Rewarding Learning

71	

Candidate Number

General Certificate of Secondary Education
2012

Science: Biology

Paper 2
Higher Tier

[G0904]

G0904

WEDNESDAY 20 JUNE, MORNING

TIME

2 hours.

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 eight** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 160.
Quality of written communication will be assessed in question **2(a)(v)**.
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	
6	
7	
8	
Total Marks	

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Examiner Only	
Marks	Remark

1 The diagram shows the gases and soot being released from a factory chimney.

© Top Photo Group / Thinkstock

(a) (i) Name a fossil fuel which is used in factories.

_____ [1]

(ii) Name **two** gases, produced by burning fossil fuels, which cause air pollution.

1. _____ [1]

2. _____ [1]

(iii) Describe the effect soot has on the outside of leaves.

_____ [1]

(iv) Explain how soot causes reduced growth of a plant.

_____

_____

_____ [2]

(v) Describe **two** ways air pollution can be reduced.

1. _____ [1]

2. _____ [1]

(b) The photograph shows one method of disposing of household waste.

Examiner Only	
Marks	Remark

© Ingram Publishing / Thinkstock

(i) Name this method of waste disposal.

_____ [1]

(ii) Give **two** disadvantages of this method of waste disposal.

1. _____

_____ [1]

2. _____

_____ [1]

(iii) Name **one other** method of household waste disposal.

_____ [1]

(c) The table shows survey results of the numbers of red and grey squirrels in three different woods, in Northern Ireland, over 20 years.

Year	Number of squirrels in each wood					
	Killnua Wood		Knock Wood		Dacrann Wood	
	Red	Grey	Red	Grey	Red	Grey
1980	500	0	300	0	400	0
1990	500	0	300	0	400	700
2000	0	300	300	0	0	800

(i) Name the wood which shows no change in the numbers of squirrels over the 20 year period.

_____ [1]

(ii) Describe the **trend** in the numbers of each squirrel in Dacrann Wood over the 20 year period.

Red _____

_____ [1]

Grey _____

_____ [1]

Grey squirrels are a non-native species while the red squirrels are native.

(iii) Suggest **three** reasons why the grey squirrels can out-compete the native red squirrels.

1. _____

_____ [1]

2. _____

_____ [1]

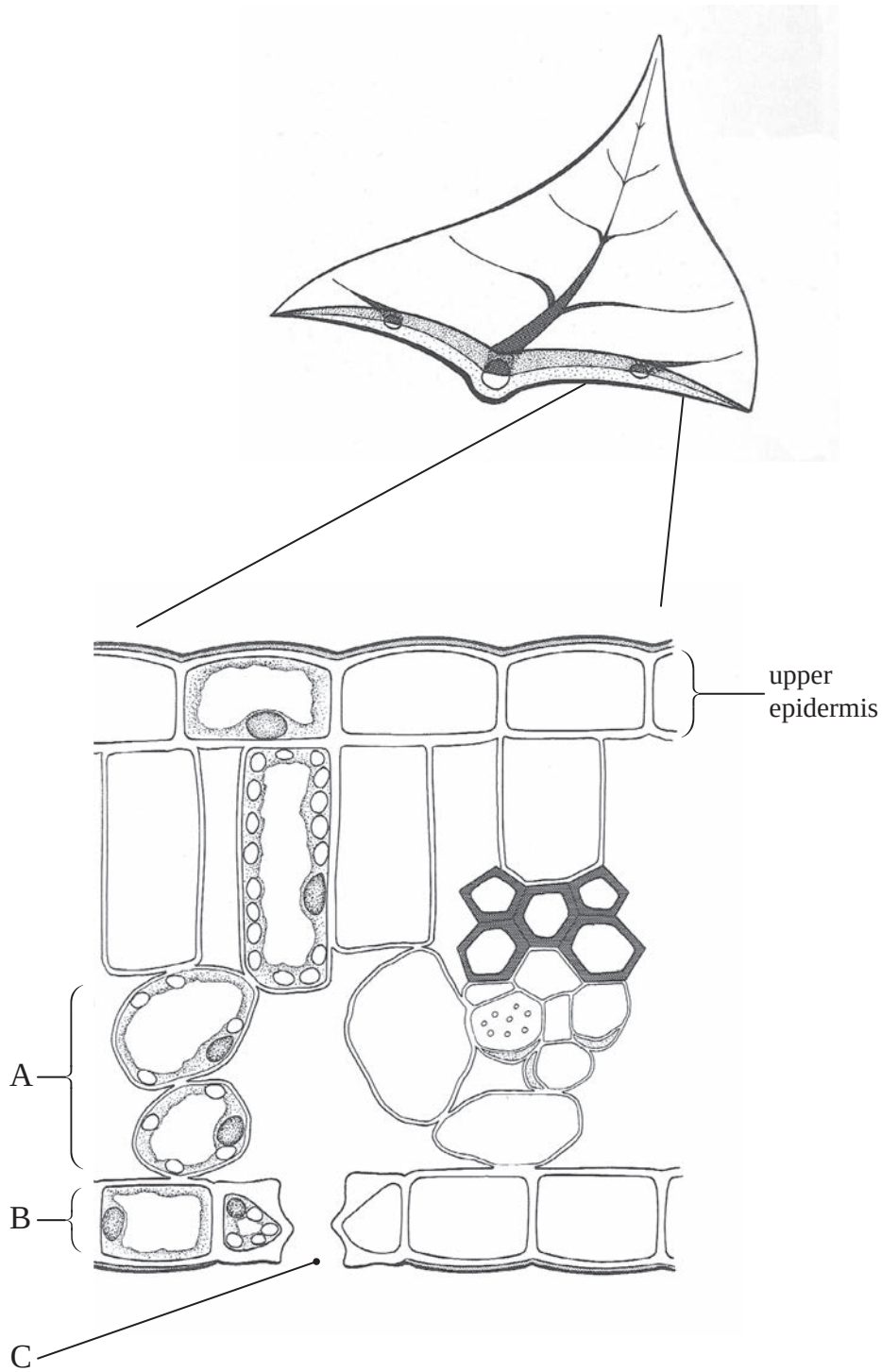
3. _____

_____ [1]

Examiner Only

Marks	Remark

2 The diagram shows part of a leaf.



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

A _____ [1]

