Rewarding Learning

Centre Number

71	

Candidate Number

General Certificate of Secondary Education
2011

Science: Double Award (Modular)

Paper 1
Higher Tier

[G8204]

G8204

THURSDAY 19 MAY, AFTERNOON

TIME

1 hour 30 minutes.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
Write your answers in the spaces provided in this question paper.
Answer **all five** questions.

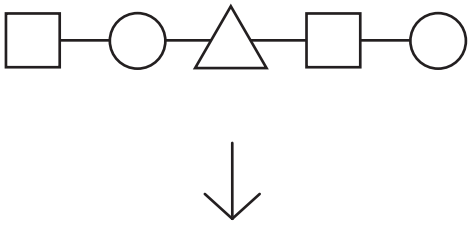
INFORMATION FOR CANDIDATES

The total mark for this paper is 110.
Quality of written communication will be assessed in question **3(c)(ii)**.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
Details of calculations should be shown.
Units must be stated in numerical answers where appropriate.

For Examiner's use only	
Question Number	**Marks**
1	
2	
3	
4	
5	
Total Marks	

Examiner Only	
Marks	Remark

1 **(a)** The diagram shows how amino acids link together to form a protein molecule.



(i) Complete the diagram above to show what happens to this protein molecule during digestion in the stomach and small intestine. [2]

(ii) The amino acids will then be absorbed into the blood. Name the process involved.

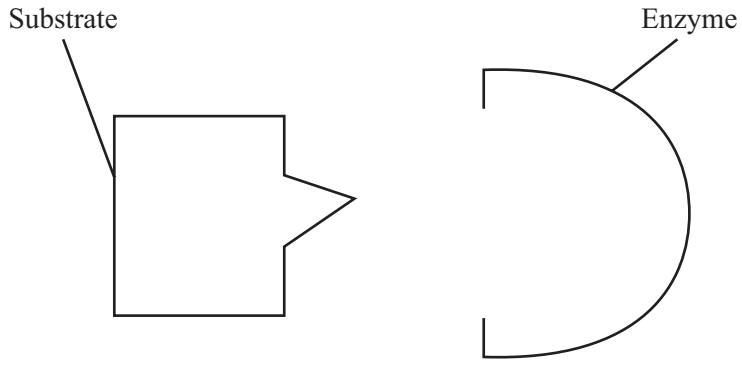
_____ [1]

(iii) Give **two** ways the small intestine is adapted for the process of absorption.

1. _____

2. _____ [2]

(b) The diagram shows the shape of a substrate molecule and part of an enzyme molecule.



(i) Complete the diagram of the enzyme molecule that would break down this substrate molecule. [1]

(ii) Explain why this enzyme molecule would not break down a different substrate molecule.

_____ [1]

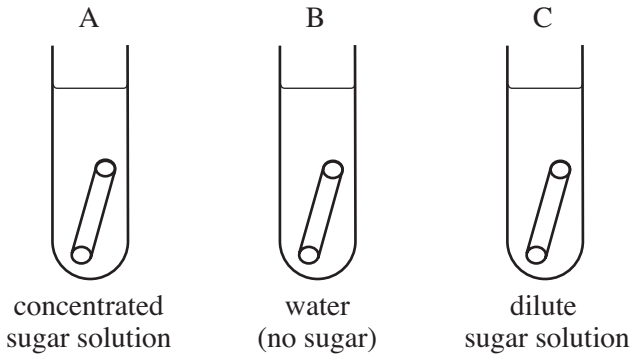
(iii) Why does increasing temperature from 20 °C to 30 °C increase the rate of an enzyme-catalysed reaction?

_____ [1]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

(c) An investigation into osmosis was carried out with potato cylinders. Three test tubes A, B and C were set up, each with a potato cylinder of 50 mm length and a different concentration of sugar solution. The potato cylinders were left for several hours, removed and their final length recorded. The results are given in the table.



Test tube	Solution	Length of potato cylinder at the start/mm	Length of potato cylinder at the end/mm
A	Concentrated sugar solution	50	48
B	Water (no sugar)	50	53
C	Dilute sugar solution	50	50

(i) Why was it **not** necessary to work out the percentage change in length in this experiment?

