Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2013

Biology

Unit 2

Higher Tier

[GBY22]

GBY22

TUESDAY 18 JUNE, MORNING

TIME

1 hour 45 minutes.

INSTRUCTIONS TO CANDIDATES

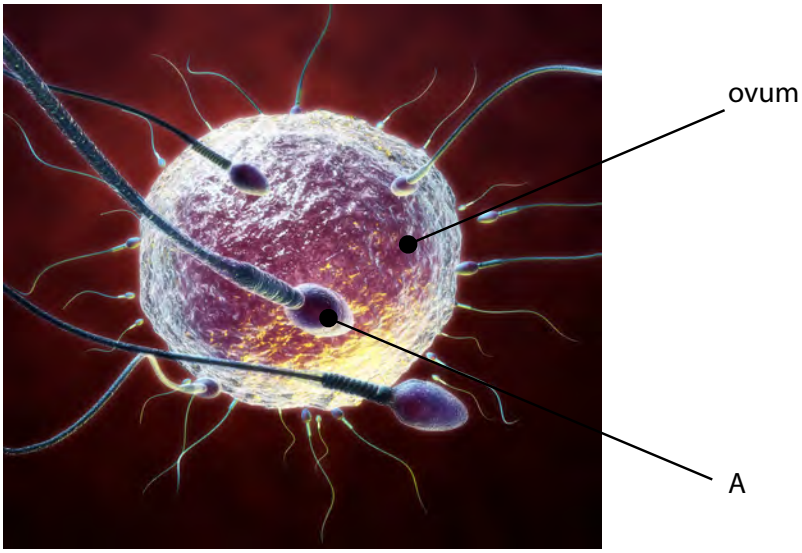
Write your Centre Number and Candidate Number in the spaces provided.
You must answer the questions in the spaces provided. Do not write outside the box, around each page or on blank pages.
Complete in blue or black ink only. **Do not write with a gel pen**.
Answer **all thirteen** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 115.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
Quality of written communication will be assessed in questions **4**, **8(c)** and **13(c)**.

Examiner Only	
Marks	Remark

1 The photograph shows sperm swimming towards an ovum.



© Medi-mation / Science Photo Library

(a) (i) Name part **A** of the sperm.

_____ [1]

(ii) Describe **one** way part **A** is adapted to its function.

_____

_____ [1]

(iii) Give **one other** way the sperm is adapted to its function.

_____ [1]

(iv) Suggest **one** reason why all the sperm do not appear to be the same size.

_____

_____ [1]

(b) Name the cell produced by fertilisation.

_____ [1]

Total Question 1

DO NOT WRITE ON THIS PAGE

(Questions continue overleaf)

Examiner Only	
Marks	Remark

2 **(a)** A ban on smoking in workplaces came into effect in the Republic of Ireland in 2004.

Bar staff completed a health questionnaire about their symptoms, before the ban and three years after the ban.

The table shows the results of the questionnaires.

Symptom	Percentage of bar staff complaining of symptoms	
	Before ban	3 years after ban
Eye irritation	82	51
Sneezing	75	34
Coughing	87	67

Adapted from: Respiratory health improvement continues after workplace smoking ban in Ireland by Michele Agnew, Patrick Goodman, Luke Clancy: Reproduced by permission of the European Respiratory Society Eur Respir J October 2008; 32, Suppl. 32: 259s (Abstract 1577) © European Respiratory Society

(i) Suggest **one** conclusion that can be made from the results of the questionnaires about the health of bar staff.

Use data from the table to support your conclusion.

_____

_____

_____

_____ [2]

(ii) Which symptom shows the greatest change after the ban?

_____ [1]

(b) Give **one** reason why a ban on smoking in workplaces could benefit non-smokers.

_____

_____ [1]

(c) Suggest why some people are opposed to a ban on smoking in workplaces.

_____

_____ [1]

Examiner Only	
Marks	Remark
Total Question 2	

Examiner Only	
Marks	Remark

3 Scientific method involves the following steps:
observation, making a hypothesis, experimentation, conclusion, validation.

Jenner is famous for having applied scientific method while developing vaccination as a way of preventing smallpox.

Some of the steps in Jenner's development of a smallpox vaccine were:

A Infect a person with cowpox. Then infect the person with smallpox.

B Jenner and other scientists repeated the procedure and got the same results.

C A person infected with cowpox may be protected from smallpox.

D Jenner heard dairymaids say "I shall never have smallpox for I have had cowpox".

(a) Which of the steps used by Jenner is an example of

observation? _____ [1]

validation? _____ [1]

(b) **Use the information given above** to help explain why Jenner's vaccination is an example of artificial, active immunity.

Artificial _____

_____ [1]

Active _____

_____ [1]

We now know that white blood cells, known as phagocytes, are important in protecting the body against diseases.

(c) Describe how phagocytes help protect against diseases.

