CCEA GCSE BIOLOGY (2003 SPECIFICATION)

BIOLOGY



EXAM QUESTION PACK

PAPER 2 HIGHER TIER G0904 PAPERS

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Rewarding Learning

Centre Number

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]

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

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Marks	Remark



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(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]

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(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. _____

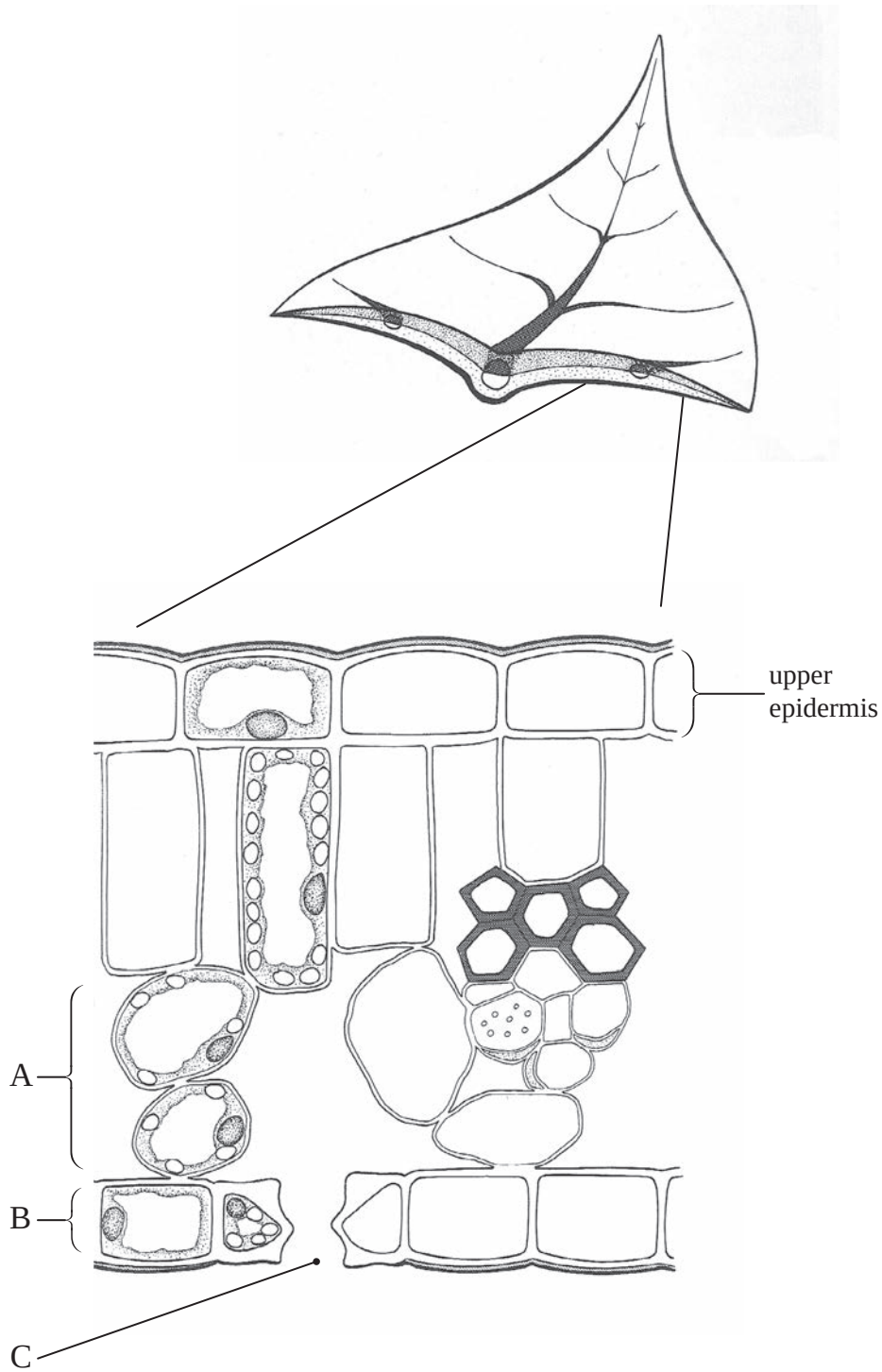
_____ [1]

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2 The diagram shows part of a leaf.



© Biology GCSE by G & M Jones, published by Cambridge University Press, 1984. ISBN 0521285321

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

A _____ [1]

B _____ [1]

C _____ [1]

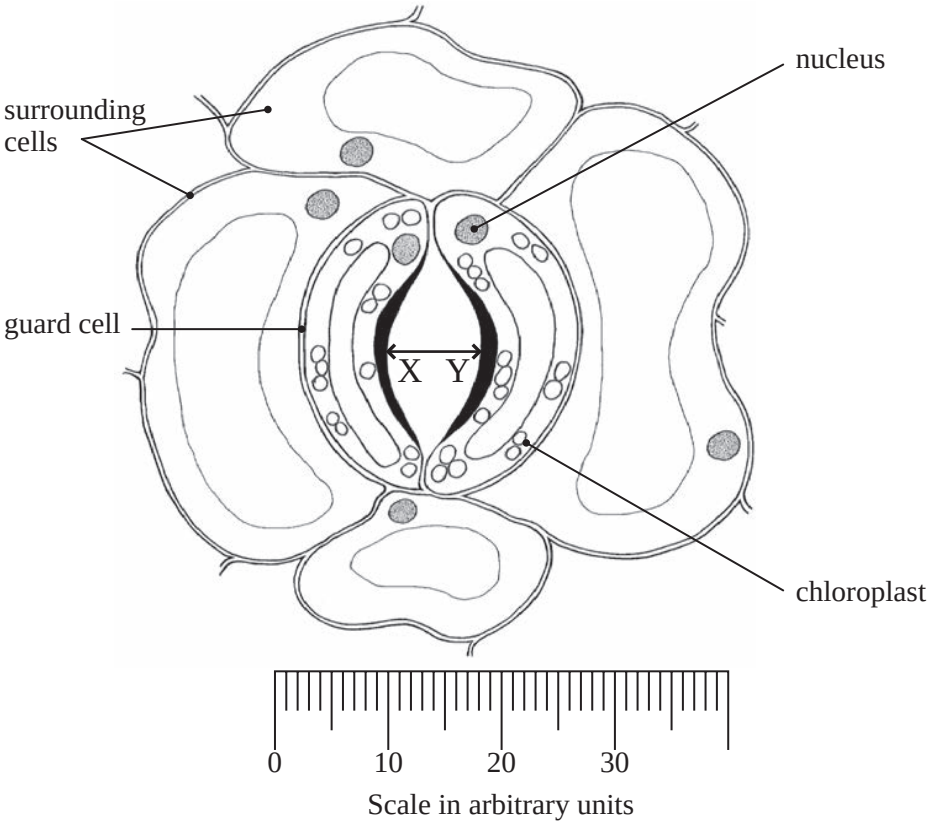
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(ii) Use the diagram to help complete the table.

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]

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

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(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.