B _____ [1]

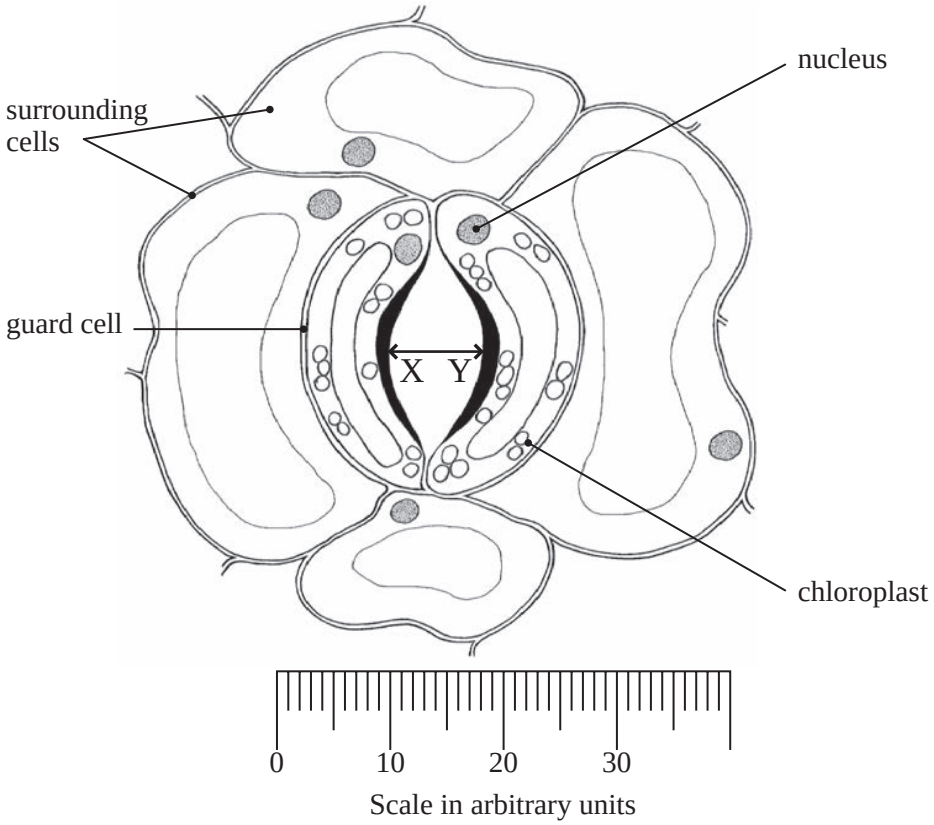
C _____ [1]

Examiner Only	
Marks	Remark

(ii) Use the diagram to help complete the table.

Leaf adaptation	How it increases photosynthesis	
Transparent upper epidermis		[1]
	Short distance for gases to diffuse	[1]
Flat leaf		[1]

The drawing shows a magnified section of leaf epidermis.



(iii) Use the scale to measure the diameter of the opening along the line X–Y.

Diameter _____ arbitrary units [1]

Examiner Only

Marks	Remark

The size and shape of guard cells differ from the surrounding cells.

Examiner Only	
Marks	Remark

(iv) Give **two other** ways guard cells differ from the surrounding cells.

_____

_____

_____

_____ [2]

(v) Describe how a named raw material used in photosynthesis enters the leaf.

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

_____

_____

_____

_____

_____

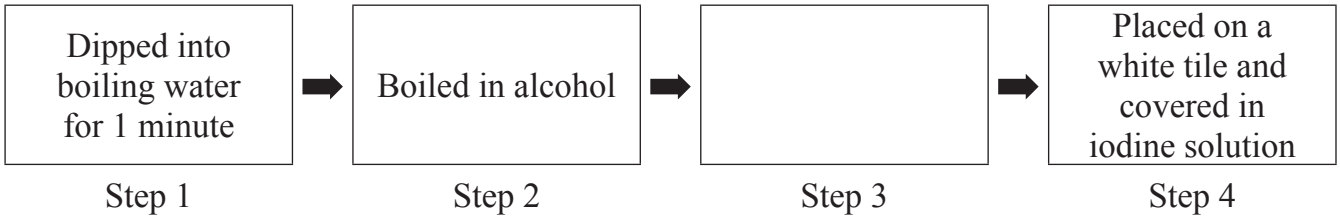
_____

_____

_____ [3]

Quality of written communication [2]

(b) The flow diagram shows the steps taken to test a leaf to find out if photosynthesis has taken place.



(i) Explain the purpose of

Step 1. _____

_____ [1]

Step 2. _____

_____ [1]

(ii) Describe **one** safety precaution necessary when carrying out Step 2.

_____

_____ [1]

(iii) **Complete the box in the diagram** to describe what happens in Step 3. [1]

(iv) Name the product tested for in Step 4, which would show that photosynthesis had taken place and describe the colour change observed in the iodine solution.

Product _____ [1]

Colour change _____

_____ [1]

Examiner Only	
Marks	Remark

A plant was left in the dark for 48 hours and one of its leaves was tested to find out if photosynthesis had taken place.

(v) Explain why the iodine solution showed no colour change.

