1 Bulldogs have been produced by selective breeding to have a large head and a flat face.



(a) The large head means that many bulldogs have to be born by a Caesarean operation.

This means that the mother has to be cut open for the puppies to be born.

The bulldog's flat face often causes it to have breathing problems.

Some people think that the breeding of bulldogs should be banned for both health and genetic reasons.

Discuss the reasons for and against a ban on the selective breeding of bulldogs.

The quality of written communication will be assessed in your answer to this question.

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..... **[6]**

(b) If the selective breeding of bulldogs is **not** going to be banned, suggest how some of the health problems could be avoided in future generations.

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

[Total: 8]

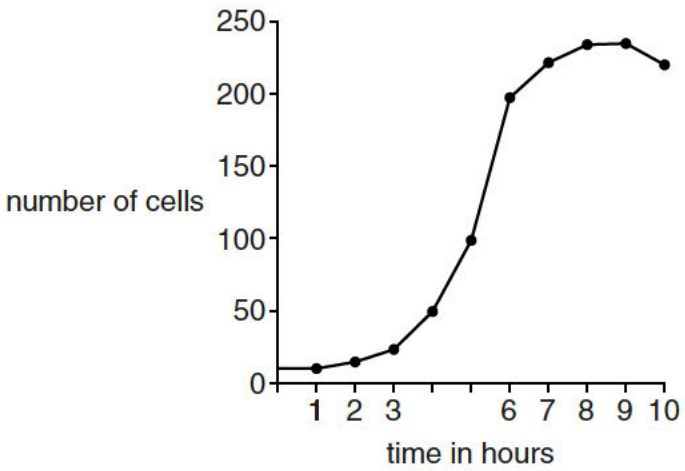
2 This question is about genetic engineering.

There is a shortage of human transplant organs.

Researchers are growing genetically engineered pig cells, containing human genes, in the laboratory.

The researchers claim that their work could help save thousands of lives a year.

(a) The graph shows the growth curve of the genetically engineered pig cells.



Use data in the graph to describe how the number of cells changes.

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

(b) The research team want to genetically engineer pigs so that they produce organs that are not rejected by humans.

Describe how they could do this.

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..... [3]

(c) Some people are against genetic engineering research.

Other people consider it a medical breakthrough.

Despite the potential benefits, transplants using these genetically engineered organs have been banned.

Do you think the Government should allow these organs to be used in transplants?

Justify your answer.

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..... [2]

[Total: 7]

3 Enzymes have many industrial uses.

(a) Draw straight lines to join each **enzyme** with the correct **use of the enzyme**.

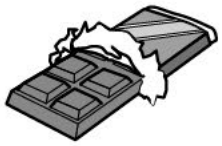
Draw only **three** lines.

Enzyme	**Use of the enzyme**
	used in the production of milk for people with intolerance to dairy products
sucrase	
	used on reagent strips to detect lactose
lactase	
	used to join strands of DNA together
ligase	
	used to produce sweeter sugars for food

[2]

(b) Read the article about using enzymes to make chocolate.

Using enzymes to make better chocolate



Chocolate is made from cocoa seeds.
The fresh seeds have to be treated to produce the chocolate flavour.

Scientists think that they can use protease enzymes to treat the seeds.
They claim that the chocolate tastes 50% better.
The enzymes can be made by genetic engineering.
This might also help the chocolate manufacturers.

(i) Which substance in the cocoa seeds is digested by protease enzymes?

..... **[1]**

(ii) The scientists say that this chocolate tastes 50% better.

Suggest why they may **not** be allowed to use this statement in advertising.

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

(iii) The protease enzyme can be made by genetically engineered bacteria.

The gene for the protease enzyme can be inserted into bacteria using a vector.

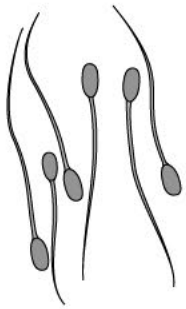
Write down **one** type of vector that can be used.

..... **[1]**

4 Look at the picture of bull sperm cells.

Bull sperm cells contain a different number of chromosomes to the number in body cells.

Bull **skin** cells contain 60 chromosomes.



(a) What is the **haploid** number of chromosomes for a bull?

.....

[1]

(b) The Holstein breed of cattle has been bred especially for milk production.

Many Holstein cattle frequently suffer lameness and diarrhoea.

This is because of the way they are bred.

Explain why the method of breeding can increase the risk of lameness and diarrhoea.

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..... **[3]**

(c) Cattle can also be cloned for increased milk production.

(i) Cloning animals is more difficult than cloning plants.

Explain why.

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..... [1]

(ii) Cloning is possible because of pioneering scientific research.

Scientists now understand a lot about how cells are controlled.

This is due to work done by several scientists.

Read the following information about some scientific work.

> Watson and Crick worked at Cambridge University. Together they were studying the structure of deoxyribonucleic acid (DNA), the molecule that contains the hereditary information for cells.
>
> At the same time, Maurice Wilkins and Rosalind Franklin were using X-ray diffraction to study DNA at King's College London. Watson and Crick used information from the X-ray studies to further their research and in April 1953 published the structure of DNA.
>
> Watson, Crick and Wilkins received the Nobel Prize for Medicine in 1962. Rosalind Franklin had died in 1958 and, despite her key experimental work, received no prize. The Nobel Prize is not awarded to someone after they have died.

Explain the advantages of using teams of scientists to investigate scientific problems.

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..... [3]

[Total: 8]