_____

_____ [1]

(ii) Give **one** factor that should have been kept constant in this experiment.

_____ [1]

(iii) Explain the results for the potato cylinder in test tube A.

_____

_____ [2]

Examiner Only	
Marks	Remark

(iv) Draw a diagram of one potato **cell** from the potato cylinder in test tube A as it would appear at the end of the investigation.

Label the cell membrane, cell wall and vacuole on your diagram.

[4]

(v) Suggest what would happen if red blood cells are placed in water. Explain your answer.

_____

_____ [2]

(d) (i) Name the process in plant root hair cells that involves the transport of minerals from the soil.

_____ [1]

(ii) Explain why energy is needed for this process.

_____ [1]

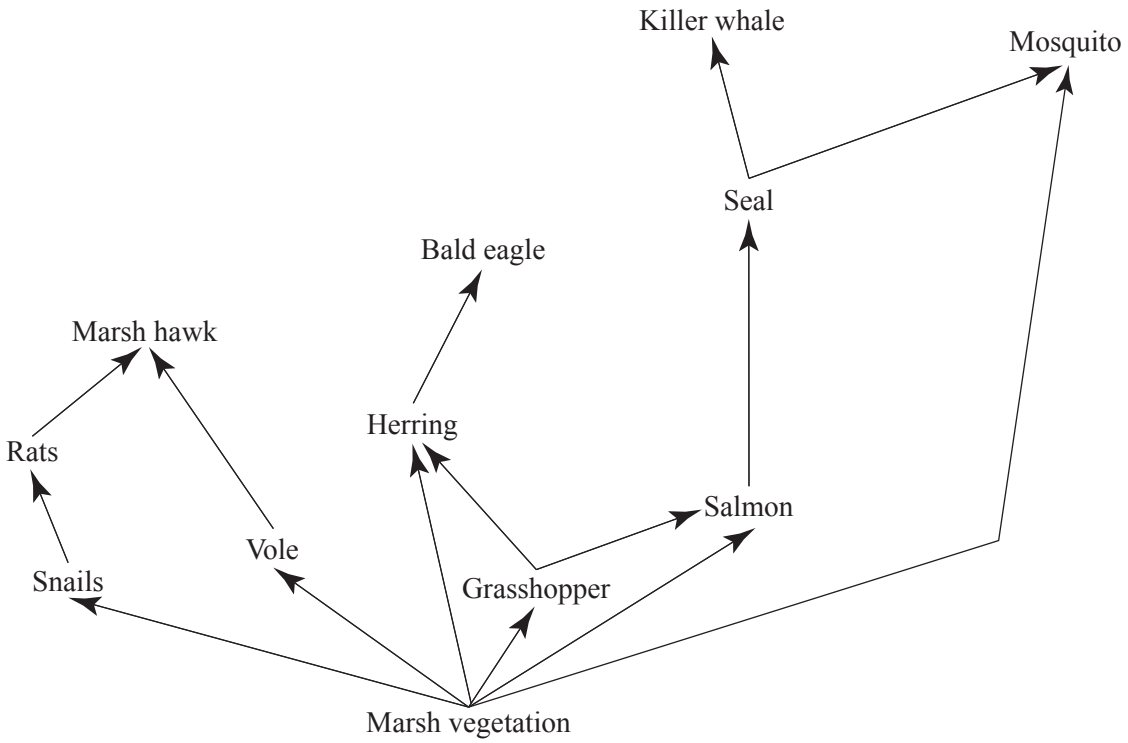
(iii) Waterlogged soil contains little oxygen. Explain how the uptake of minerals is affected if the plant is grown in waterlogged soil.

_____

_____ [2]

Examiner Only	
Marks	Remark

2 **(a)** The diagram shows a food web.



http://www.acklamgrange.org.uk/science/topics/food_web3.jpg

(i) What is the source of energy for this food web?

_____ [1]

(ii) At what two trophic levels is the herring feeding?

_____ and _____ [1]

(iii) Draw the food chain from the food web where the bald eagle is acting as a tertiary consumer.