_____

_____

_____ [2]

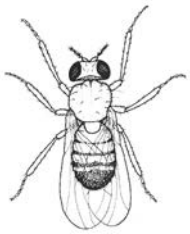
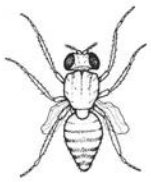
Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

3 The diagram shows a genetic cross between two homozygous flies.

The size of the wings is controlled by a pair of alleles.

In the diagram **N** represents the dominant allele for normal wings and **n** represents the recessive allele for vestigial (shrivelled) wings.

Parents	Normal wing	Vestigial wing
		
Genotype	**NN**	_____

1st Generation offspring

Genotype **Nn**

Phenotype _____

Source: Jones, G and Jones, M, BIOLOGY GCSE Edition, 2nd Edition, 1987, Cambridge University Press

(a) (i) **Complete the diagram** to show the

genotype of the vestigial-winged parent. [1]

phenotype of the offspring. [1]

(ii) Suggest why vestigial wings would be a disadvantage.

_____

_____

_____ [2]

[Turn over

Alleles are different types of the same gene.

(iii) What are genes and where are they found?

_____

_____

_____ [2]

(b) Two of the first generation, **Nn** offspring were mated.

(i) Use the Punnett square to predict the genotypes of the flies that could be produced by this mating.

	N	**n**
N		
n		

[1]

[1]

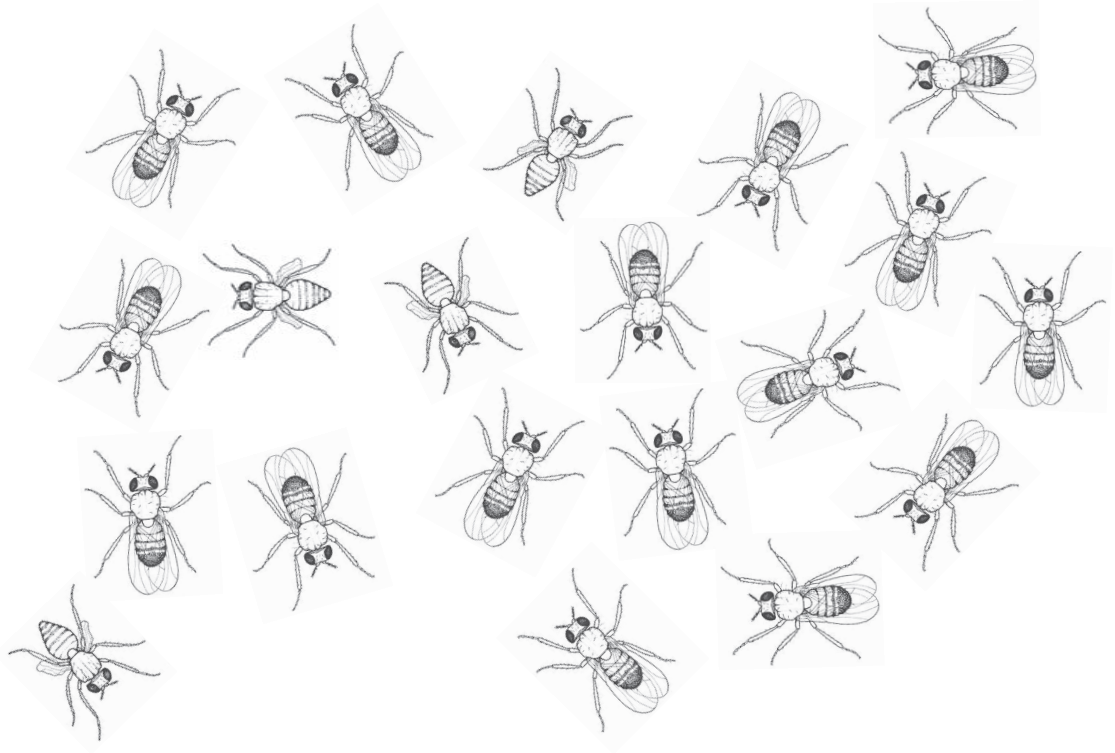
(ii) Give the ratio of normal to vestigial-winged flies predicted by the Punnett square.

_____ [1]

Examiner Only

Marks	Remark

The diagram shows the actual flies produced by this mating.



(iii) Complete the table by counting the flies.

Number of normal-winged flies	Number of vestigial-winged flies

[1]

(iv) Calculate the ratio of normal to vestigial-winged flies.

_____ [1]

(v) Suggest why the actual and predicted ratio of normal to vestigial-winged flies may not always be the same.

_____

_____

_____ [1]

Examiner Only

Marks	Remark

Examiner Only	
Marks	Remark

(c) The genes which humans inherit cause them to produce sex hormones. During puberty these sex hormones trigger the development of secondary sexual characteristics.

(i) Name a hormone which causes the development of secondary sexual characteristics

in males. _____ [1]

in females. _____ [1]

(ii) Complete the table of secondary sexual characteristics, using ✓ if the characteristic is present and ✗ if the characteristic is absent.

Secondary sexual characteristic	Males	Females	
Voice deepens			[1]
Growth of body and pubic hair			[1]
Menstruation begins			[1]
Sexual awareness			[1]

4 **(a)** One type of food poisoning is caused by Salmonella microorganisms. Raw chicken often contains Salmonella. If frozen chicken is cooked without being completely defrosted it can cause food poisoning when eaten. To prevent food poisoning frozen chicken should be thoroughly defrosted before cooking. The raw chicken should not be allowed to touch another food which is not going to be cooked. After cooking in a hot oven the chicken should be cooled quickly and stored in a refrigerator at 4 °C. *1* *3* *5* *7* *9*

Examiner Only	
Marks	Remark

(i) Name the type of microorganism which causes Salmonella food poisoning.

_____ [1]

(ii) Explain how freezing safely preserves chicken.