_____

_____

_____

_____

_____

_____

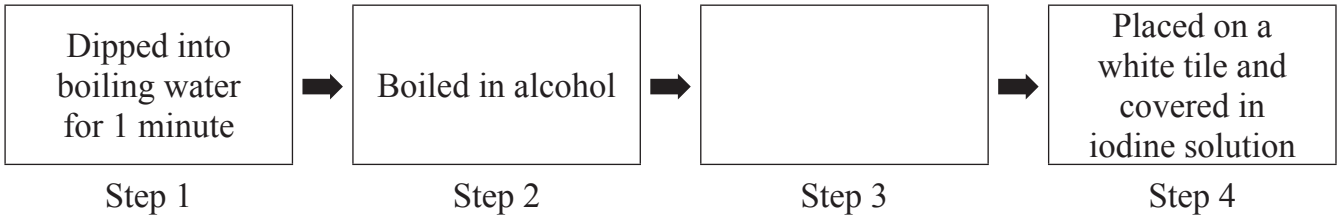
_____

_____ [3]

Quality of written communication [2]

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(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]

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Marks	Remark

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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]

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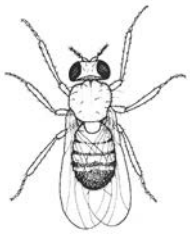
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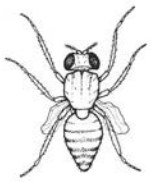
3 The diagram shows a genetic cross between two homozygous flies.

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]

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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.

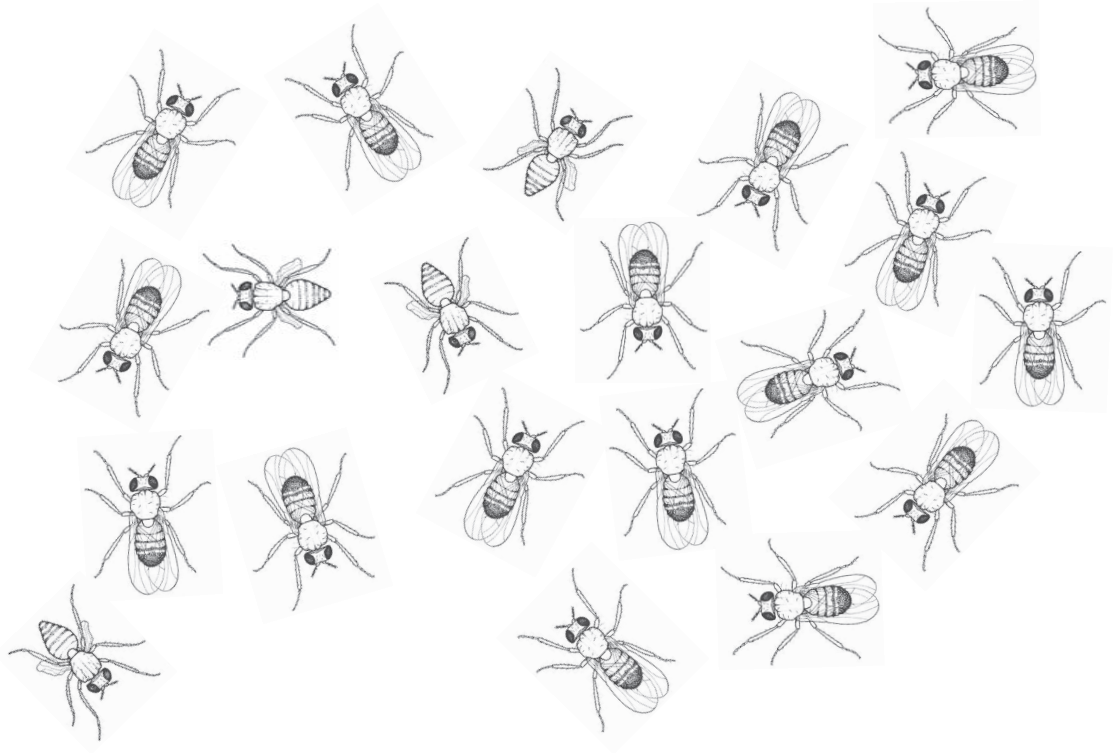
_____ [1]

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The diagram shows the actual flies produced by this mating.



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(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]

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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]

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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

(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.

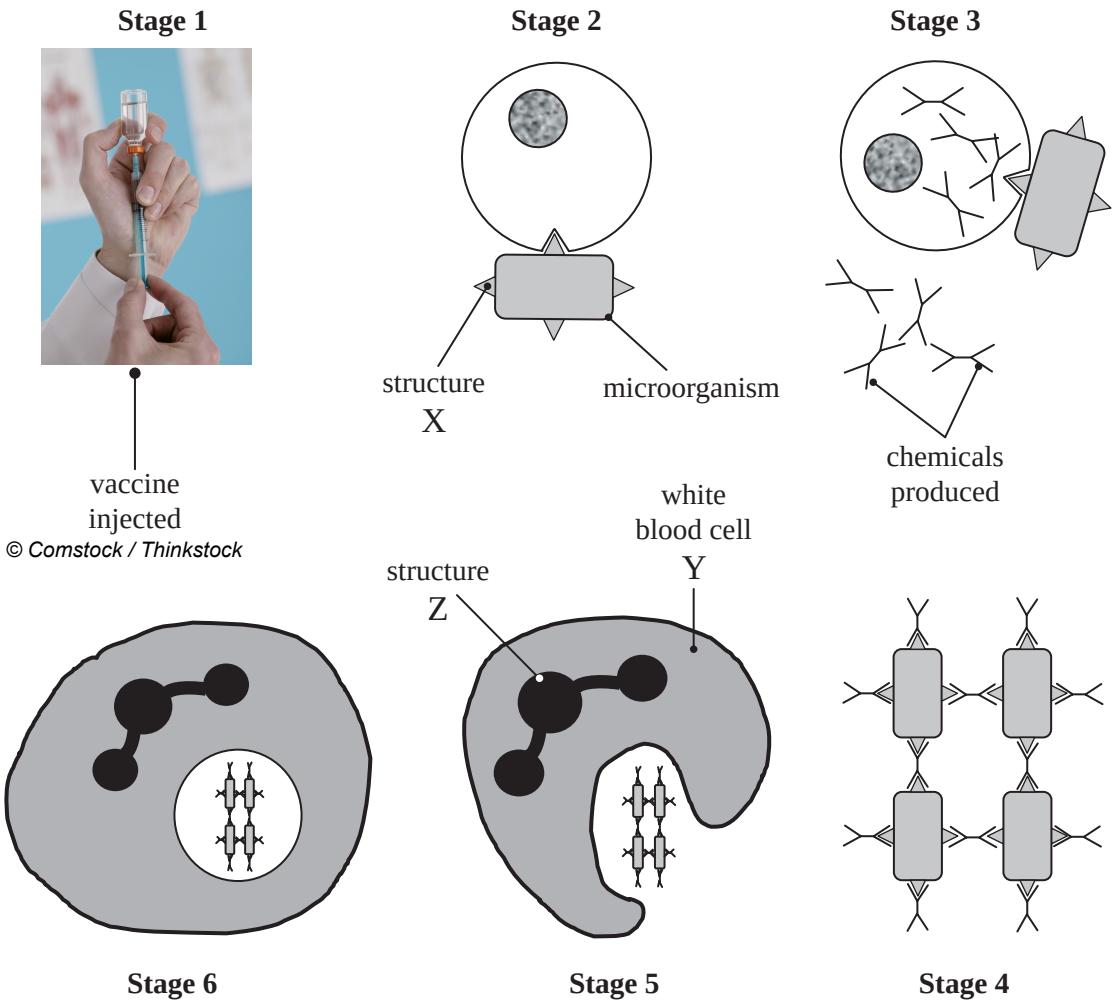
_____

_____

_____ [2]

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(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]

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Marks	Remark

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(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]

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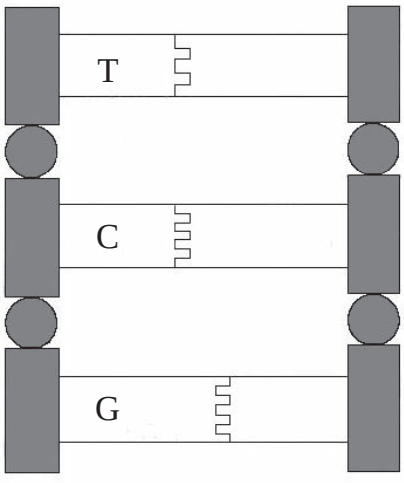
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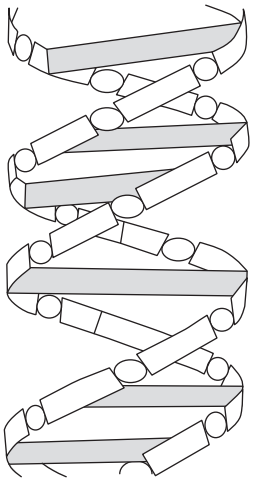
5 The diagrams show two models of a DNA molecule.