_____

_____

_____ [2]

Total Question 3

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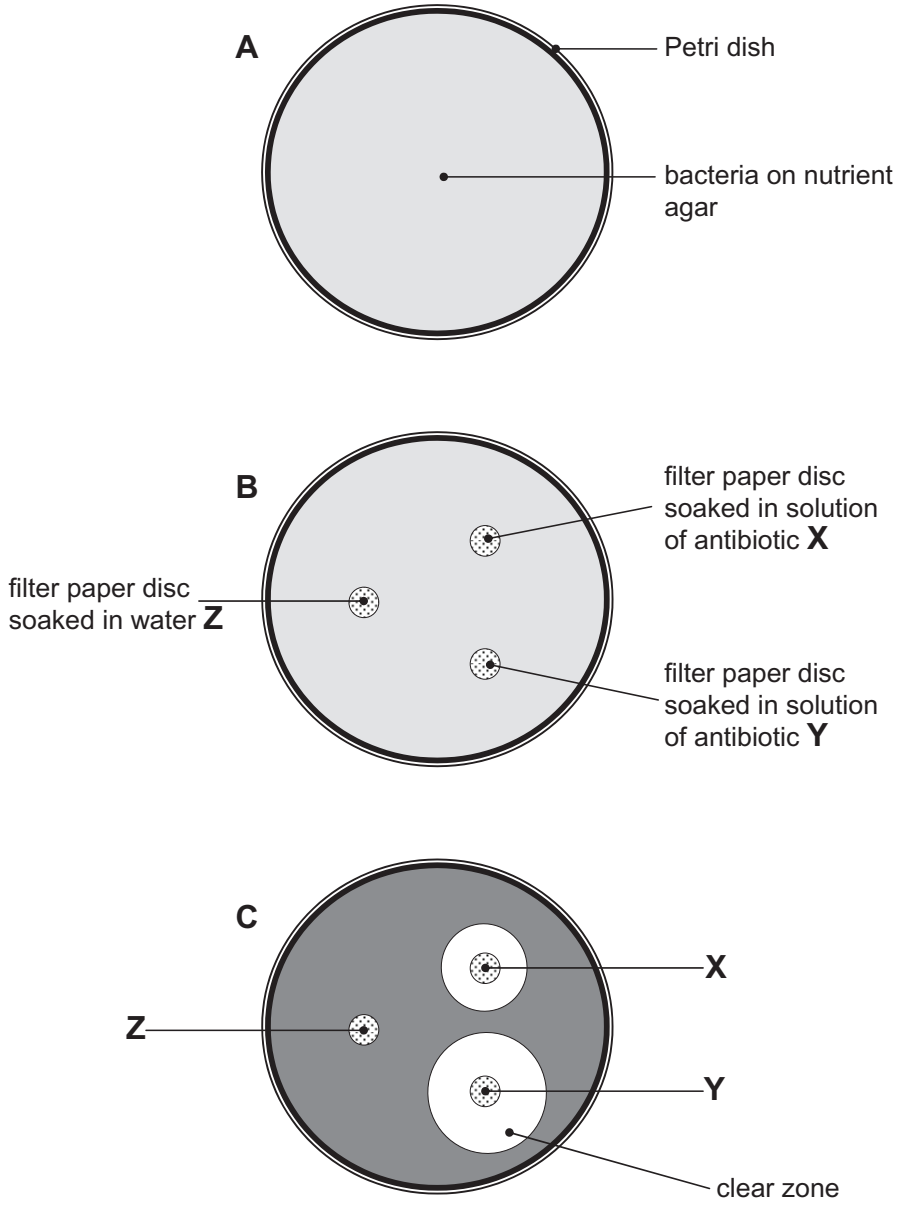
(Questions continue overleaf)

Examiner Only	
Marks	Remark

4 A student investigated the effect of two antibiotics **X** and **Y** on the growth of a bacterium.

She carried out the following procedure using aseptic techniques.

1. 1 ml of bacterial culture was added to a sterile Petri dish containing sterile nutrient agar as shown in diagram **A**.
2. Discs of filter paper were soaked in antibiotic solutions or water and placed on top of the nutrient agar. This is shown in diagram **B**.
3. The Petri dish was sealed, inverted and incubated at no more than 20°C for 48 hours. Diagram **C** shows the appearance of the Petri dish after this time.



Use evidence from the diagram and the procedure to explain

- Which antibiotic was most effective
- How the experiment was a fair test
- The safety precautions needed.

In this question, you will be assessed on your written communication skills, including the use of specialist scientific terms.

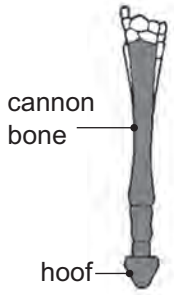
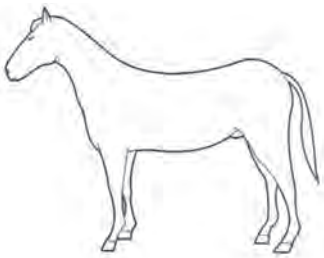
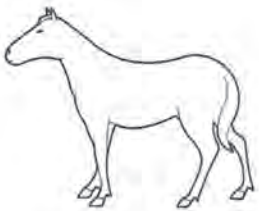
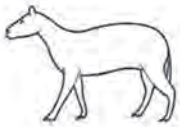
[6]

Examiner Only	
Marks	Remark
Total Question 4	

[Turn over

Examiner Only	
Marks	Remark

5 The table shows some information, from fossil records, about the evolution of the horse.

Millions of years ago	Lower leg bones	Body	Height/m
1			1.6
10			1.0
40			0.6
60			0.4

Using evidence from the table, describe the changes that appear to have happened to the horse over time.