_____

_____ [1]

(iii) Suggest why cooking a frozen chicken, which has not been completely defrosted, could result in food poisoning (Line 3).

_____

_____

_____ [2]

(iv) Explain why cooled, cooked chicken can safely be stored in a fridge at 4 °C for a short period of time (Line 8).

_____

_____ [1]

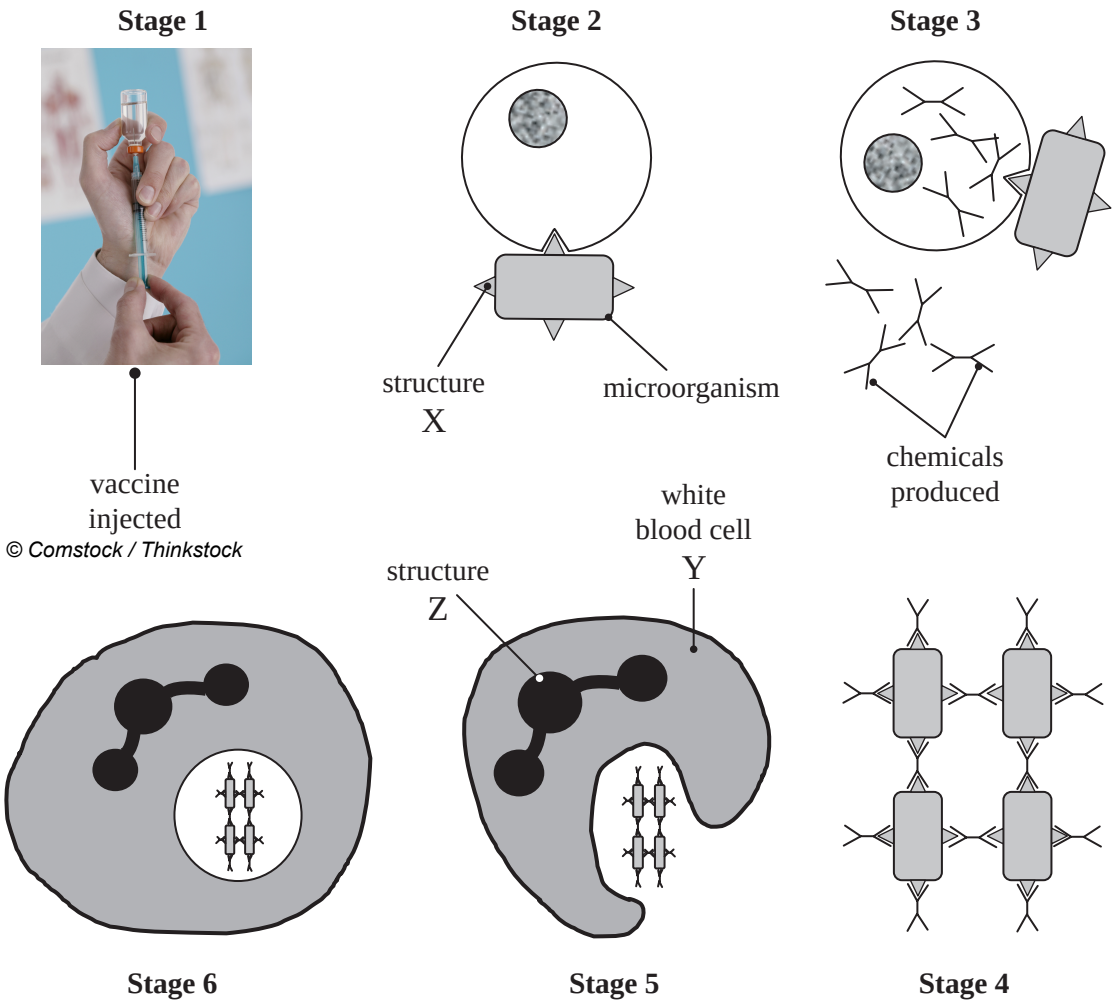
(v) Suggest **two** other precautions which should be taken to prevent the spread of food poisoning.

_____

_____

_____ [2]

(b) The diagrams show how a vaccine brings about immunity.
The diagrams are not all drawn to the same scale.



(i) Suggest why microorganisms contained in the vaccine at Stage 1 must be dead or weakened.

_____

_____ [1]

(ii) Name structure X on the microorganism.

_____ [1]

(iii) Describe what is happening at Stage 2.

_____

_____ [1]

Examiner Only

Marks	Remark

(iv) What type of white blood cell is Y?

_____ [1]

(v) Name structure Z. _____ [1]

(vi) Name the chemicals produced by the white blood cell at Stage 3 and describe their effect on the microorganisms at Stage 4.

Chemicals _____ [1]

Effect _____

_____

_____ [2]

(vii) Describe what is happening at Stages 5 and 6.

Stage 5 _____

_____ [1]

Stage 6 _____

_____ [1]

Microorganisms which enter the blood can also be killed by chemicals such as penicillin.

(viii) What type of chemical is penicillin?

_____ [1]

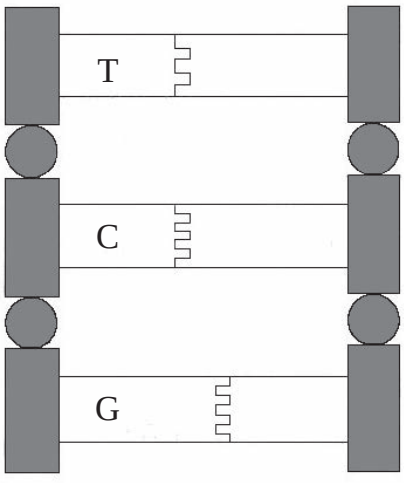
Examiner Only

Marks	Remark

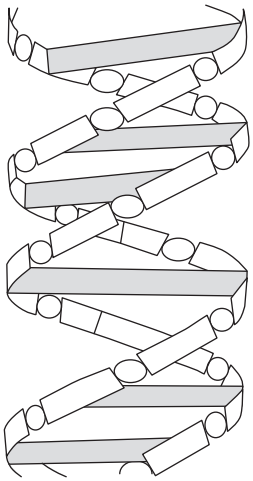
5 The diagrams show two models of a DNA molecule.

