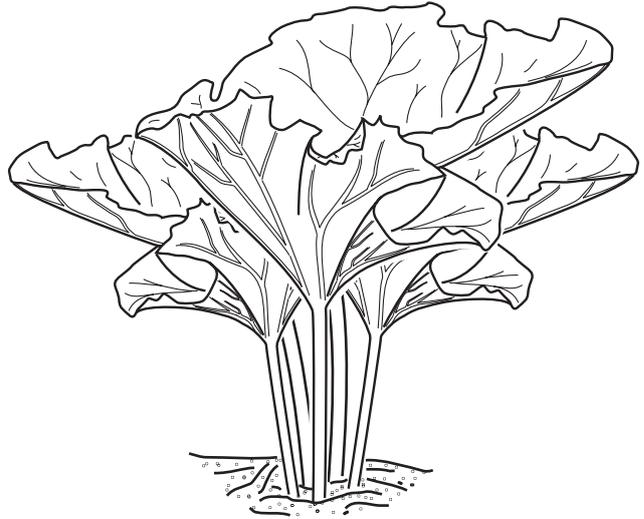
- Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- Write your answer to each question in the space provided, however additional paper may be used if necessary.

**INFORMATION FOR CANDIDATES**

- The number of marks is given in brackets [ ] at the end of each question or part question.
- The total number of marks for this paper is **36**.
- This document consists of **12** pages. Any blank pages are indicated.

Answer **all** the questions.

- 1 Charlie grows rhubarb in her garden.  
She harvests the rhubarb and sells it.



- (a) Charlie knows that the rhubarb leaves use light to photosynthesise.

Complete the word equation for photosynthesis.

..... + water  $\Rightarrow$  glucose + .....

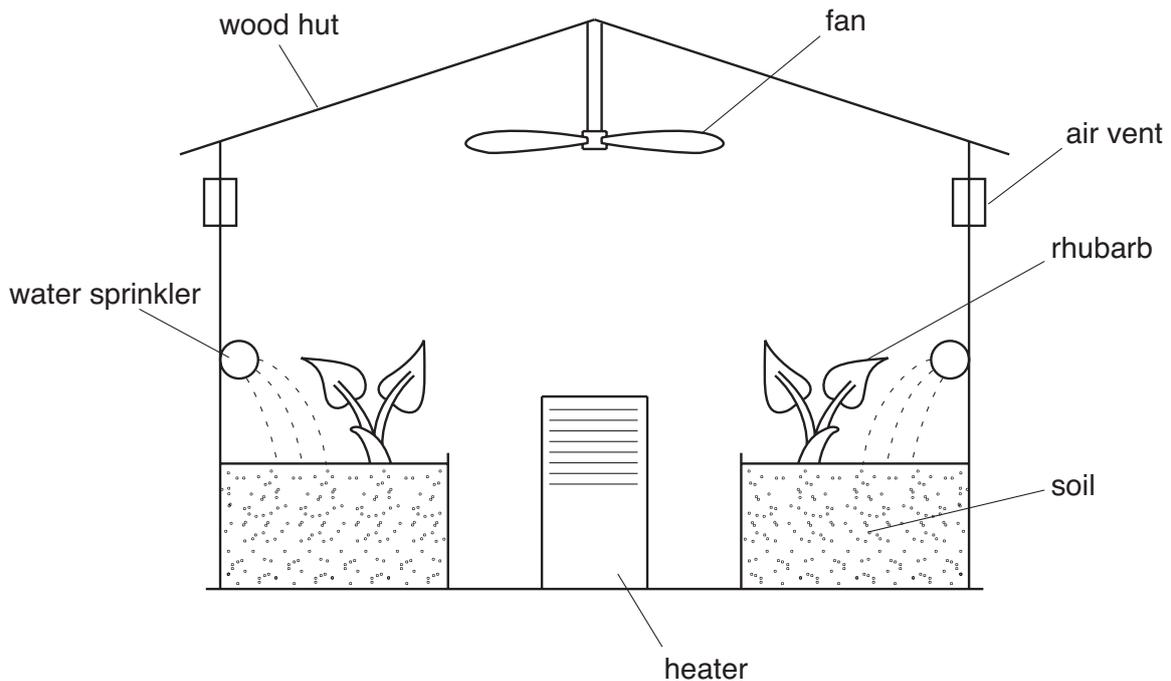
[2]

- (b) Charlie does a web search.