_____

_____

_____

_____

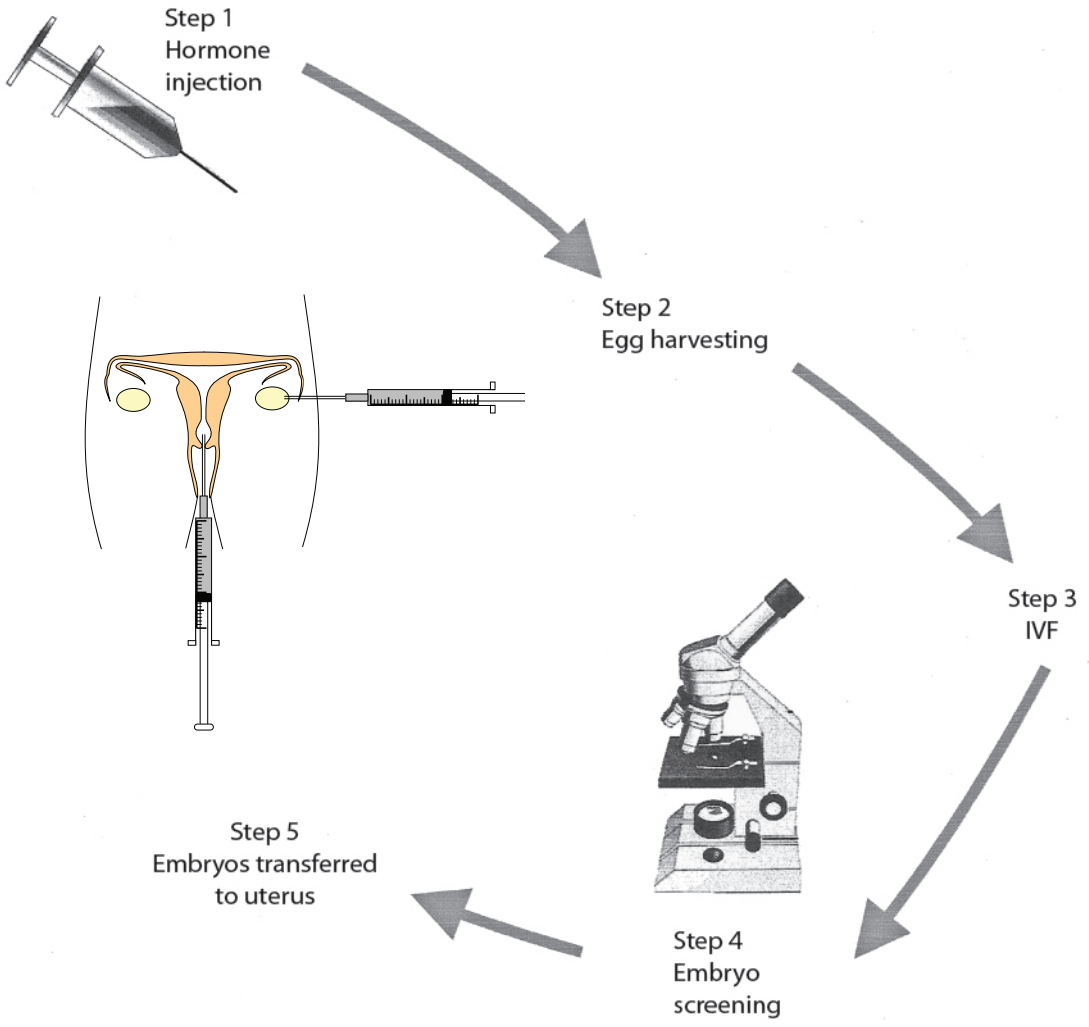
_____ [4]

Examiner Only	
Marks	Remark
Total Question 5	

[Turn over

Examiner Only	
Marks	Remark

6 The diagram shows the reproductive system from an infertile woman and summarises how *in vitro* fertilisation (IVF) can be used to overcome her infertility.



(a) **Use the diagram** to suggest the probable cause of infertility in this woman.

_____

_____ [1]

During step 1 the woman receives a hormone injection.

(b) What effect does this injection have on the ovaries?

_____

_____ [1]

(c) Describe the process of *in vitro* fertilisation at step 3.

_____

_____

_____ [2]

(d) Suggest **two** reasons why the government introduced regulations which allow doctors to transfer only two embryos at step 5.

1. _____

_____ [1]

2. _____

_____ [1]

(e) Give **two** causes of infertility in males.

1. _____ [1]

2. _____ [1]

Examiner Only	
Marks	Remark
Total Question 6	

7 The table shows the results of an experiment carried out to investigate the effect of placing potato cylinders into a range of sugar solutions kept at the same temperature for 24 hours.
All the potato cylinders were taken from the same potato.