Examiner Only	
Marks	Remark

Model A



Model B



(a) (i) Complete model A by filling in the letters of the missing bases. [2]

Model A resulted from the work of Franklin and Wilkins.

(ii) Name the method used by Franklin and Wilkins.

_____ [1]

(iii) Name the scientists who developed model B.

_____ [1]

(iv) What term describes the structure of model B?

_____ [1]

(v) Describe the role of DNA in protein production.

_____

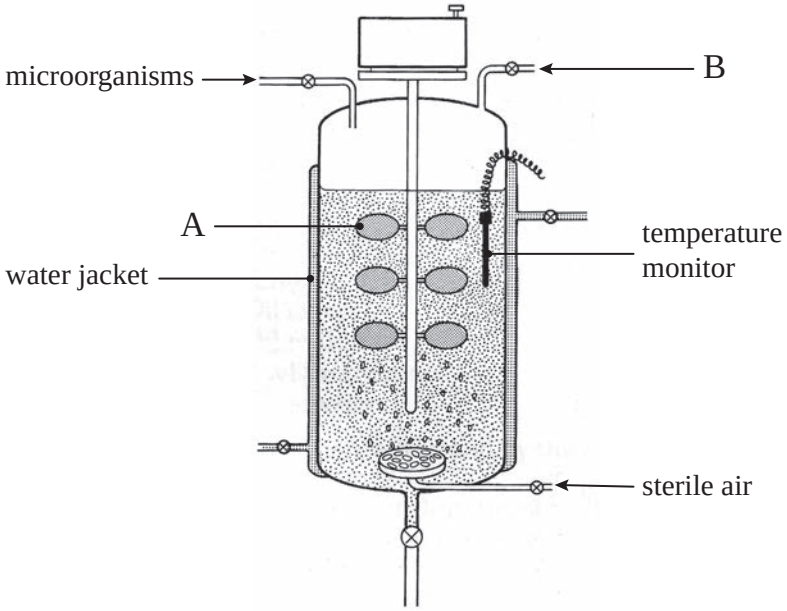
_____

_____

_____

_____ [3]

The diagram shows a fermenter in which genetically engineered bacteria are cultured.



(b) (i) Name part A.

_____ [1]

(ii) What must be added at B for the microorganisms to grow?

_____ [1]

(iii) Explain the function of the water jacket.

_____

_____

_____ [2]

(iv) Suggest **two other** conditions which must be monitored.