Examiner Only	
Marks	Remark

Model A



Model B



© Biology by A Cadogan and N Green, published by Heinemann Educational, 1985. ISBN 0435590898.
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(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.

_____

_____

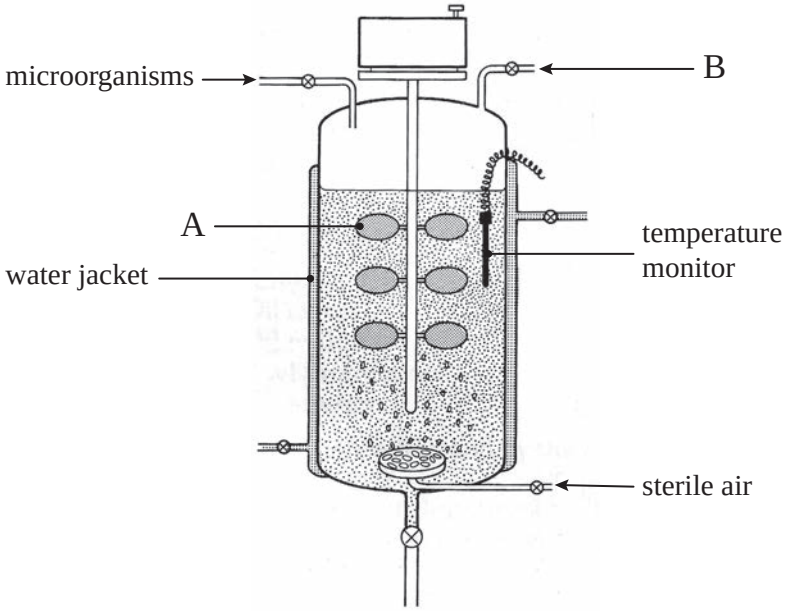
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_____

_____ [3]

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



© Biology in Focus: micro-organisms in action by P W Freeland, published by Hodder & Stoughton, 1991, "Reproduced by permission of Hodder Education".

(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.

_____

_____

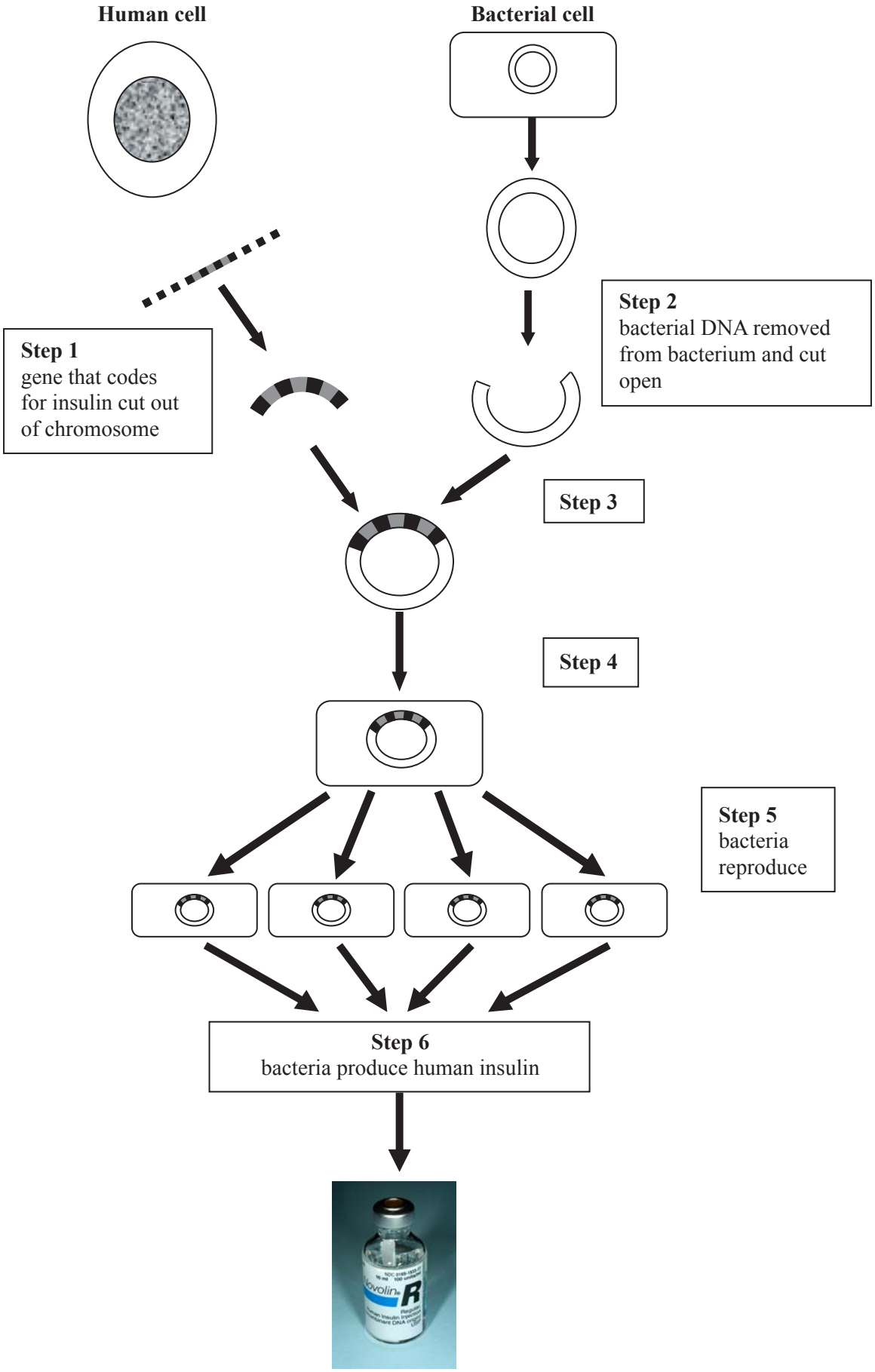
_____ [2]

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



© Scott Camazine / Science Photo Library

(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]

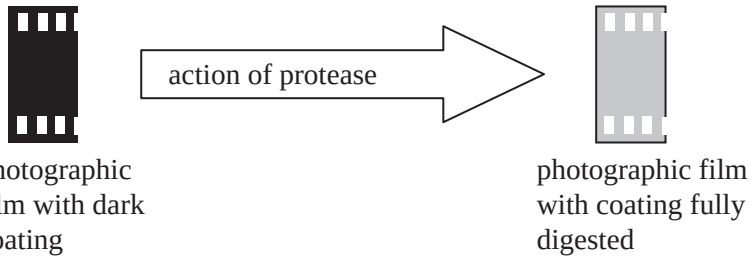
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Marks	Remark

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.