Concentration of sugar solution/M	Initial mass of potato cylinder/g	Final mass of potato cylinder/g	Change in mass of potato cylinder/g	Percentage change in mass of potato cylinder
0.0	4.00	4.80	+0.80	+20.0
0.2	4.28	4.75	+0.47	
0.4	3.95	4.03	+0.08	+2.0
0.6	4.00	3.72	−0.28	−7.0
0.9	4.20	3.36	−0.84	−20.0

(a) **Use the information given** to suggest **two** ways the experiment was a fair test.

_____

_____

_____ [2]

(b) **Complete the table** by calculating the percentage change in mass of the potato cylinder placed in 0.2 M solution.
Show your working.

[2]

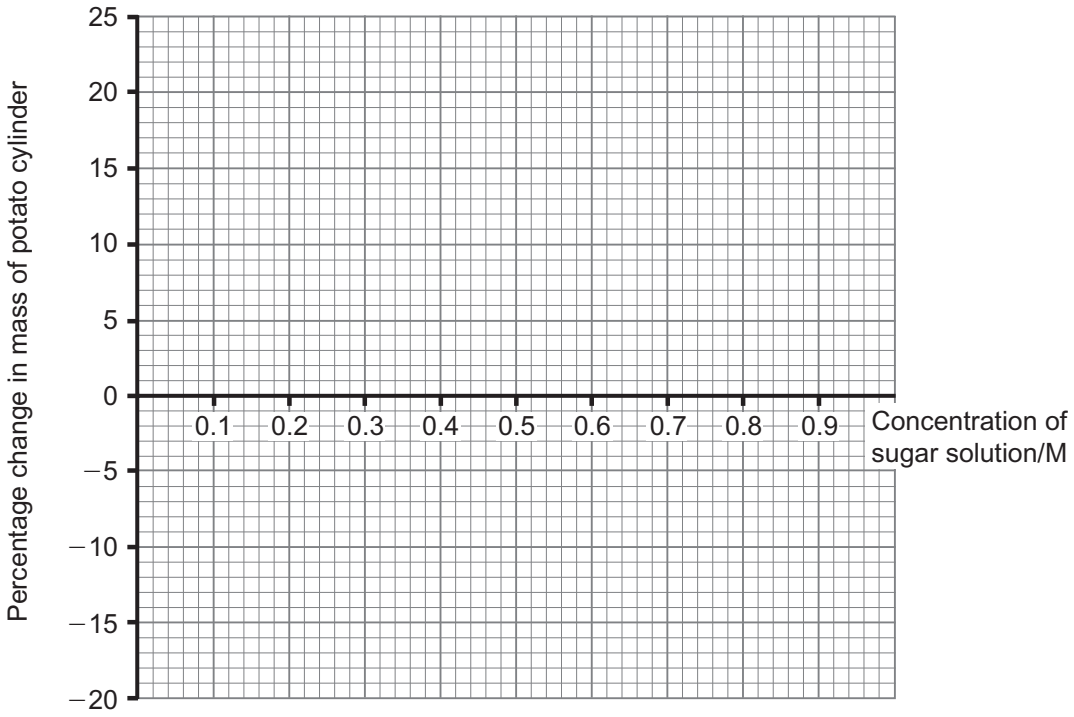
Examiner Only

Marks	Remark

(c) Explain the percentage change in mass of the potato cylinder placed in 0.6 M solution.

[3]

(d) Draw a line graph of these results on the grid provided.



[3]

Examiner Only	
Marks	Remark

(e) **Use the graph** to find the concentration of sugar solution which is equal to the concentration of the cytoplasm in potato cells.

Explain your answer.

Concentration _____ M

Explanation _____

_____

_____ [2]

Examiner Only	
Marks	Remark
Total Question 7	

DO NOT WRITE ON THIS PAGE

(Questions continue overleaf)

Examiner Only	
Marks	Remark

8 The table shows the percentage of adults who have a high concentration of cholesterol in their blood.

Year	Percentage of adults who have a high concentration of cholesterol in their blood	
	Men	Women
1998	75	77
2005	58	61

Adapted from: www.heartstats.org

(a) Describe **one** trend shown in the table.