_____

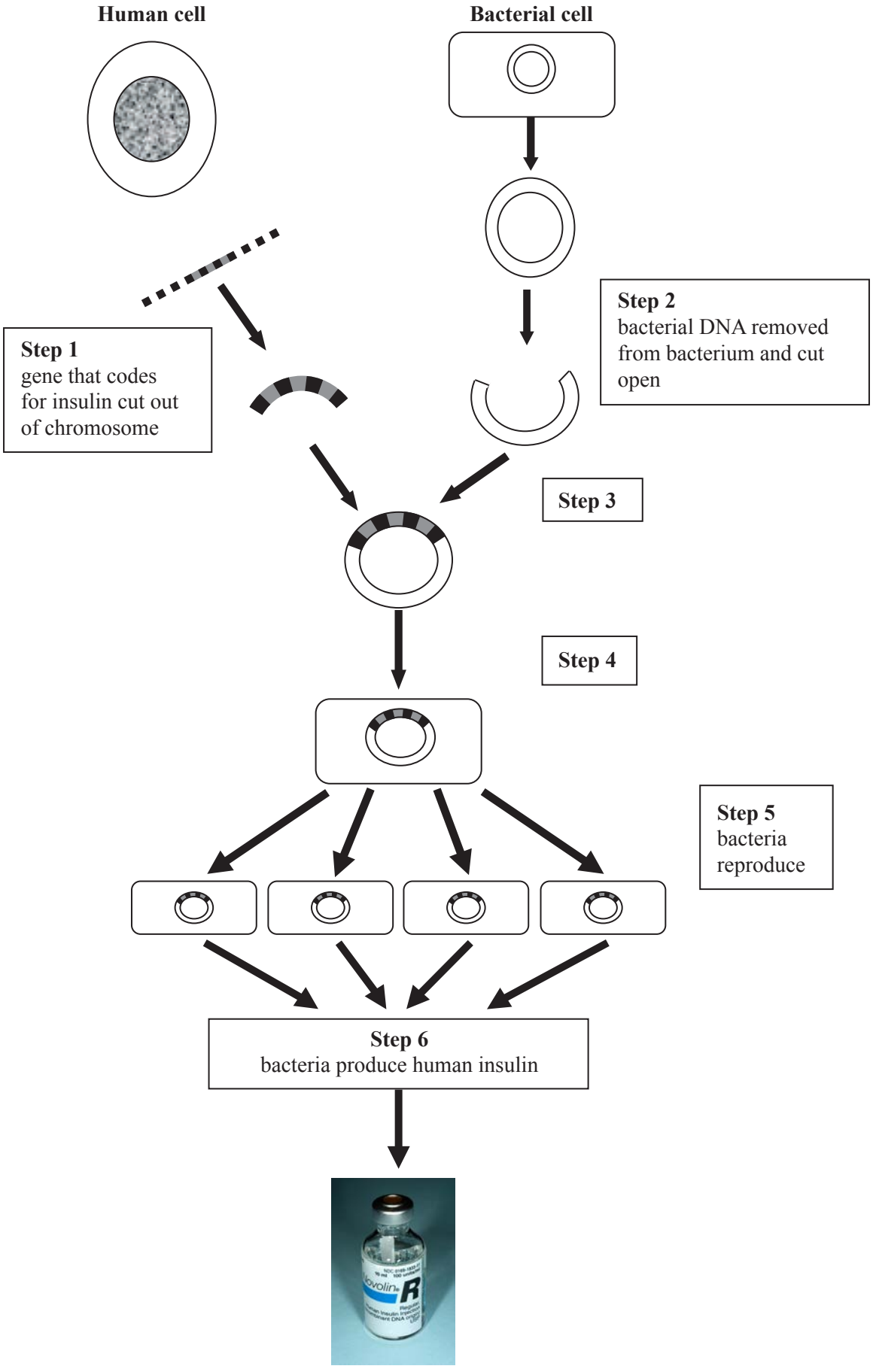
_____

_____ [2]

Examiner Only

Marks	Remark

(c) The diagram shows some of the steps involved in the manufacture of genetically engineered human insulin.



(i) Explain how the gene in Step 1 is cut out of the chromosome.

_____

_____ [1]

(ii) Describe what happens in

Step 3. _____

_____ [1]

Step 4. _____

_____ [1]

(iii) Explain why every bacterial cell in Steps 5 and 6 contains the human insulin gene.

_____

_____

_____ [2]

(iv) Describe what happens to the insulin after it is produced at Step 6 before it can be used by patients.

_____

_____

_____ [2]

Before this method of genetic engineering was developed insulin was obtained from pigs and cows.

(v) Suggest why genetically engineered human insulin is better than that obtained from pigs and cows.

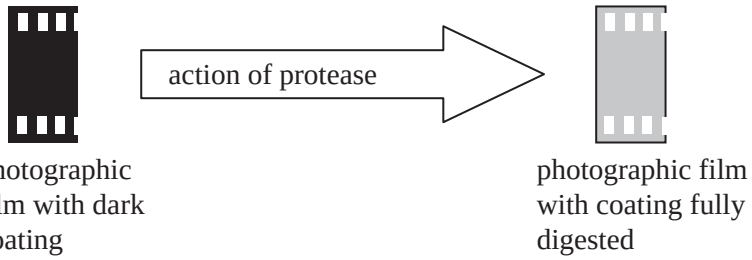
_____

_____ [1]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

6 **(a)** The diagram shows the effect of protease enzyme on photographic film.



(i) What is a protease enzyme?

_____

_____

_____ [2]

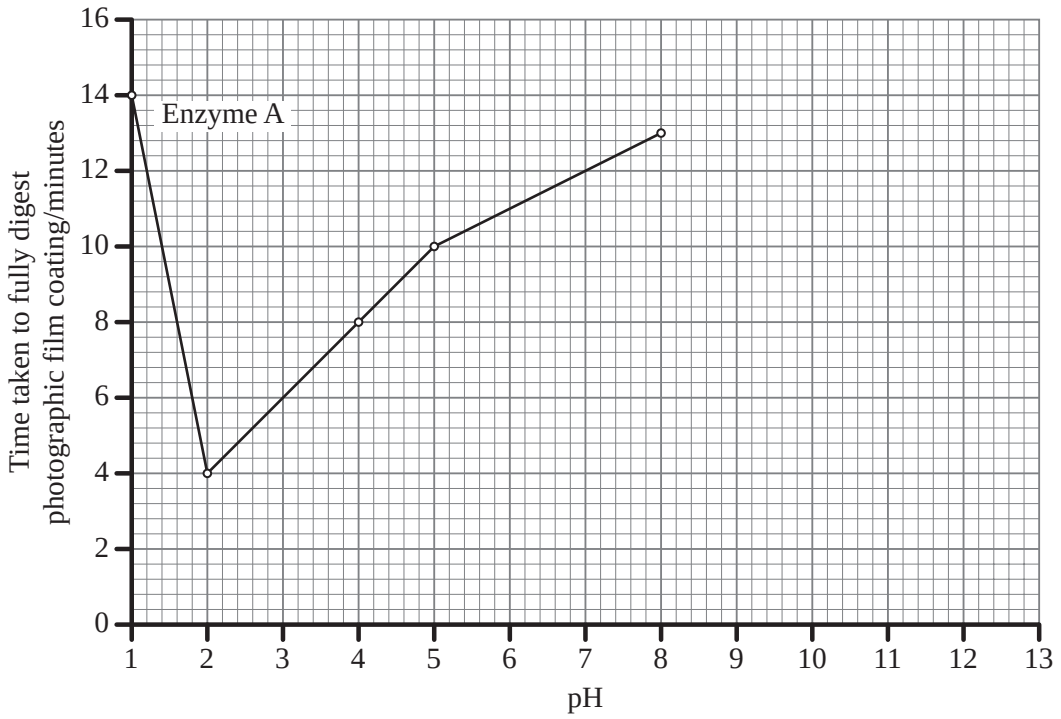
(ii) Name the chemicals produced when the photographic film coating is fully digested.

_____ [1]

(b) The table shows the time taken to fully digest the photographic film coating at different pH levels using two different enzymes.

pH	Time taken to fully digest photographic film coating/minutes	
	Enzyme A	Enzyme B
1	14	–
2	4	–
4	8	–
5	10	15
8	13	2
9	–	8
11	–	11
12	–	14

The graph shows the results for enzyme A.



(i) Complete the graph by plotting the results for enzyme B. [4]

(ii) Suggest **two** factors which must be controlled.

1. _____ [1]

2. _____ [1]

(iii) Calculate the difference in the time taken to digest the photographic film coating by enzyme A at pH 3 and pH 7.

Show your working.