She finds out that rhubarb can also be grown in the dark.

The rhubarb stems grow much quicker and are soft and tender.

She uses a hut to grow rhubarb in controlled conditions.



(i) Write down **one** condition, apart from light, that is being controlled.

Describe its effect on the growth of plants such as rhubarb.

condition .....

effect .....

..... [2]

(ii) Charlie does tests as the rhubarb grows.

Draw a straight line from each **description** to the correct **type of test**.

description	type of test
uses a pH meter to test the soil	semi-quantitative
inspects leaves for mineral deficiency	qualitative
uses pH indicator paper to test the soil	quantitative

[2]

- (c) Charlie grows the same number of rhubarb plants in both her garden and her hut. She compares the two crops every year for three years.

year	mass of rhubarb crop from garden (in kg)	mass of rhubarb crop from hut (in kg)
1	30.5	40.1
2	28.5	44.5
3	23.5	46.2

- (i) The crops are measured as wet mass.

Why is this method not very accurate?

..... [1]

- (ii) Suggest why the crop yield from the hut is higher than that from the garden.

.....  
 .....  
 .....  
 ..... [2]

- (iii) Explain why Charlie can charge more for the rhubarb grown in her hut.

.....  
 .....  
 ..... [2]

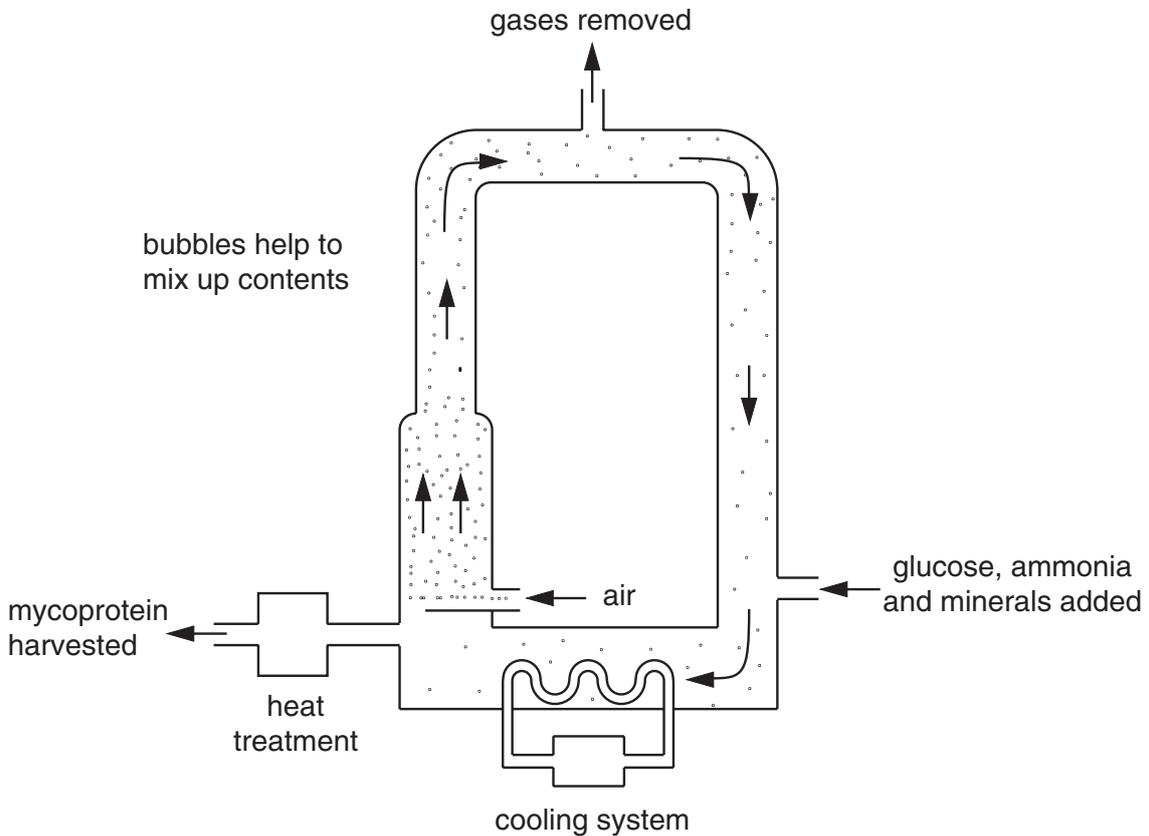
[Total: 11]

2 Protein is an important part of our diet.

A fungus called *Fusarium* is grown in large fermenters.