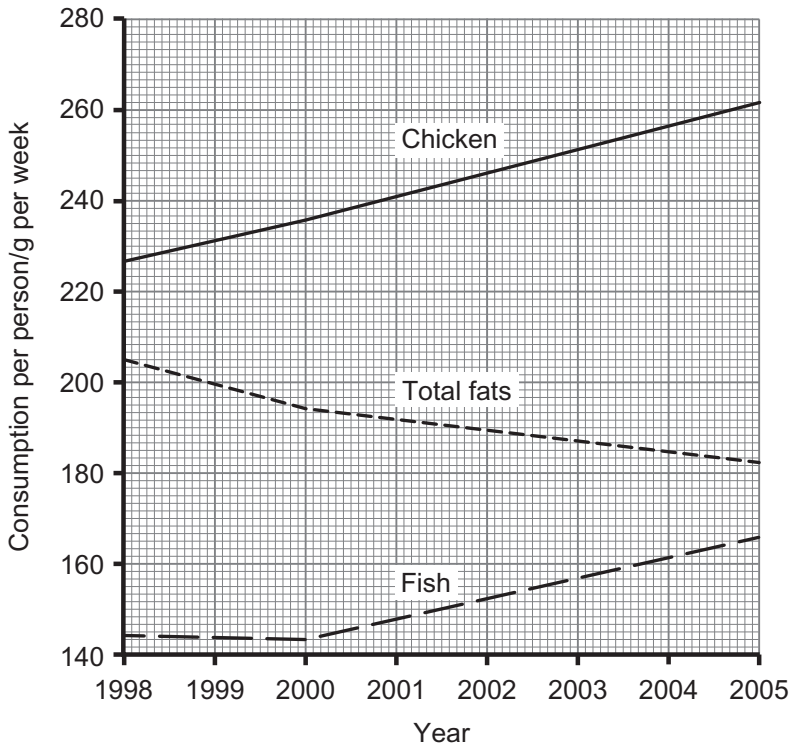
_____

_____

_____ [1]

One of the factors causing high cholesterol in blood is the fat in a person's diet.

The graph shows the consumption of fish, chicken and total fats between 1998 and 2005 by adults.



Source: www.heartstats.org

(b) Use data from the graph and the table to help explain why the percentage of adults who have a high concentration of cholesterol in their blood has changed between 1998 and 2005.

[4]

Examiner Only	
Marks	Remark

(c) The diagram shows how cholesterol can build up in an artery wall when the concentration of cholesterol in the blood is high.

Examiner Only	
Marks	Remark

diagram removed for copyright reasons

Compare and contrast the effect on the heart of a build up of cholesterol in a coronary artery wall with the effect on the brain of a build up of cholesterol in an artery wall.

In this question, you will be assessed on your written communication skills, including the use of specialist scientific terms.

[6]

Total Question 8

9 **(a)** Name the chamber of the heart which

receives deoxygenated blood from the vena cava.

_____ [1]

pumps oxygenated blood into the aorta.

_____ [1]

(b) Explain the role of the valve between the heart and the pulmonary artery.

_____

_____

_____ [2]

(c) Name the blood vessel which returns blood from the brain to the heart.

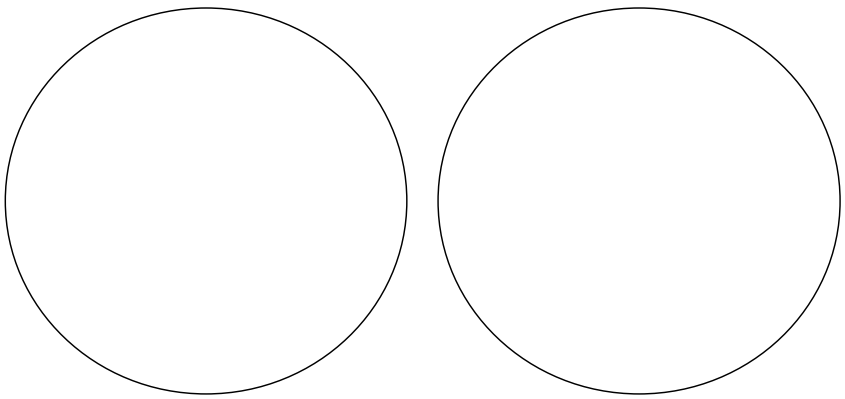
_____ [1]

Examiner Only	
Marks	Remark
Total Question 9	

10 (a) The diagram shows chromosomes during cell division.

Examiner Only	
Marks	Remark

(i) **Complete the diagrams** below by drawing the chromosomes of the daughter cells that would be produced when this cell divided by mitosis.



[2]

Mitosis is used in asexual reproduction and cloning.

(ii) Give **two** other ways mitosis is used in living organisms.