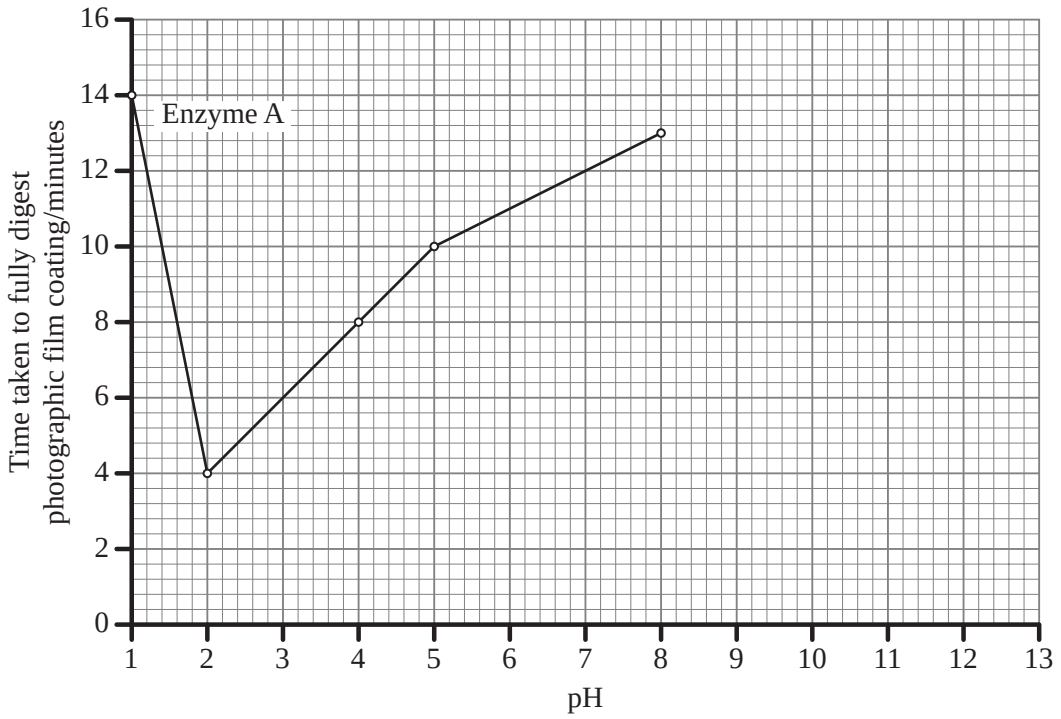
_____ [1]

(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

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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]

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(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]

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

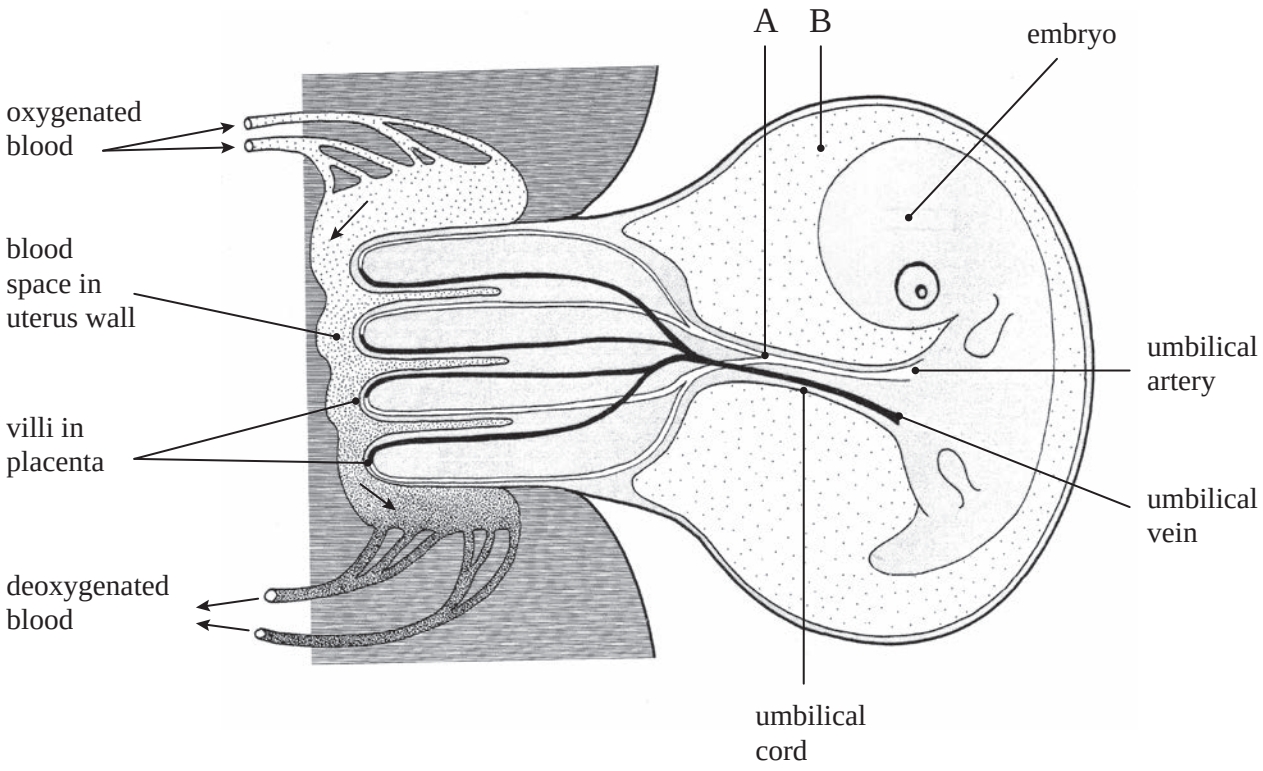


Diagram from Biology: a Modern Introduction by B S Beckett (OUP, 1976) copyright © Oxford University Press 1976, reprinted by permission of Oxford University Press

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(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.

_____

_____

_____

_____

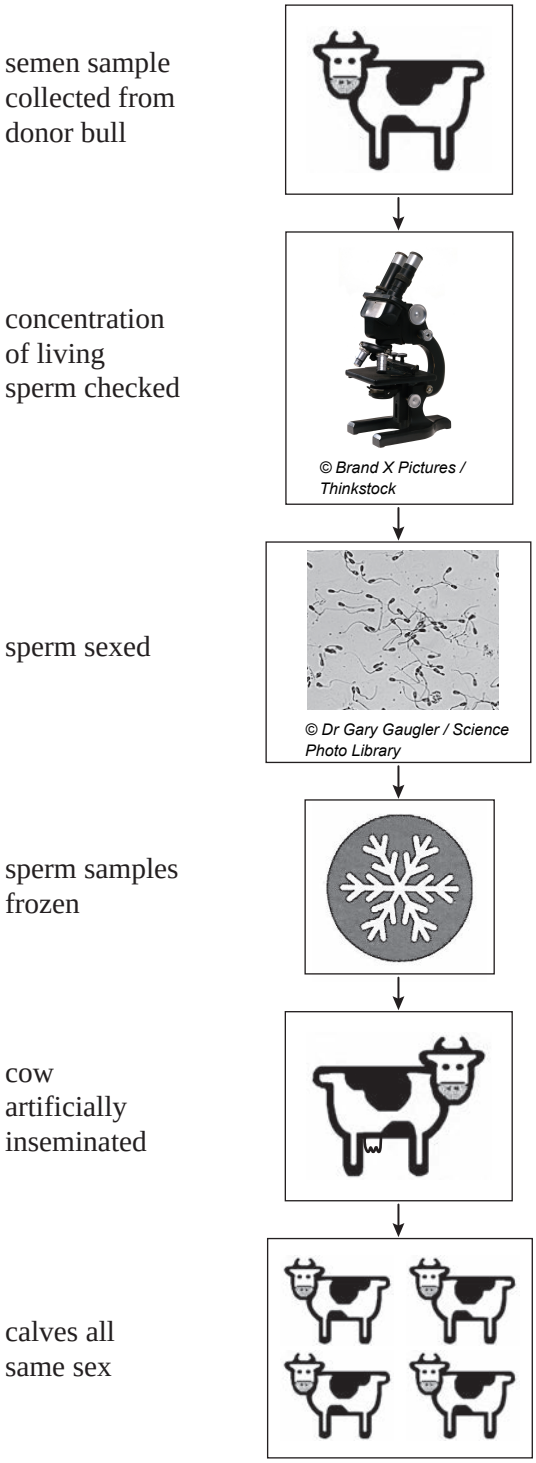
_____ [3]

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Marks	Remark

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(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]

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Marks	Remark

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(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]

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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]

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(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.