[2]

(iv) Suggest why the population of salmon might increase if the herring population was wiped out by overfishing.

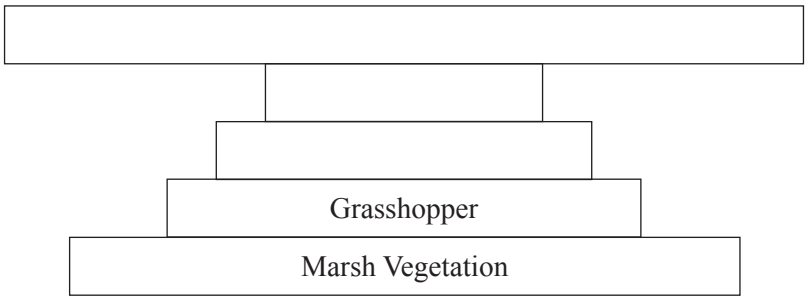
_____ [1]

(v) Explain why the marsh hawk would gain more energy from eating voles than from eating rats.

_____

_____ [2]

A pyramid of numbers for one of the food chains in the food web is shown below.



(vi) Complete the labels on the pyramid with the correct name of the organisms in the food chain. [2]

(vii) On the grid, draw a pyramid of biomass from the pyramid of numbers above.

Beside each level write the name of the organism.

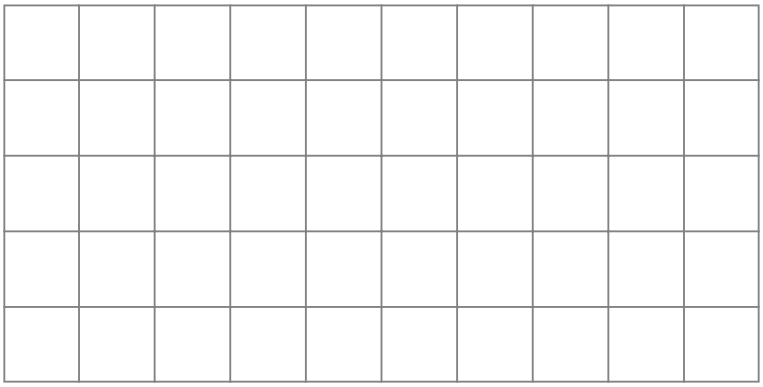
_____

_____

_____

_____

_____

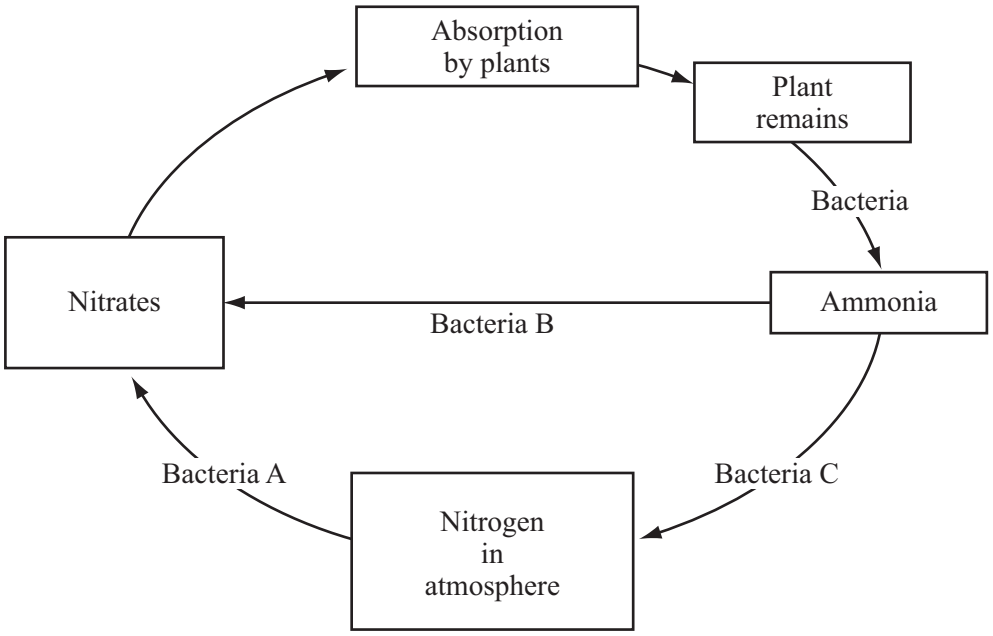


[4]

Examiner Only

Marks	Remark

(b) The diagram shows part of the nitrogen cycle.