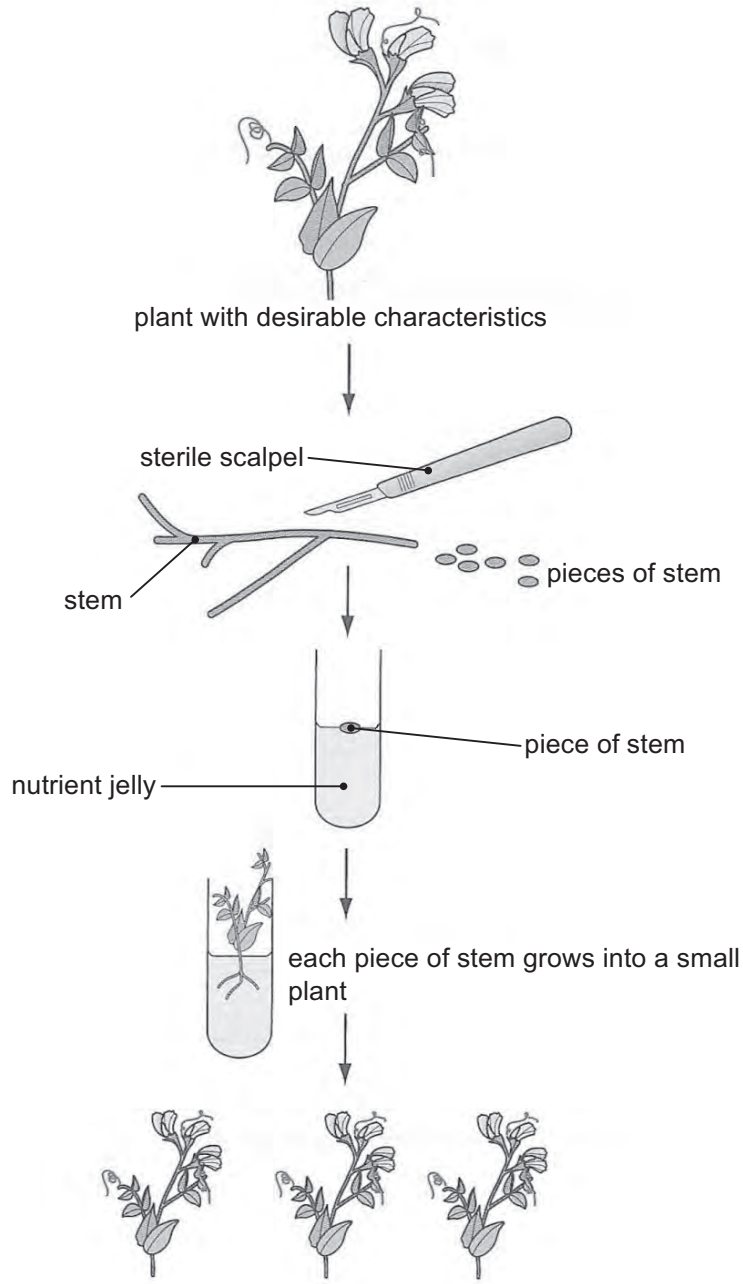
1. _____

_____ [1]

2. _____

_____ [1]

(b) The diagram shows some steps involved in cloning plants.



© Barking Dog Art

(i) Suggest why the scalpel used to cut the pieces of plant stem must be sterile.

_____

_____ [1]

Examiner Only	
Marks	Remark

[Turn over

(ii) Why are the plants produced in this process called clones?

_____

_____ [1]

(iii) Give **one** advantage and **one** disadvantage of cloning plants in this way.

Advantage _____

_____ [1]

Disadvantage _____

_____ [1]

Examiner Only	
Marks	Remark
Total Question 10	

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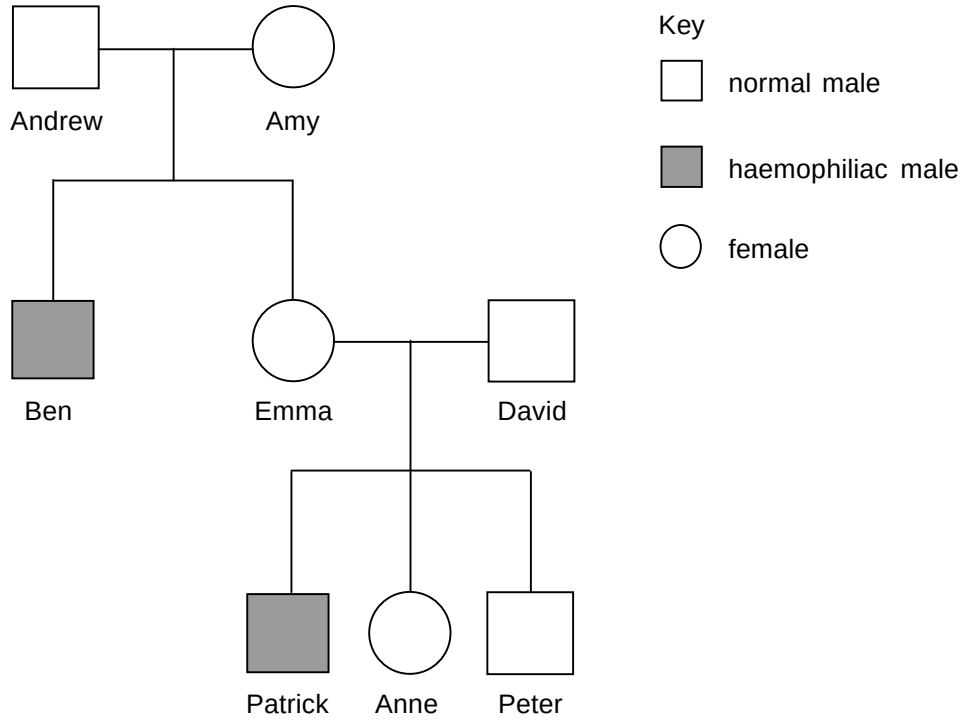
(Questions continue overleaf)

11 Haemophilia is a recessive sex-linked inherited disorder.

The diagram shows a family tree.



Use the following symbols to help answer the questions.

X^H for the normal allele.

X^h for the recessive haemophiliac allele.

(a) **Use evidence from the diagram** to explain why Amy must be a carrier of haemophilia.

_____

_____

_____

_____ [2]

Examiner Only	
Marks	Remark

(b) Explain using the Punnett square, the genotypes and phenotypes of each of Emma and David's children.