_____

_____

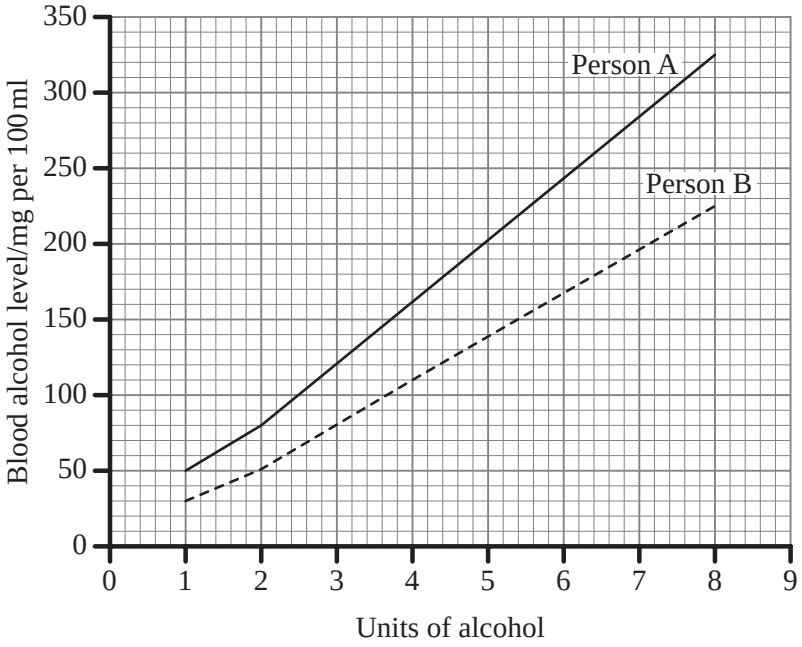
_____

_____

_____

_____ [3]

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



© GCSE Biology for CCEA by R McIlwaine & J Napier, published by Hodder & Stoughton, 2003. ISBN 0340858257 "Reproduced by permission of Hodder Education".

(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]

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2012

Science: Biology

Paper 2
Higher Tier

[G0904]

WEDNESDAY 20 JUNE, MORNING

MARK SCHEME

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					AVAILABLE MARKS
1	(a)	(i)	Coal/oil;	[1]	
		(ii)	Any **two** from: CO/CO_2; SO_2/SO_X; NO_2/NO_X;	[2]	
		(iii)	Soot covers leaves/blocks stomata; (Must affect **outside** of leaf)	[1]	
		(iv)	Less light enters leaf/trapped by chlorophyll/ Less gas exchange; Less photosynthesis;	[1] [1]	
		(v)	Any **two** from: Renewable sources of energy; Scrubbers in factory chimneys; Catalytic converters; Increased use of public transport/example described; Increased insulation; Burn less fossil fuels; Use unleaded petrol;	[2]	
	(b)	(i)	Landfill;	[1]	
		(ii)	Any **two** from: Smell; Unsightly; Disease; Attracts unwanted birds/gulls/animals/rodents/foxes; Leaching of toxins to ground/water; Needs **large area** of land/damages habitats/needs long time;	[2]	
		(iii)	Incineration/burning/composting/recycling;	[1]	
	(c)	(i)	Knock;	[1]	
		(ii)	Red squirrels decreasing; Grey squirrels increasing; (**Reject** a description of numerical values)	[2]	
		(iii)	Any **three** from: Grey squirrels – Eat wider range of food; Outcompete them for habitats; Higher reproduction rate; Resistant to/carrier of virus (parapox);	[3]	18

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2 **(a)** **(i)** A – **Spongy mesophyll**;
B – **Lower** epidermis;
C – Stoma(ta); [3]

(ii) Allows (maximum amount of) light into leaf/cells/mesophyll/chloroplasts;
Thin (leaf);
Large **surface area** (for light absorption); [3]

(iii) 8 (arbitrary units); [1]

(iv) Any **two** from:
Thickened **inner** walls;
Chloroplasts present;
Smaller vacuole;
No cuticle; [2]

(v) Any **three** from:
Carbon dioxide ; / By diffusion; / Through stomata; **or** Water / From xylem; / By osmosis;
Into mesophyll cell/chloroplast/air space/vacuole/any appropriate named structure; [3]

Quality of written communication [2]

(b) **(i)** Kill the leaf/break down cuticle/cells to allow chemicals to enter;
Remove chlorophyll/green colour/decolorise leaf; [2]

(ii) Any **one** from:
Turn off Bunsen/no naked flames;
Wear goggles; [1]

(iii) Dip(ped) in water; [1]

(iv) Starch;
Yellow-brown to blue-black; [2]

(v) Starch all used (up)/not present;
By respiration; [2]

AVAILABLE MARKS

22

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AVAILABLE MARKS

3 **(a)** **(i)** nn;
Normal wing; [2]

(ii) Wings can't be used/can't fly;
to get food/find mate/escape (predators); [2]

(iii) Length of DNA/chromosome;
In nucleus; [2]

(b) **(i)** NN, Nn;
Nn, nn; [2]

(ii) 3:1; [1]

(iii) 16, 4; [1]

(iv) 4:1; [1]

(v) Any **one** from:
Random process;
Large numbers required/small numbers produced in this case; [1]

(c) **(i)** Males: Testosterone;
Females: Oestrogen; [2]

(ii)

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

[4]

18

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					AVAILABLE MARKS
4	(a)	(i)	Bacterium;	[1]	
		(ii)	Prevents bacteria/microorganisms reproducing;	[1]	
		(iii)	Temperature does not get high enough; Microorganisms not killed/can grow/can reproduce;	[2]	
		(iv)	Microorganisms can only reproduce **slowly** at 4º C;	[1]	
		(v)	Any **two** from: Wash hands/utensils before handling food; Keep raw and cooked food apart; Allow cooked food to cool before refrigerating; Ensure reheated food reaches a high temperature; Cover food; Obey use by dates; Avoid hand to mouth actions/described;	[2]	
	(b)	(i)	So person does not catch the disease/microorganism/bacterium;	[1]	
		(ii)	Antigen;	[1]	
		(iii)	White blood cell (lymphocyte) recognises antigen/structure X;	[1]	
		(iv)	Phagocyte;	[1]	
		(v)	Nucleus;	[1]	
		(vi)	Any **three** from: Antibodies;	[1]	
			Attach to/clump microorganisms; Prevent microorganisms reproducing/spreading; Makes easier target for phagocyte;	[2]	
		(vii)	Stage 5 – White blood cell (phagocyte) **engulfs** the microorganisms; Stage 6 – White blood cell (phagocyte) **digests** microorganisms;	[2]	
		(viii)	Antibiotic;	[1]	18