Use the diagram and your knowledge to answer the following questions.

(i) Name the types of bacteria shown in the diagram.

Bacteria A _____

Bacteria B _____

Bacteria C _____ [3]

(ii) Explain why harvesting a crop causes a decrease in the nitrate content of the soil.

_____ [1]

Examiner Only

Marks	Remark

(iii) Suggest and explain **two** methods, other than applying fertiliser, by which a farmer could increase the nitrate content of the soil.

Examiner Only

Marks	Remark

Method 1 _____

Explanation _____

_____

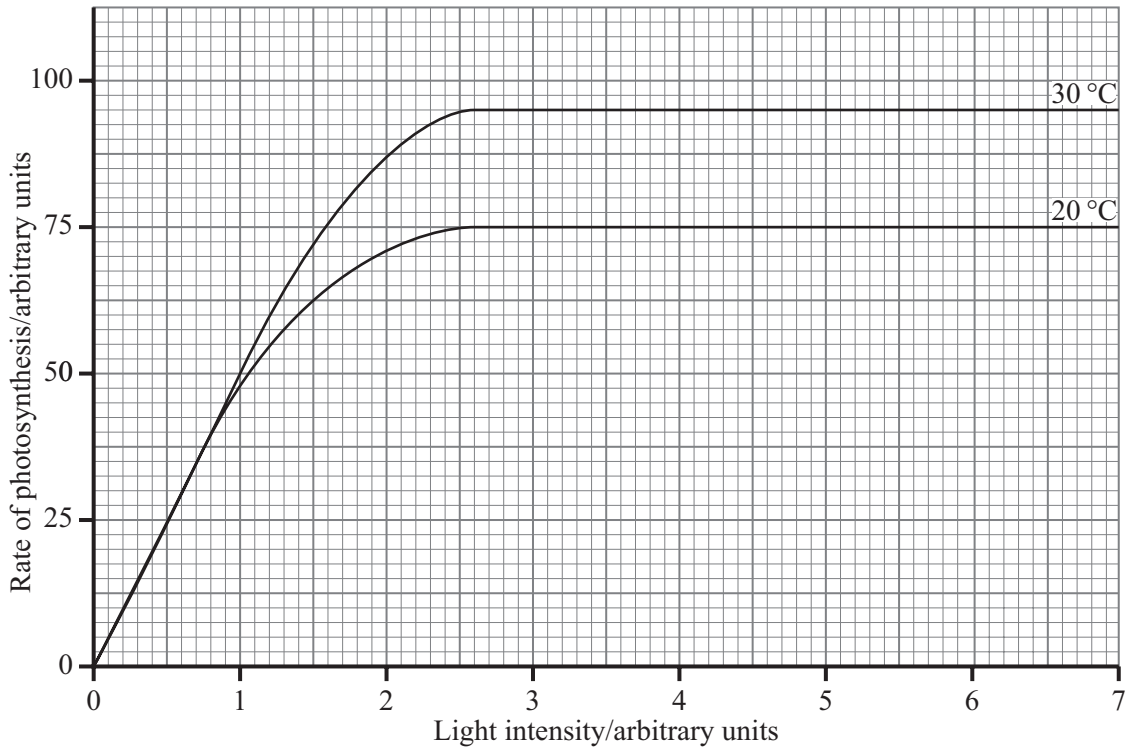
Method 2 _____

Explanation _____

_____ [4]

Examiner Only	
Marks	Remark

3 **(a)** The graph shows the effect of light intensity on the rate of photosynthesis, at two different temperatures. The carbon dioxide concentration is 0.03% at both temperatures.



(i) Use the information in the graph and your knowledge to suggest the light intensity and temperature that a market gardener should have his greenhouse to maximise his profit. Explain your answer.