		David's gametes	
Emma's gametes			

[4]

Phenotypes

Patrick _____ [1]

Peter _____ [1]

Anne _____

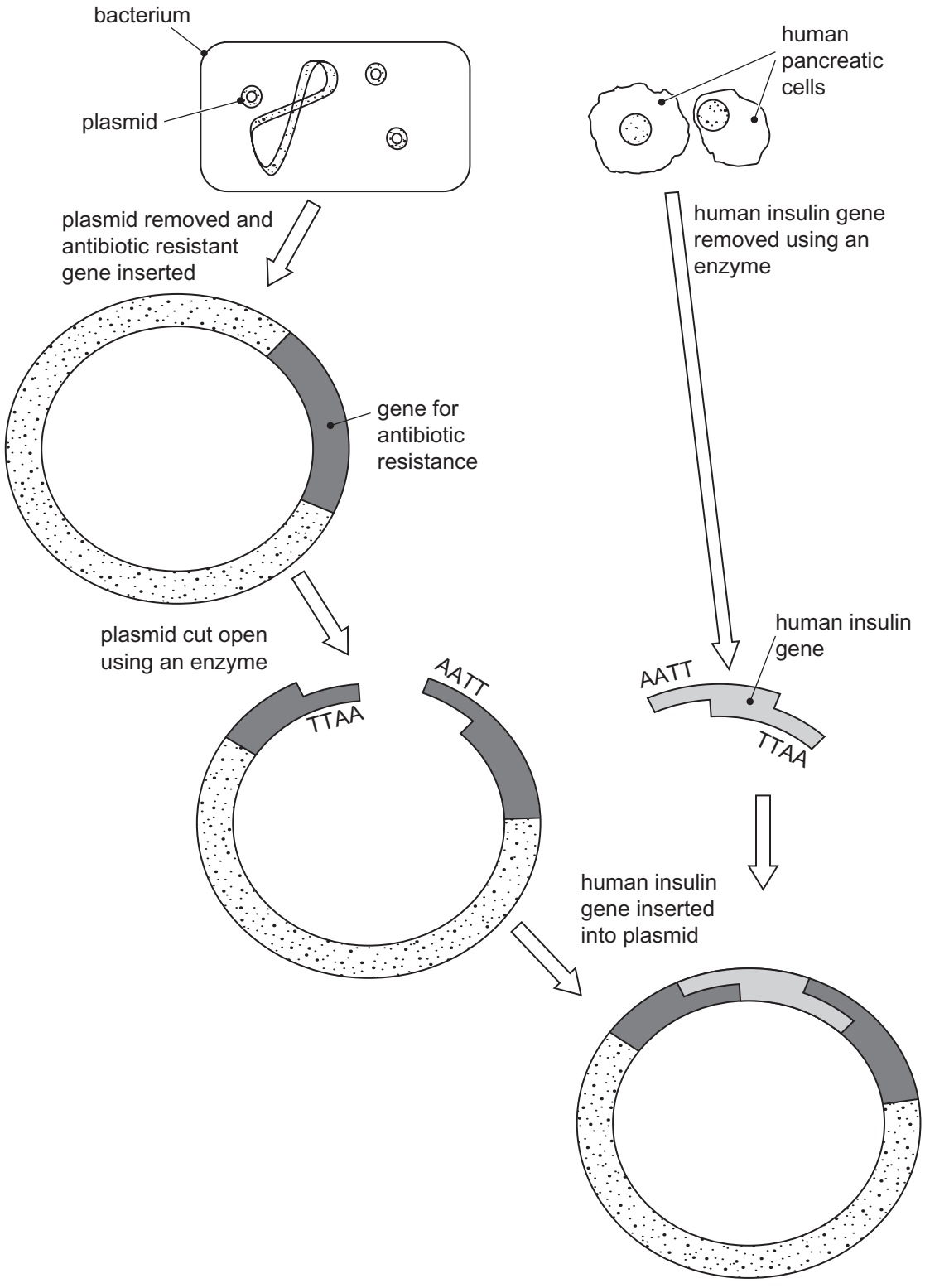
_____ [2]

Examiner Only	
Marks	Remark
Total Question 11	

[Turn over

12 The diagram shows some of the steps involved in the production of a genetically modified bacterium containing the human insulin gene.

Examiner Only	
Marks	Remark



(a) Name the type of enzyme used to cut out the insulin gene and cut open the plasmid.

_____ [1]

(b) **Use the information in the diagram** to explain why it is important to use the same enzyme to cut out the insulin gene and cut open the plasmid.

_____

_____

_____

_____ [2]

(c) What could you conclude if, after this process, the antibiotic-resistant gene in the plasmid remained intact?

_____

_____ [1]

The plasmid with the human insulin gene inserted is then placed into a bacterium.

(d) Describe the next stages involved in the production of insulin in an industrial fermenter.

_____

_____

_____

_____

_____ [4]

Examiner Only	
Marks	Remark

[Turn over

(e) Give **three** stages involved in downstream processing once the insulin has been produced in the fermenter.

_____

_____

_____

_____ [3]

Before genetically engineered human insulin was available, people with diabetes used animal insulin.

(f) Give two advantages of using genetically engineered human insulin rather than animal insulin.

1. _____

_____

2. _____

_____ [2]

(g) Suggest **two other** factors which scientists have to take into consideration when making decisions about implementing new scientific techniques.