Answer _____ [2]

(iv) Explain the shape of the graph for enzyme A.

_____

_____

_____ [2]

Examiner Only

Marks	Remark

(v) Suggest and explain which enzyme would be found in the human stomach.

_____

_____

_____ [2]

(vi) Describe and explain what would happen to the photographic film if the enzyme used was a lipase instead of a protease.

_____

_____

_____

_____

_____ [3]

Examiner Only	
Marks	Remark

7 **(a)** The diagram shows an embryo and its placenta.

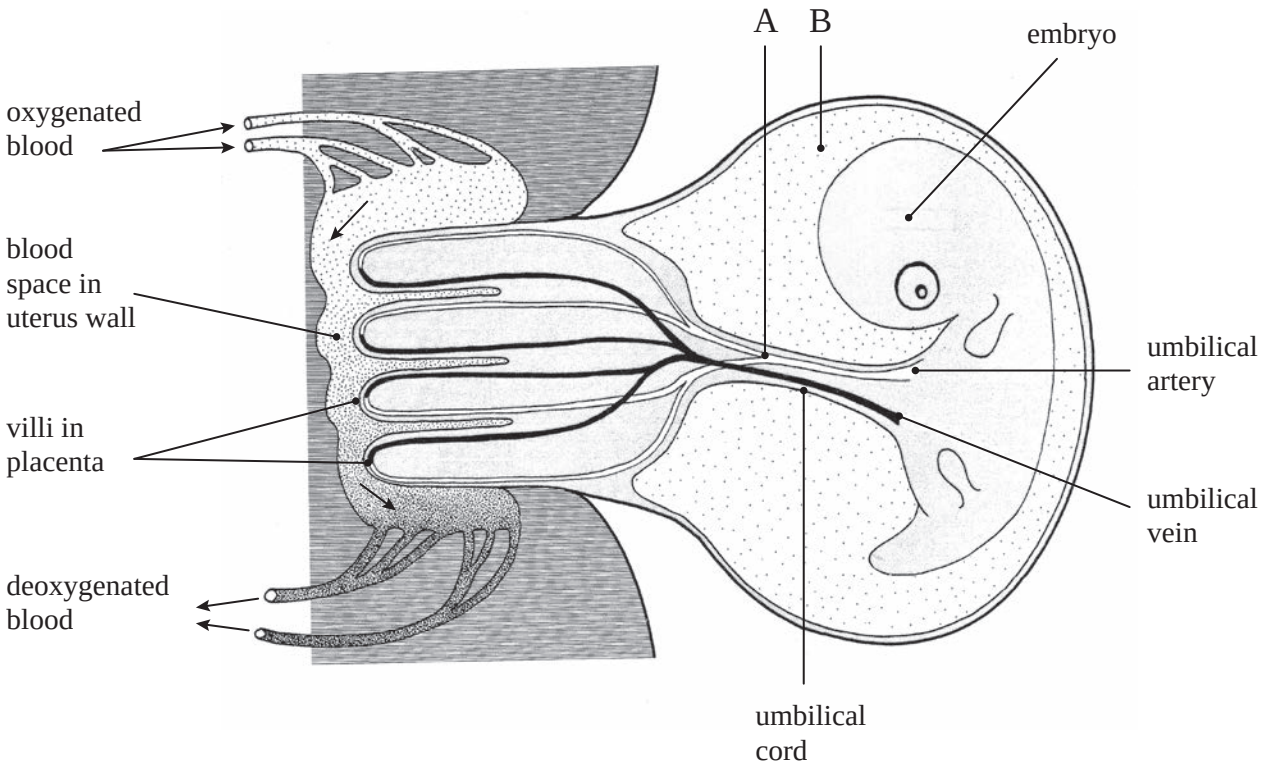


Diagram from Biology: a Modern Introduction by B S Beckett (OUP, 1976) copyright
© Oxford University Press 1976, reprinted by permission of Oxford University Press

(i) Name liquids A and B.

A _____ [1]

B _____ [1]

(ii) Describe how oxygen reaches the embryo from the mother.

_____

_____

_____ [2]

(iii) Name **two** waste substances which travel from the embryo to the mother.

1. _____ [1]

2. _____ [1]

(iv) Use the diagram to help describe **three** ways in which the villi are adapted to maximise exchange.