Light intensity _____ arbitary units

Temperature _____ °C

Explanation _____

_____

_____

_____

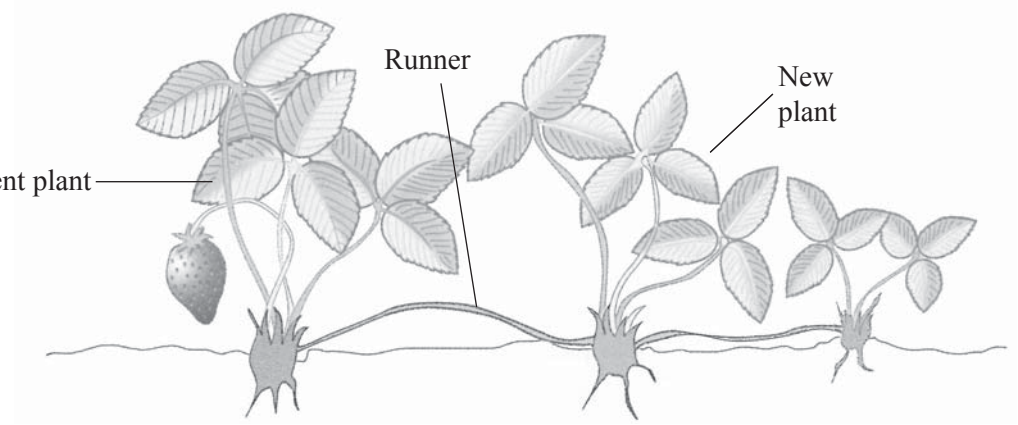
_____ [3]

(ii) Explain why temperatures above 50 °C would be a problem when growing plants in a greenhouse.
Suggest how a grower might regulate temperatures in a greenhouse.

_____

_____ [2]

(b) The diagram shows a strawberry plant with runners.



(i) Name this type of reproduction.

_____ [1]

(ii) Give **one** disadvantage of this type of reproduction.

_____ [1]

(iii) If a grower had a strawberry plant that produced tasty fruit what **two other** methods could she use to increase her stock of this plant?

_____

_____ [2]

Examiner Only	
Marks	Remark

Examiner Only

Marks	Remark

(c) The table below shows the mineral level (nitrates and phosphates) and depth of light penetration in an unpolluted lake, a polluted lake and Lough Neagh.

Lake	Mineral level/arbitrary units per litre	Depth of light penetration/m
Unpolluted	10–34	6
Polluted (eutrophic)	35–100	3
Lough Neagh	165	1.1

Use the data in the table and your knowledge to answer the following questions.

(i) Compare the mineral level in Lough Neagh with the other lakes.

_____

_____ [1]

(ii) The minerals are used by the water plants for growth. Why is light only able to penetrate 1.1 m in Lough Neagh?
Explain how this can result in death of fish in the lough.

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

_____

_____

_____

_____

_____

_____

_____

_____

_____ [5]

Quality of written communication [2]

(d) Organisms of the same species show variation and this allows natural selection.

Examiner Only	
Marks	Remark

(i) Suggest **one** adaptation a plant might possess that would enable it to survive better in low light intensity than other plants of the same species.

_____ [1]

(ii) How would this adaptation be passed on?