_____

_____

_____

_____ [2]

Examiner Only	
Marks	Remark
Total Question 12	

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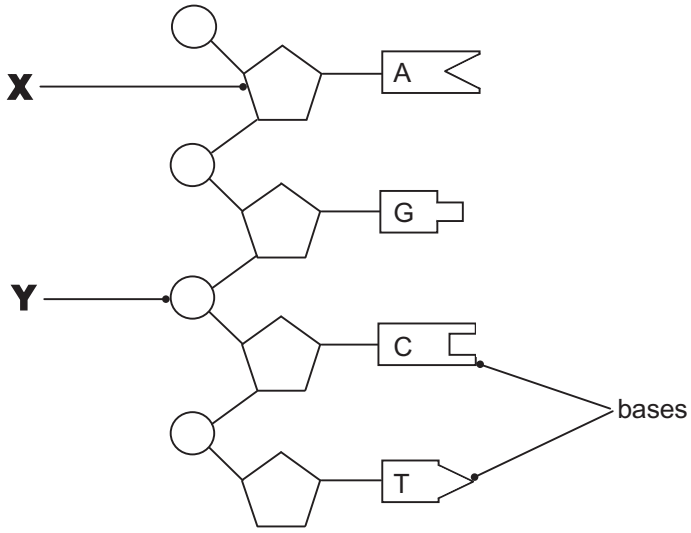
(Questions continue overleaf)

13 The diagram shows part of a strand of DNA.



(a) Name the chemicals **X** and **Y**.

X _____ [1]

Y _____ [1]

(b) What term is used to describe the three-dimensional shape of a DNA molecule?

_____ [1]

Examiner Only	
Marks	Remark

(c) Describe how using different lines of evidence led scientists to the discovery of the structure of DNA.

In this question, you will be assessed on your written communication skills, including the use of specialist scientific terms.

[6]

Examiner Only	
Marks	Remark

[Turn over

(d) The results of research into the percentage of each of the bases present in the DNA of five people are shown in the table.

Person	Percentage of base in DNA			
	A	T	G	C
1	30.9	29.7	19.9	20.1
2	28.9	29.8	22.4	19.5
3	29.2	29.6	19.1	21.3
4	29.7	30.1	21.2	21.0
5	28.3	29.3	20.4	19.6
Average	29.4	29.7	20.6	

Examiner Only	
Marks	Remark

(i) **Complete the table** by calculating the average percentage of the base **C**. [1]

(ii) Suggest why the results for each base are considered to be reliable.

_____

_____ [1]

(iii) What **two conclusions** can be made from these results about the percentage of the bases present in these samples of DNA?

1. _____

_____

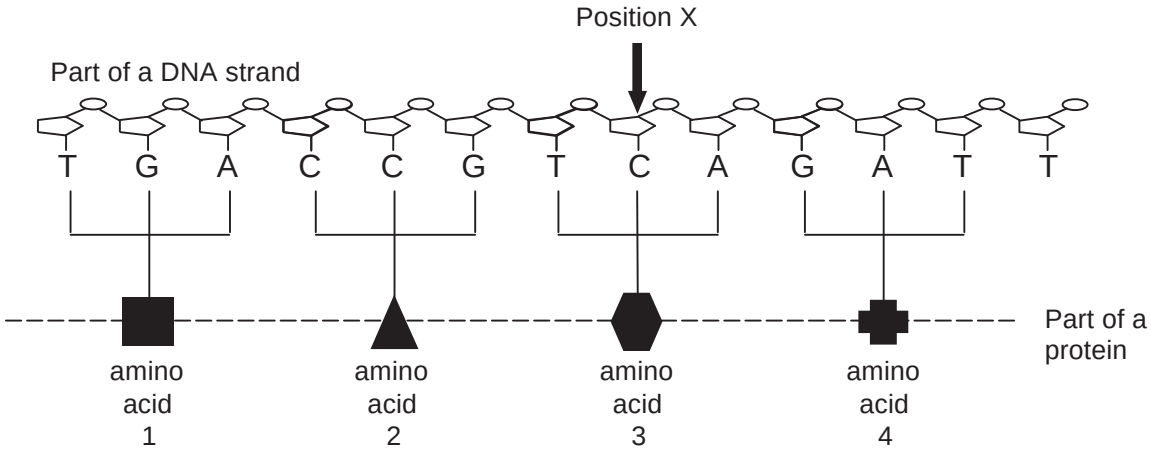
_____ [1]

2. _____

_____

_____ [1]

(e) The diagram shows how the bases on part of a DNA strand are used as a code.



(i) Explain the effect of a random change in the DNA molecule at position X from base C to G.

_____

_____

_____ [2]

(ii) What name is given to such a change in the DNA molecule?

_____ [1]

(iii) Give the cause and effect of such a change in the DNA of skin cells.

Cause _____ [1]

Effect _____ [1]

Examiner Only	
Marks	Remark

[Turn over

(iv) Suggest **two** possible consequences of a random change in the DNA molecule during meiosis.

_____

_____

_____

_____ [2]

Examiner Only	
Marks	Remark
Total Question 13	

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Question Number	**Marks**
1	
2	
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12	
13	
Total Marks	

Examiner Number