1 Genetic engineering can be used to produce plants that are resistant to herbicide.

One herbicide works by preventing the activity of an enzyme.

Some bacteria have a form of this enzyme that is not affected by the herbicide.

(a) Suggest how genetic engineering can be used to produce plants resistant to this herbicide.

(3)

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(b) This herbicide is sprayed onto the leaves of plants.

Suggest which vessel could transport the herbicide from the leaf to other parts of the plant.

(1)

.....

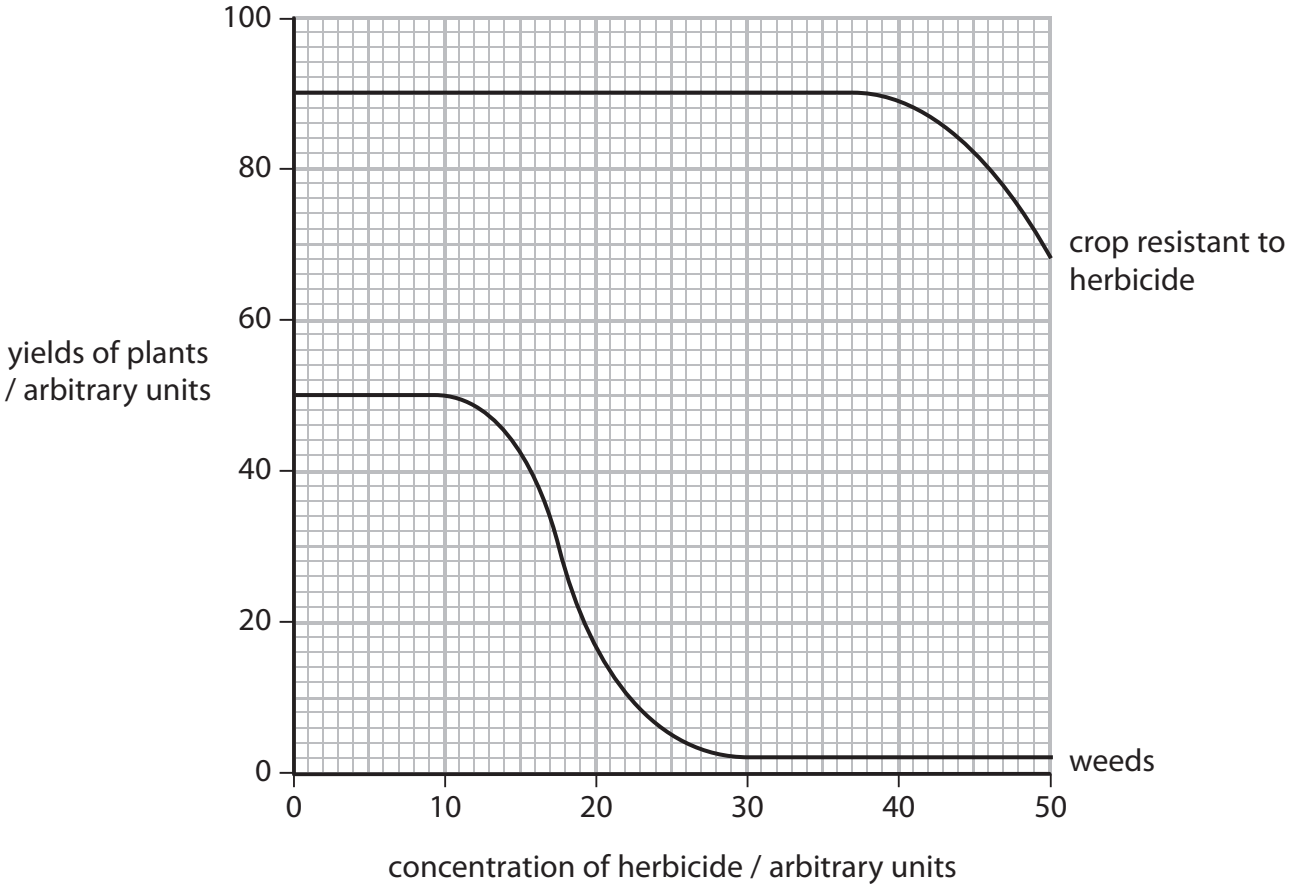
(c) Fields of crops have weeds growing in them.

In an investigation, crops resistant to a herbicide were grown in different fields.

The crops were sprayed with different concentrations of the herbicide.

The mass of the crops and weeds were recorded.

The graph shows the results of this investigation.



(i) Describe the effects of the herbicide on the yield of weeds.

(2)

.....

.....

.....

.....

(ii) Complete the sentence by putting a cross (☒) in the box next to your answer.

The most appropriate concentration of herbicide to use is

(1)

☐ **A** 10 arbitrary units

☐ **B** 30 arbitrary units

☐ **C** 40 arbitrary units

☐ **D** 50 arbitrary units

(d) The table shows the number of species of weeds resistant to this herbicide from 1996 to 2004.

	Year				
	1996	**1998**	**2000**	**2002**	**2004**
Number of species of weeds resistant to this herbicide	1	2			

(i) Describe the trend shown in the data.

(1)

.....

.....

(ii) Suggest reasons for this trend.

(2)

.....