_____ [1]

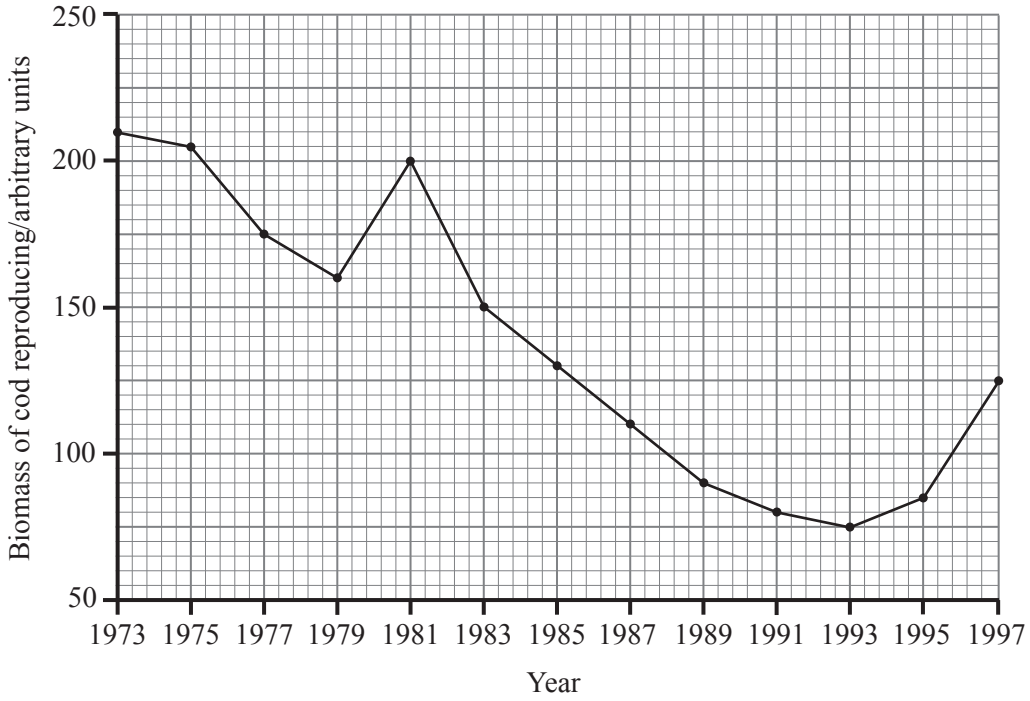
(iii) Explain why an adaptation that does **not** give a plant an advantage may not be passed on.

_____

_____ [2]

Examiner Only	
Marks	Remark

(e) The graph shows the biomass of cod reproducing in the North Sea over a 24 year period.



Use the graph and your knowledge to answer the following questions.

(i) How many times greater was the biomass of cod reproducing in 1983 compared to 1993?

_____ times [2]

The biomass of cod reproducing in the North Sea started to rise in 1993 after the introduction of new regulations by the European Commission. One regulation made the fishing industry use increased mesh size in fishing nets.

(ii) Explain how this regulation helped to increase the biomass of cod reproducing.

_____

_____ [2]

(iii) Suggest **two** other regulations that could have been imposed by the European Commission to help increase cod stocks.

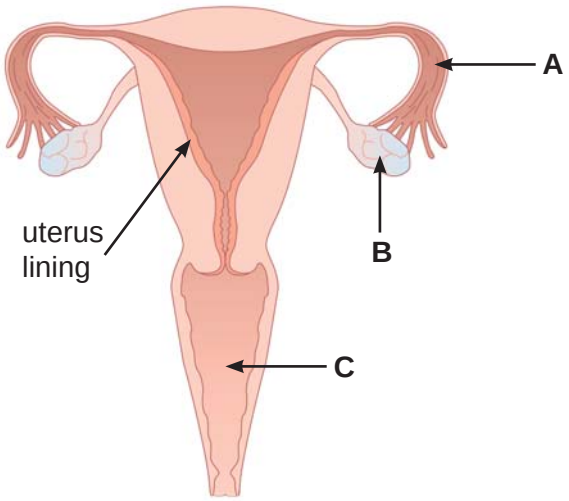
1. _____

2. _____ [2]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

4 **(a)** The diagram shows part of the female reproductive system.



(i) Name the parts A, B and C.