_____

_____

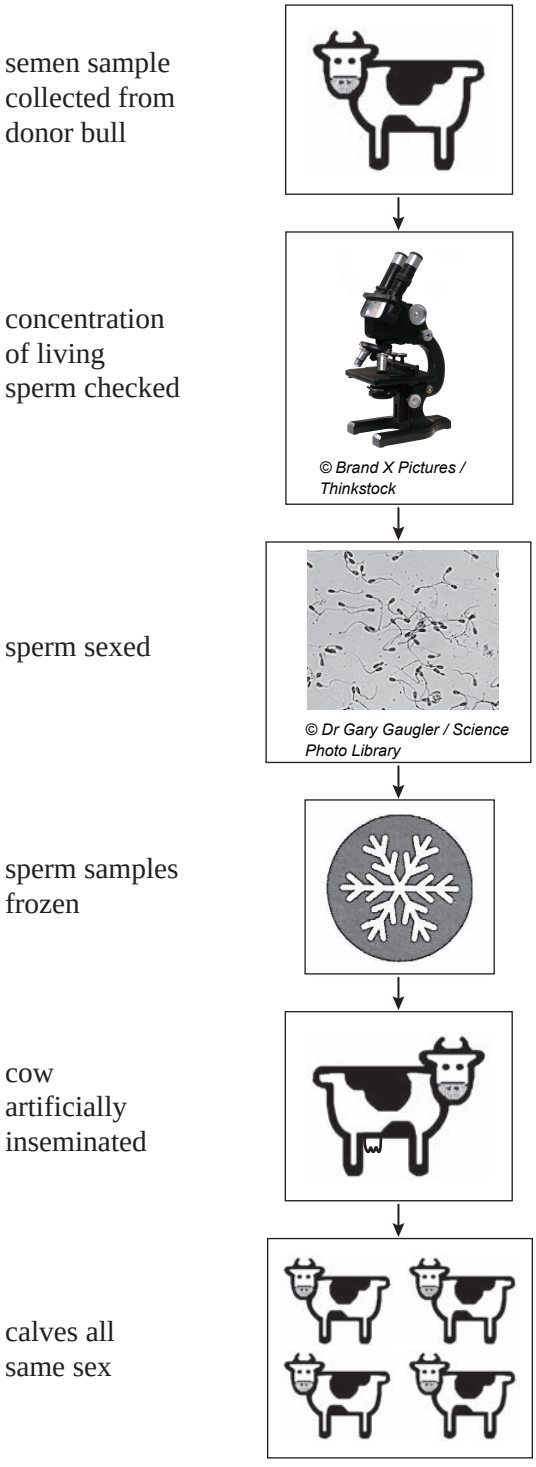
_____

_____

_____ [3]

Examiner Only	
Marks	Remark

(b) The diagram shows some of the steps involved in artificial insemination in agriculture.



Source: www.nhs.uk

After collection, the bull's semen is examined microscopically to check the concentration of the living sperm. The semen is then mixed with glucose and antibiotics before being placed in a small glass tube (straw) for freezing.

(i) Suggest why it is important that there is a high concentration of living sperm in the sample.

_____

_____ [1]

One advantage of artificial insemination is that the sperm can be sexed so that the gender of the embryos produced after fertilization can be chosen.

(ii) Explain why only sperm and not eggs, need to be sexed in order to determine the gender of the embryo.

_____

_____

_____ [2]

(iii) Suggest why it is important to farmers to be able to choose the sex of the calves.

_____

_____ [1]

(iv) Suggest why the semen is mixed with

glucose. _____

_____ [1]

antibiotics. _____

_____ [1]

Examiner Only

Marks	Remark

(v) Give **two** advantages of freezing semen.

1. _____

_____ [1]

2. _____

_____ [1]

Agricultural practices may also use embryo transfer and *in vitro* fertilization.

(vi) Explain what is meant by

embryo transfer. _____

_____ [1]

in vitro fertilization. _____

_____ [1]

Farmers with non-pedigree cows use embryo transfer rather than artificial insemination.

(vii) Suggest why these farmers choose embryo transfer rather than artificial insemination to improve the quality of their herd.

_____

_____

_____ [2]

(viii) Give **one** disadvantage of embryo transfer.

_____ [1]

Examiner Only	
Marks	Remark

8 (a) (i) What is a hormone and how is it transported?

_____

_____

_____ [2]

(ii) Complete the table to show information about two hormones.

Hormone	Stimulus for production	Produced by	Site of action
	Rise in blood sugar	Pancreas	
Adrenaline			Heart, muscles, bronchioles and skin

[2]

[2]

(iii) Describe and explain the response produced by adrenaline on the

heart. _____

_____

_____ [2]

muscles. _____

_____

_____ [2]

bronchioles. _____

_____

_____ [2]

Examiner Only

Marks	Remark

(iv) Suggest why a person often looks pale when adrenaline is released.

_____

_____ [1]

(v) Describe negative feedback in relation to the control of blood glucose levels.

_____

_____

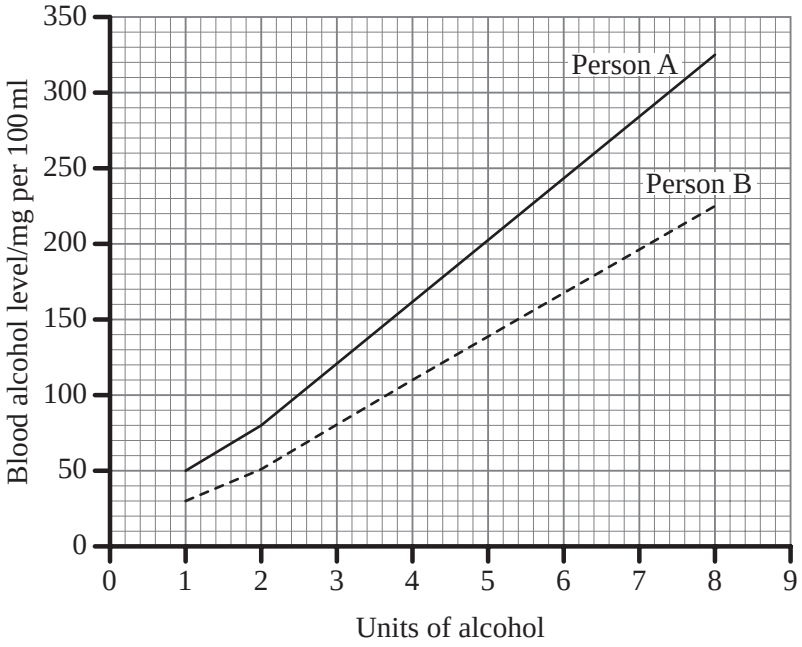
_____

_____

_____

_____ [3]

(b) The graph shows the average blood alcohol levels for two people.



Examiner Only

Marks	Remark

(i) Give **one** similarity and **one** difference between the blood alcohol levels of the two people.

Similarity. _____

_____ [1]

Difference. _____

_____ [1]

(ii) Suggest **two** reasons for the difference in the blood alcohol levels between the two people.

1. _____

_____ [1]

2. _____

_____ [1]

(iii) Give **two** harmful effects to a person if they drink excess alcohol.

_____

_____

_____ [2]

Examiner Only	
Marks	Remark

THIS IS THE END OF THE QUESTION PAPER