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					AVAILABLE MARKS
5	**(a)**	**(i)**	A, G, C; ([–1] for each wrong up to maximum [–2])	[2]	
		(ii)	X-ray crystallography/diffraction;	[1]	
		(iii)	Crick and Watson;	[1]	
		(iv)	Double helix;	[1]	
		(v)	Genes/bases; Codes for; amino acids;	[3]	
	(b)	**(i)**	A – Stirrer;	[1]	
		(ii)	Nutrients;	[1]	
		(iii)	To maintain (optimum) temperature/prevent high temperatures; Could cause death/denaturing of genetically engineered bacterium;	[2]	
		(iv)	Any **two** from: pH; O_2 (concentration); CO_2 (concentration); Amount/concentration of nutrient/sugar/glucose;	[2]	
	(c)	**(i)**	Enzyme used;	[1]	
		(ii)	Step 3 – Human **insulin gene** inserted into bacterial **chromosome/plasmid**; Step 4 – Bacterial **chromosome/plasmid** placed into **bacterium**;	[2]	
		(iii)	Divides/reproduces/clones; Produces (genetically) **identical** copy;	[2]	
		(iv)	Any **two** from: Extracted/separated from bacterial culture; Purified/concentrated; Packaged/sterilized;	[2]	
		(v)	Any **one** from: Animal insulin not the same/does not work as well; Concentration not known; Allergic response/side effects; No ethical issue with use of animal material/described; Get larger quantities produced;	[1]	22

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					AVAILABLE MARKS
6	(a)	(i)	(Biological) catalyst; Digests protein;	[2]	
		(ii)	Amino acids;	[1]	
	(b)	(i)	Accurate plots (×2); Line drawn; Line labelled;	[4]	
		(ii)	Any **two** from: Size/surface area/of film; Temperature; Type of film/thickness of coating; **Volume**/**concentration** of protease;	[2]	
		(iii)	6; minutes;	[2]	
		(iv)	Correct reference to **rate of reaction**/**digestion**; Optimum at pH2;	[2]	
		(v)	Enzyme A; Optimum at acid pH (as in stomach);	[2]	
		(vi)	Film coating not clear/not digested; Enzymes are specific; Lipase would not react with protein substrate/only reacts with lipids/fats;	[3]	18

					AVAILABLE MARKS
7	**(a)**	**(i)**	A – Blood; B – Amniotic fluid;	[2]	
		(ii)	Any **two** from: Carried in the umbilical vein; Diffuses; Across placenta/villi;	[2]	
		(iii)	Carbon dioxide; Urea;	[2]	
		(iv)	Large surface area; Thin (membrane)/short diffusion distance/capillaries **close** to surface; Good blood supply/maintains concentration (diffusion) gradient;	[3]	
	(b)	**(i)**	To **increase the chance** of a sperm reaching/fertilizing the egg;	[1]	
		(ii)	Sperm carry X **or** Y chromosome; Eggs carry **only** X chromosome;	[2]	
		(iii)	Dairy farmers prefer female calves/beef farmers prefer male calves;	[1]	
		(iv)	Glucose – provides energy (food) for sperm; Antibiotics – kill pathogens which could damage sperm/embryo/ infect cow;	[2]	
		(v)	Can be used after bull is dead/appropriate time reference; Easily transported;	[2]	
		(vi)	Embryo transfer – Placing embryos into host/another female (cow); IVF – Fertilization in (glass) dish/outside female's body;	[2]	
		(vii)	Pedigree embryo has qualities of pedigree mother and father; Qualities of non-pedigree mother are not transferred to embryo;	[2]	
		(viii)	More expensive/more skilled;	[1]	22

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					AVAILABLE MARKS
8	(a)	(i)	**Chemical** messenger; Transported **in the blood**;	[2]	
		(ii)	Insulin; [1] Liver; [1] Fight/fright/stress; [1] Adrenal gland; [1]	[4]	
		(iii)	**Heart** – **Increased** heart rate; Increased blood flow (to muscles); **Muscles** – More oxygen/glucose; **More** respiration; **Bronchioles** – Dilate; More O_2 **absorbed**/CO_2 **released**/**gas exchange**;	[6]	
		(iv)	Blood is diverted away from skin/to other organs;	[1]	
		(v)	Blood glucose level **monitored by pancreas**; **Correct reference to** insulin production; Brings blood glucose level back/return to **normal**;	[3]	
	(b)	(i)	Similarity – Both increase/rise; Difference – Gradients differ/A steeper than B/A always above B/higher than B;	[2]	
		(ii)	Any **two** from: Different masses/blood volume; Gender; B more alcohol tolerance/more used to heavy drinking/good liver function; Amount of food in stomach; Duration of drinking;	[2]	
		(iii)	Any **two** from: Impaired judgement/described/Increased risk of accidents; Increased risk of cancer/liver disease (cirrhosis)/other appropriate health issues; Social effects;	[2]	22
				Total	**160**

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Rewarding Learning

Centre Number

71	

Candidate Number

General Certificate of Secondary Education
2011

Science: Biology

Paper 2
Higher Tier

G0904

[G0904]

THURSDAY 2 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.

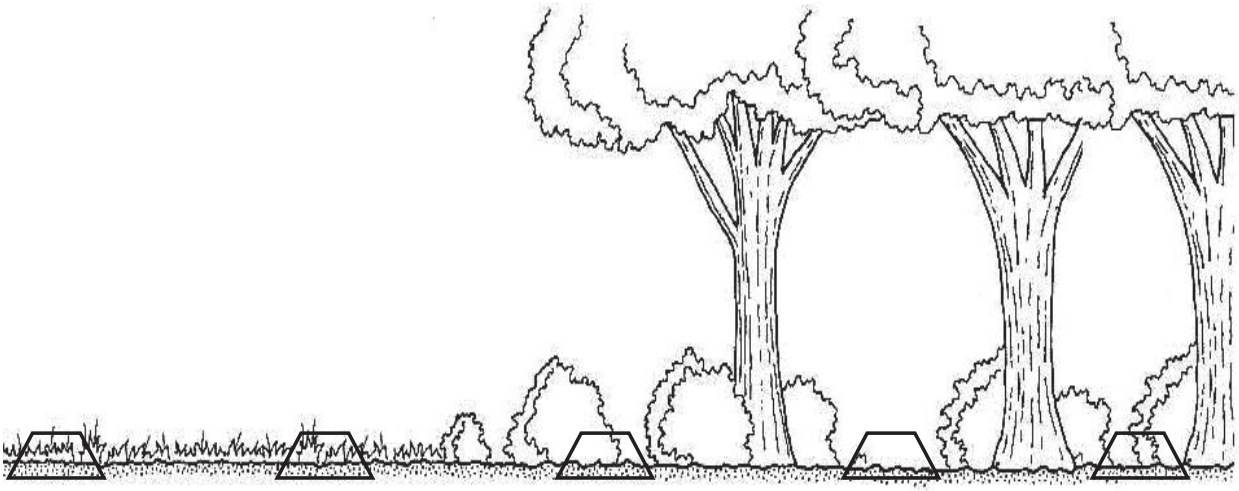
INFORMATION FOR CANDIDATES

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

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1 **(a)** The diagram shows where light measurements and samples were taken in a habitat study.



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Examiner Only	
Marks	Remark

The table shows the number of plant species in each sample area.

Sample area	1	2	3	4	5
Number of plant species	12	11	7	4	3

(i) Suggest why the number of plant species decreases from sample area 1 to sample area 5.

_____

_____ [1]

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Marks	Remark

(ii) Explain how light is used by plants.