A _____

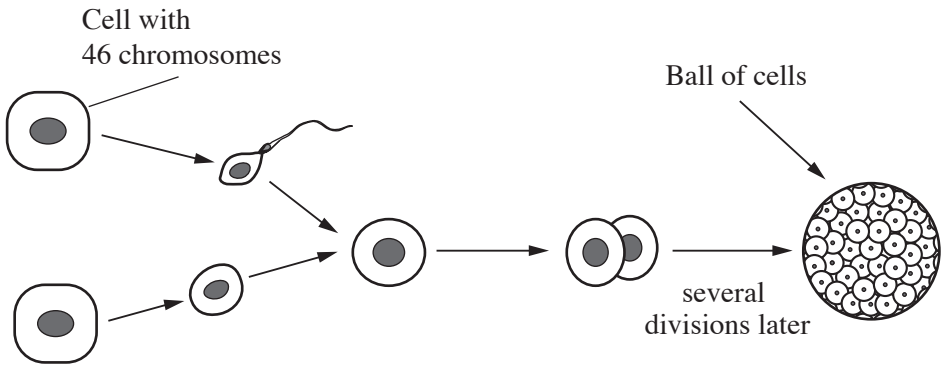
B _____

C _____ [3]

(ii) Give the function of organ B.

_____ [1]

(b) The diagram shows some of the stages of fertilisation and the early development of the embryo.



Stage 1 Stage 2 Stage 3

(i) What type of cell division occurs at Stage 1 to produce eggs and sperm?

_____ [1]

(ii) Why must eggs and sperm be produced by this type of cell division?

_____ [1]

(iii) The process of fertilisation is shown in stage 2. Where in the female reproductive system does fertilisation take place?

_____ [1]

(iv) What type of cell division occurs at stage 3?

_____ [1]

(v) What must happen to the ball of cells before it can develop into a baby in the uterus?

_____ [1]

(vi) Describe the process of birth.

_____

_____

_____

_____

_____

_____ [3]

Examiner Only	
Marks	Remark

Examiner Only

Marks	Remark

(c) A number of methods of contraception can be used to prevent pregnancy.

(i) Complete the table.

Method of contraception	Type of contraception	How pregnancy is prevented
Mechanical (barrier)	Condom	
Surgical		Prevents gametes from reaching the other gamete
	Contraceptive pill	Prevents egg from being released

[3]

(ii) Which method of contraception is permanent?

_____ [1]

(d) Gonorrhoea is a type of sexually transmitted infection which is caused by a bacterium.

(i) How is gonorrhoea treated?

_____ [1]

(ii) Name one other sexually transmitted infection and the type of micro-organism that causes it.

sexually transmitted infection _____

micro-organism _____ [2]

(iii) How may the spread of sexually transmitted infections be reduced?

_____ [1]

Examiner Only	
Marks	Remark

5 **(a)** The colour of the spots in Dalmatian dogs is determined by a gene. The allele (gene) for black spots is dominant to the allele (gene) for brown spots.

© iStockphoto / Thinkstock

Let B represent the allele (gene) for black spots.
Let b represent the allele (gene) for brown spots.

A Dalmatian which is heterozygous for black spots is crossed with a Dalmatian with brown spots.

(i) Give the genotypes for this cross.

Heterozygous Black spotted Dalmatian	×	Brown spotted Dalmatian
_____		_____ [2]

(ii) Use a Punnett square to show the possible genotypes of the offspring.

[2]

(iii) Give the phenotypes of the offspring and the ratio of the phenotypes.

Phenotypes _____ and _____

Ratio _____ [2]

(b) A breeder purchases another black spotted Dalmatian. She carries out a back cross (test cross) to check the genotype of this Dalmatian.

All of the puppies in the litter had black spots.

Draw **one** Punnett square to show how **this** litter was produced.

[3]

(c) The hormone insulin regulates blood sugar levels in the body.

(i) Susan is not able to produce enough insulin. What condition does she suffer from?