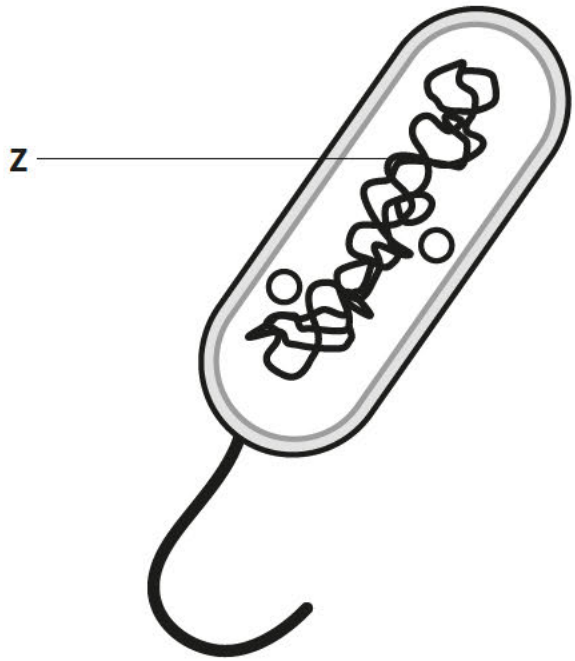
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(Total for Question 1 = 10 marks)

2 The diagram shows a bacterial cell.



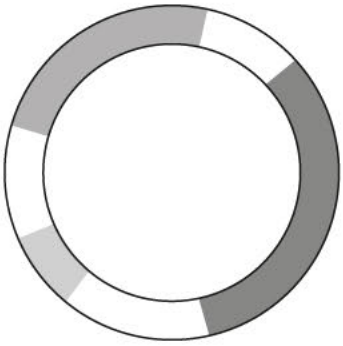
(a) What is the part of the bacterial cell labelled **Z**?

Put a cross (☒) in the box next to your answer.

(1)

- ☒ **A** chromosomal DNA
- ☒ **B** flagellum
- ☒ **C** nucleus
- ☒ **D** ribosome

(b) The diagram shows a plasmid from a bacterial cell.



(i) Name **two** structures other than DNA, that bacterial cells have but animal cells do not.

(2)

(ii) Describe how the plasmid can be used to genetically modify a bacterial cell to contain a human gene.

(3)

(iii) Suggest how a named product from genetically modified (GM) bacteria can benefit humans.

(2)

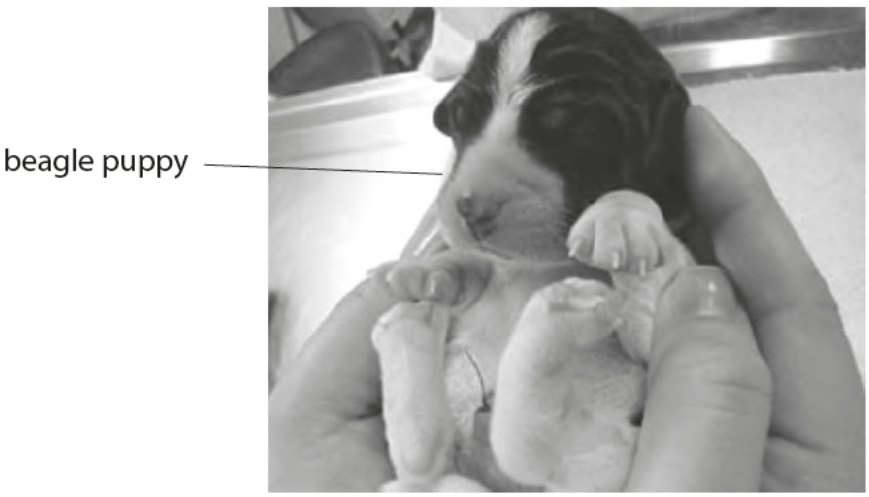
(Total for Question 2 = 8 marks)

3 In 2011, South Korean scientists genetically engineered a cell from a beagle.

They then cloned this cell to create a beagle.

They called this beagle Tegon.

Tegon glows in the dark when UV light is shone on him.



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Cloning involves cells that divide by mitosis.

(a) Complete the sentence by putting a cross (☒) in the box next to your answer.

When a cell divides by mitosis it produces

(1)

☒ **A** two cells that are genetically different

☒ **B** two cells that are genetically identical

☒ **C** four cells that are genetically different

☒ **D** four cells that are genetically identical

(b) To genetically engineer the original cell so that it would glow, the scientists had to obtain a suitable gene.

(i) Describe the stages that a scientist would complete to obtain this gene.

(2)

*(ii) Describe the stages used in the laboratory to clone and produce Tegon from the genetically engineered cell.

(6)

(c) Suggest the advantages of cloning mammals, such as dogs, for use in medical research into human diseases.

(3)

(Total for Question 3 = 12 marks)

4 (a) Purple tomatoes are transgenic plants that have been produced by genetic engineering.



(i) As a result of genetic modification, these tomatoes produce a new substance which has health benefits and turns the tomatoes purple.

Name this substance.

(1)

.....

(ii) What is inserted into the DNA of another plant to make it transgenic?

Put a cross (☒) in the box next to your answer.

(1)

- ☐ **A** a gene from another species
- ☐ **B** a gene from the same species
- ☐ **C** chromosomes from the same species
- ☐ **D** proteins from another species

*(b) Describe how *Agrobacterium tumefaciens* can be used to create transgenic plants.

(6)

(c) *Bacillus thuringiensis* contains a gene that codes for a toxin.

Explain **one** advantage and **one** disadvantage of introducing this gene into crop plants.

(4)

(Total for Question 4 = 12 marks)