_____

_____

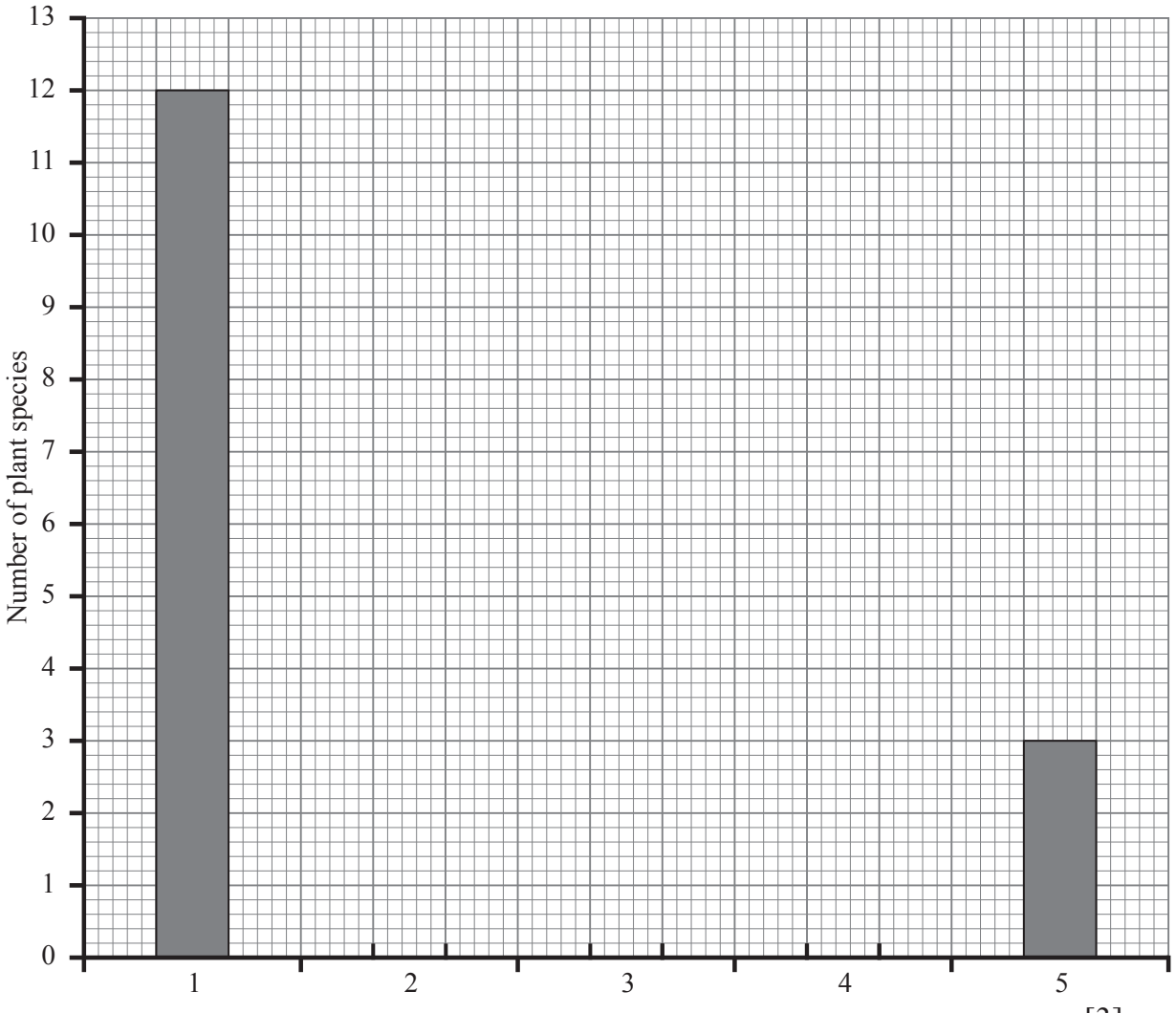
_____ [2]

(iii) Give **two other** environmental factors which could affect the plants found.

1. _____ [1]

2. _____ [1]

(iv) Use the results table to label the axis of the graph and complete the bar graph.



[3]

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Marks	Remark

(b) The diagram shows a sample of the animals collected during the habitat study.



A – © iStockphoto / Thinkstock
B – © iStockphoto / Thinkstock
C – © Brand X Pictures / Thinkstock
D – © iStockphoto / Thinkstock
E – © Hemera / Thinkstock

(i) Give the letters of the animals which are insects.

_____ [1]

(ii) Give **two** features of insects **not visible** in the diagram.

1. _____ [1]

2. _____ [1]

(iii) To which group do insects belong?

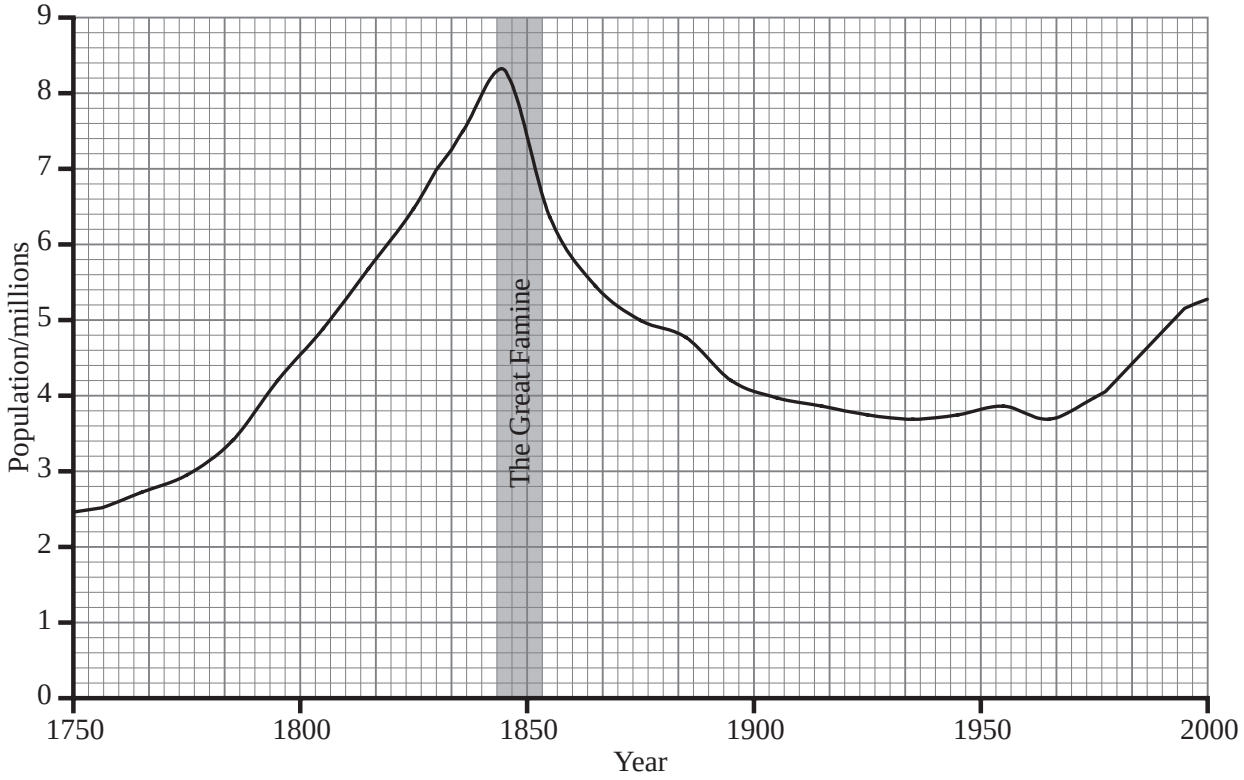
_____ [1]

(iv) Give **one** feature **visible** in the diagram, which adapts all these animals for life on land.