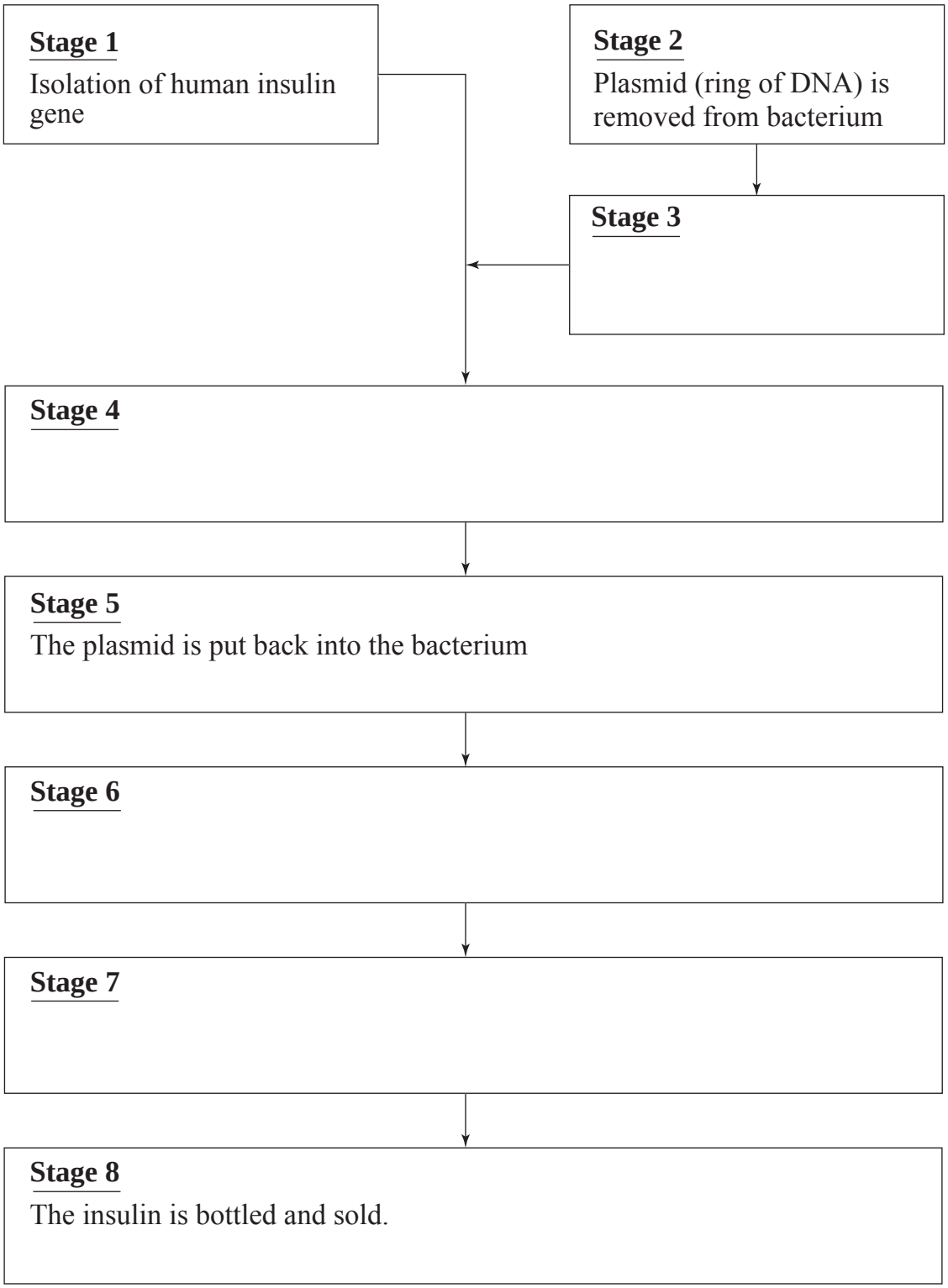
_____ [1]

(ii) How does insulin regulate blood sugar levels?

_____ [1]

Examiner Only	
Marks	Remark

The flow diagram shows some stages in the production of human insulin by genetic engineering.



(iii) Complete the boxes for stages **3**, **4**, **6** and **7**. [4]

Examiner Only

Marks	Remark

Examiner Only	
Marks	Remark

(iv) What type of molecule is the hormone insulin?

_____ [1]

(v) State **one** advantage of making human insulin using genetic engineering.

_____ [1]

(d) (i) Name the two scientists who initially used **x-ray diffraction** to work out the shape of DNA.

_____ and _____ [2]

(ii) This knowledge was then used by other scientists to build a 3D model of DNA. Circle the shape below which best shows the structure of DNA.

© iStockphoto / Thinkstock

© iStockphoto / Thinkstock

© Hemera / Thinkstock

[1]

THIS IS THE END OF THE QUESTION PAPER