The fungus produces large amounts of protein called mycoprotein.

Look at the diagram showing the production of mycoprotein.



(a) Explain why glucose and air are added to the fermenter.

glucose .....

air ..... [2]

(b) Suggest why a cooling system is needed.

.....

..... [1]

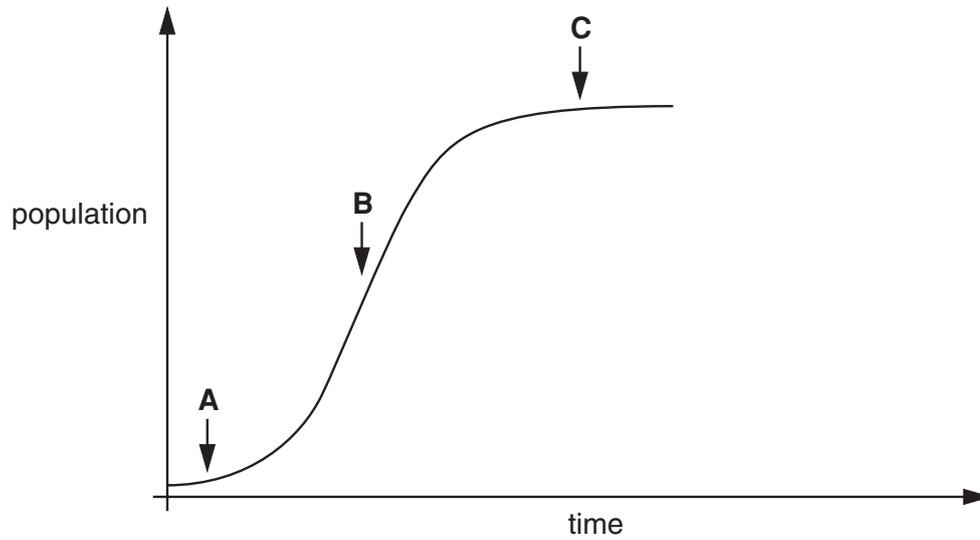
(c) This method of production is called continuous culture.

Write down **one** advantage and **one** disadvantage of using continuous culture.

advantage .....

disadvantage ..... [2]

(d) The population growth rate of microorganisms can be recorded.



(i) The graph shows three stages.

**Stage B** has been named for you.

Name the stages **A** and **C**.

**A** .....

**B** rapid growth

**C** .....

[1]

(ii) Continue the graph to show what would happen to the population if the supply of glucose was stopped. [2]

(iii) The individual *Fusarium* organisms are difficult to count.

Suggest **one other** method of measuring population growth.

..... [1]

[Total: 9]

3 Read the newspaper story about a monster pig.

### A monster pig!

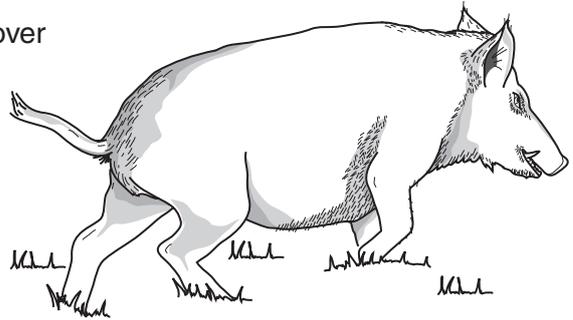
A large male pig weighing 477 kg and measuring over three metres long has been hunted and shot in America.

It could produce about 320 kg of sausages!

A spokesperson said, "It's a pity it is dead.

It could have been used in a selective breeding programme."

The technique of artificial insemination would have been used.



(a) Explain how the monster pig would have been used in a **selective breeding** programme.

.....  
.....  
..... [2]

(b) Artificial insemination or embryo implantation can be used as part of a selective breeding programme.

(i) List in the correct order the main stages used in **artificial insemination**.

The first one has been done for you.

1 **selection of animals**

2 .....

3 .....

4 .....

[3]

(ii) Explain what is meant by **embryo implantation**.

