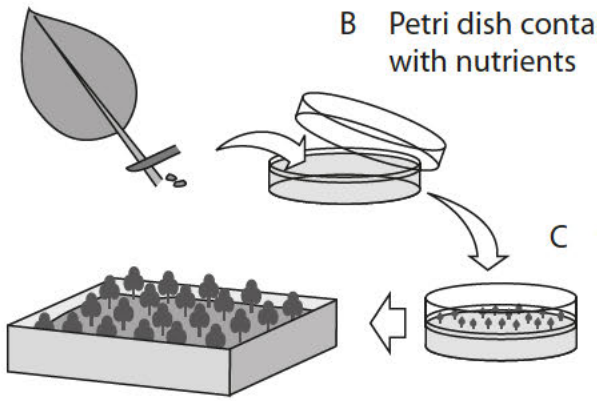
1 The diagram shows how plants can be produced using micropropagation (tissue culture).

A tissue sample removed from parent plant and transferred to agar medium in Petri dish



B Petri dish containing agar medium with nutrients

C tissue samples developing into small plants

D small plants grown in compost

(a) Suggest how the tissue samples are removed and transferred to the agar medium.

(2)

.....

.....

.....

.....

(b) Nutrients are added to the agar medium to help plant growth.

Give two nutrients that should be added to the agar medium. Explain how each nutrient helps plant growth.

(2)

1 .....

.....

.....

2 .....

.....

.....

(c) Suggest three precautions needed to ensure healthy growth of the small plants.

(3)

1 .....

.....

2 .....

.....

3 .....

.....

(Total for Question = 7 marks)

2 Read the passage below. Use the information in the passage and your own knowledge to answer the questions that follow.

Micropropagation: good or bad?

Plant cells have the ability to produce a genetically identical copy of their parent plant. They can do this because the information is coded in the sequence of bases in their DNA. Micropropagation involves taking small pieces, known as explants, from a plant with the desired characteristics. The explants are sterilised and then put into a growth medium containing sucrose, amino acids and a variety of minerals as well as growth promoting chemicals.

All the young plants produced from the original cell or piece of tissue are clones. The sterile conditions in which they have been grown allow these plants to be disease free. Micropropagation can also produce plants which are free of pathogens such as viruses.

Micropropagation is used to produce commercial quantities of plants. Large quantities of flowers are cloned in this way. The quality and characteristics of the flowers produced can be controlled more easily than when using sexual methods of reproduction. With rare or endangered plant species, micropropagation may be the last chance of reproducing them if more conventional methods have failed.

The process has been used to create large numbers of palm oil plants. The oil extracted from these plants can be used in a wide variety of food and consumer products. It can also be used to make biofuel for use as a sustainable energy source in cars.

The increased demand for the use of palm oil has had serious environmental consequences, with huge areas of rainforest being destroyed to make way for fresh plantations. Today, Malaysia and Indonesia account for 90 per cent of global production. Indonesia already has six million hectares of oil palm plantations, with plans for another four million by 2015 dedicated to biofuel production. This destruction of habitat will result in more rainforests disappearing, pushing several species such as the orangutan towards extinction.

(a) Name one base found in DNA (line 3).

(1)

(b) Suggest why explants are sterilised (line 4).

(2)

(c) Suggest why amino acids are provided in the growth medium (line 5).

(1)

(d) What is meant by the term **pathogen** (line 10)?

(1)

(e) Suggest two reasons why growers prefer to use micropropagation rather than sexual methods of reproduction to produce good quality flowers (lines 11 to 14).

(2)

1

2

(f) Suggest what is meant by the term **sustainable energy source** (lines 19 and 20).

(1)

(g) The destruction of habitat can lead to extinction of species.

Give three other disadvantages of deforestation.

(3)

1 .....

.....

2 .....

.....

3 .....

.....

(Total for Question = 11 marks)

3 (a) Describe how micropropagation (tissue culture) can be used to produce large quantities of identical plants.

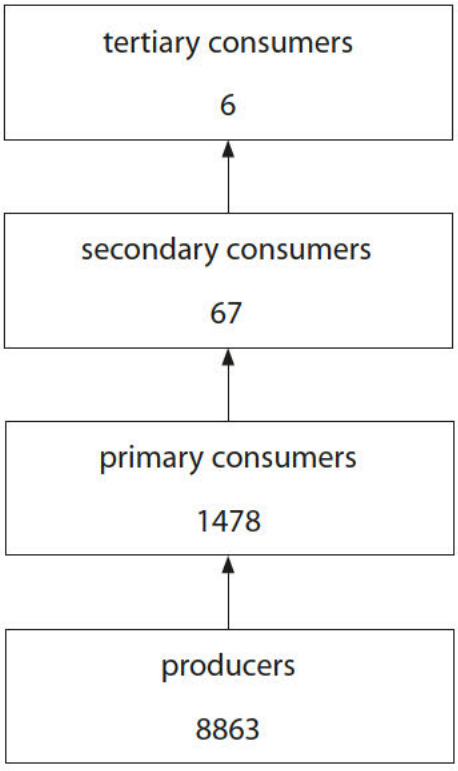
(6)

(b) Explain what is meant by the term **genetic modification (GM)** and suggest why a farmer might want to grow a GM crop.

(3)

(Total for Question = 9 marks)

4 The diagram shows the energy transfer in a river ecosystem. The numbers on the diagram refer to the energy in the biomass at each trophic level in arbitrary units.



(a) The formula shows how to calculate energy transfer efficiency as a percentage.

$$\text{percentage energy transfer efficiency} = \frac{\text{total energy in biomass}}{\text{total energy available}} \times 100$$

(i) The total energy available to the producers from sunlight is 1 700 000 in arbitrary units.

Use this information, and the formula, to calculate the percentage energy transfer efficiency from sunlight to plants.

Show your working.

(2)

Answer ..... %

(ii) Suggest why the percentage energy transfer efficiency from sunlight to plants is low.

(1)

.....

.....

.....

(b) The table shows the calculated energy transfer efficiencies between the different trophic levels in the river ecosystem.

Trophic levels	Percentage energy transfer efficiency
plants to primary consumers	16.7
primary consumers to secondary consumers	4.5
secondary consumers to tertiary consumers	9.0

Suggest two reasons why the energy transfer from plants to primary consumers is not 100%.

(2)

1 .....

.....

.....

2 .....

.....

.....

(Total for Question = 5 marks)

5 The picture shows a sheep that has been genetically modified to contain a human gene for making a human protein in its milk.



The protein in its milk is a blood clotting substance called factor IX.

(a) The process of genetic modification used to produce this sheep involves the use of two types of enzyme. One enzyme cuts DNA and the other enzyme joins DNA. The process also used a vector.

(i) Name the enzyme that cuts DNA.

(1)

.....

(ii) Name the enzyme that joins DNA.

(1)

.....

(iii) Name a vector.

(1)

.....

(b) This sheep is transgenic.

What is meant by the term **transgenic**?

(1)

(c) The transgenic sheep can be reproduced by cloning.

Suggest the advantages of reproducing the transgenic sheep by cloning.

(3)

(d) (i) Name the small structures in normal plasma that are involved in blood clotting.

(1)

(ii) Explain why is it important to have blood that clots.

(2)

(Total for Question = 10 marks)