.....  
.....  
..... [2]

- (iii) Natural breeding programmes have about a 70% chance of a successful pregnancy.  
Artificial insemination programmes have about a 90% chance of a successful pregnancy.  
Embryo implantation programmes have about a 20% chance of a successful pregnancy.

Which method has the greatest chance of success?

Explain why.

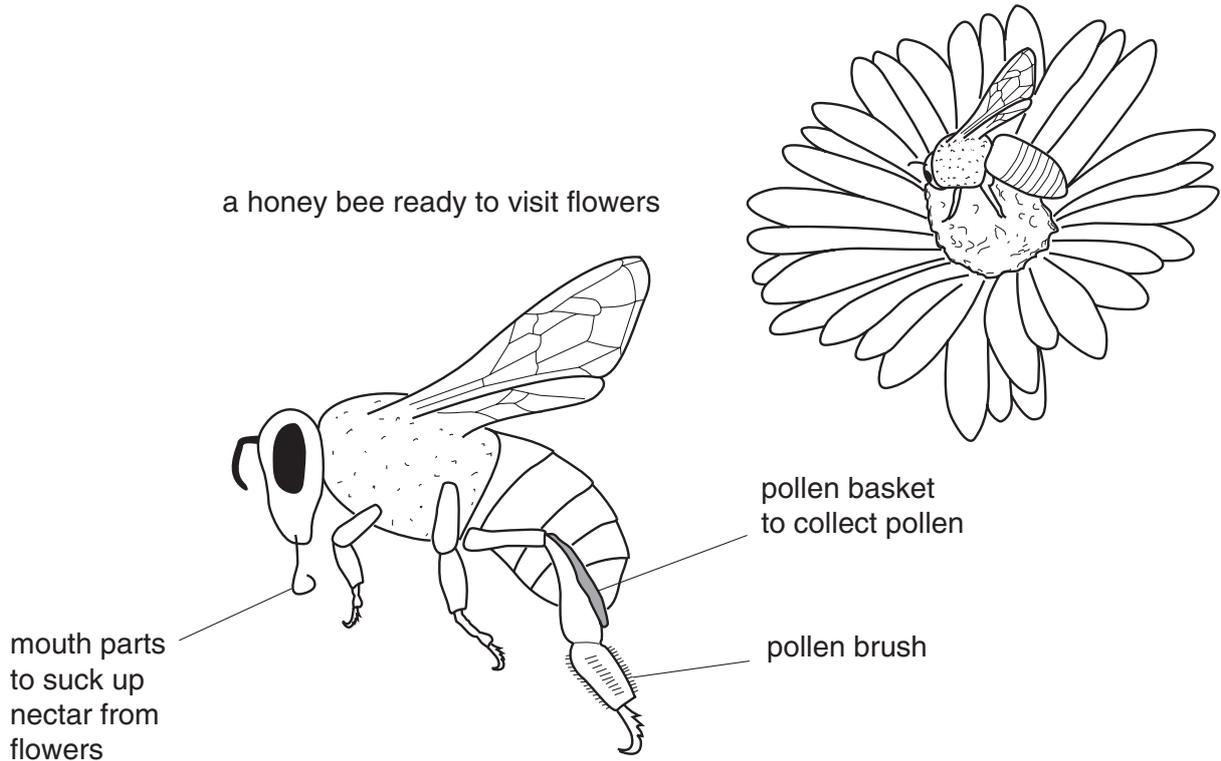
.....

.....

..... [2]

[Total: 9]

4 American dairy and arable farmers in 2007 were concerned when they discovered that honey bees in about 90% of bee hives had vanished.



(a) Suggest why the American farmers were concerned about the vanishing bees.

.....  
..... [2]

(b) Scientists thought of a number of possible explanations for the vanishing bees:

- a mutated virus
- genetically modified (GM) crops
- parasitic mites
- use of pesticides.

(i) A mutated virus is caused by a change in its DNA.

Why might a change in DNA produce changes to organisms?

.....  
.....  
..... [2]

- (ii) The bees may have reacted to pollen and nectar from genetically modified crops.

What is meant by **genetically modified**?

.....  
.....  
..... [2]

- (iii) Write down one example of the use of genetic modification of a microorganism to make a useful product.

microorganism .....

product .....

[1]

[Total: 7]

**END OF QUESTION PAPER**

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