_____ [1]

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(c) The graph shows changes in the population of Ireland between 1750 and 2000.



© Dr Wesley Johnston

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Marks	Remark

(i) Explain, in terms of birth rate and death rate, the population change during the Great Famine.

_____

_____

_____ [2]

After the Great Famine, the population decreased mainly due to emigration.

(ii) What is emigration?

_____

_____ [1]

(iii) Suggest **two** reasons why the population started to increase after 1960.

1. _____ [1]

2. _____ [1]

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2 (a) (i) Complete the table on organ systems.

Organ system	Function
Skeletal	
	Breaks down food for absorption
Circulatory	
	Controls and co-ordinates body functions

[1]

[1]

[1]

[1]

(ii) What is meant by an organ system?

_____

_____ [1]

The main function of the respiratory system is gas exchange.

(iii) Suggest why it is an advantage to take air in through the nose rather than the mouth.

_____

_____

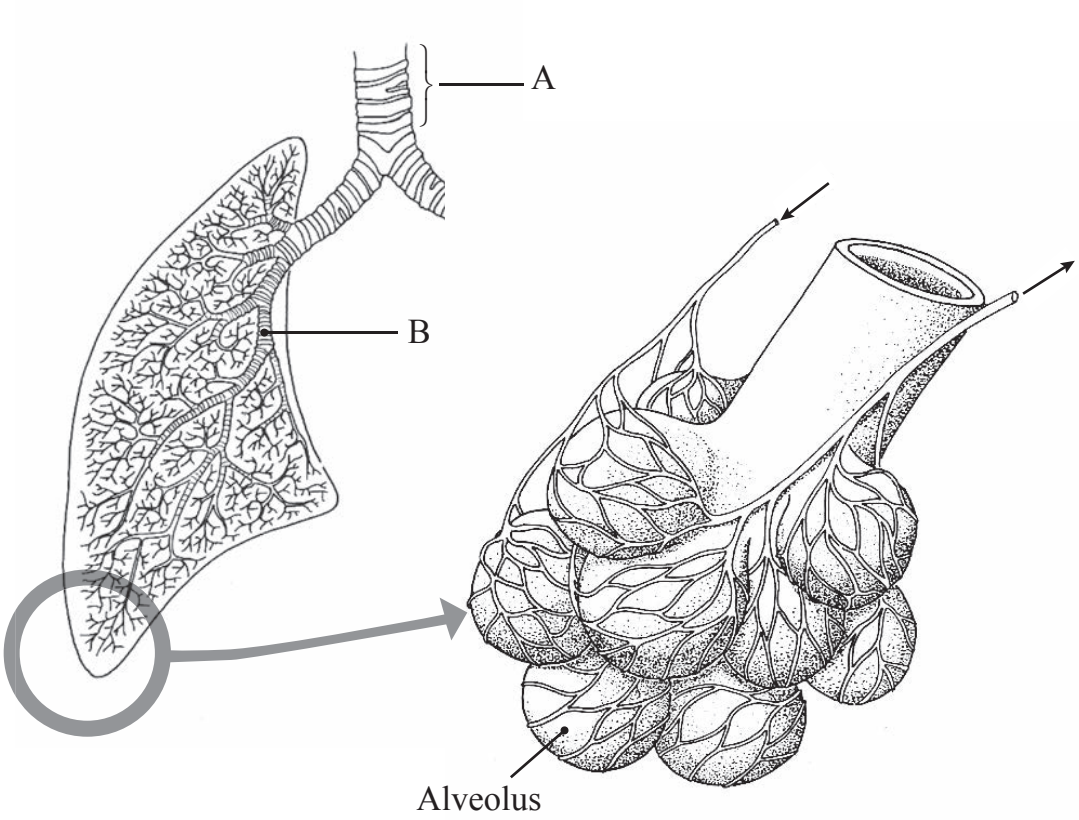
_____

_____ [2]

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Marks	Remark

(b) The diagrams show part of the human respiratory system.



© *Introduction to Biology by D G Mackean, published by John Murray, 1978, ISBN 0719534496*

(i) Name parts A and B.

A _____ [1]

B _____ [1]

(ii) Describe how an alveolus is adapted for gas exchange.

_____

_____

_____

_____

_____

_____

_____

_____ [3]

Quality of written communication [2]

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Marks	Remark

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(c) Use this passage about smoking cigarettes, to help answer the question.

Examiner Only	
Marks	Remark

In the UK about 120,000 people per year die of smoking-related diseases. 82% of all deaths from lung cancer, 83% of all deaths from bronchitis and emphysema and about 25% of all deaths from heart disease are linked to smoking.
People who smoke between 1 and 14 cigarettes a day have 8 times the risk of dying from lung cancer compared to non-smokers. The risk increases the more cigarettes are smoked; those who smoke over 25 cigarettes a day have 25 times this risk.
Many smokers would like to quit. Ten years after stopping smoking the risk of getting lung cancer has fallen to half that of a smoker and the risk of having a heart attack is the same as never having smoked.

(i) How many people die of smoking-related diseases each year?

_____ [1]

(ii) Complete the table. (Lines 2–4)

Cause of death	Percentage linked to smoking	
Bronchitis and emphysema		[1]
	25	[1]
		[1]

(iii) Describe the difference in the risk of smoking 10 cigarettes per day compared to 30 cigarettes per day. (Lines 5–8)

_____

_____

_____ [2]

(iv) Which chemical in cigarette smoke can cause lung cancer?

_____ [1]

(v) Suggest why people who smoke cigarettes find it hard to stop.

_____ [1]

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Examiner Only	
Marks	Remark

3 **(a)** Complete the table on cell structure by placing a ✓ or an ✗ in the boxes.

✓ = present ✗ = absent

Cell structure	Plant cell	Animal cell
Cell wall	✓	
Cytoplasm		
Chloroplast		
Vacuole		✗

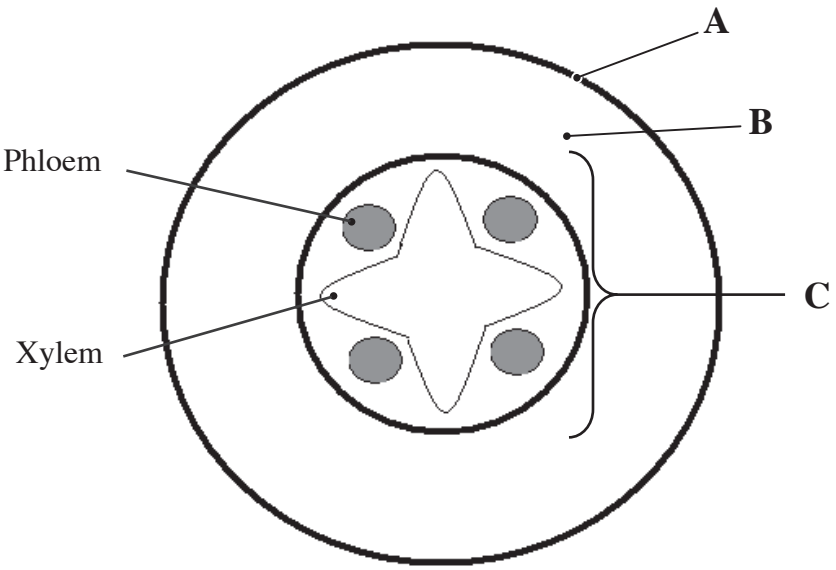
[1]

[1]

[1]

[1]

(b) The diagram shows a section through a plant root.



(i) Name parts A, B and C.

A _____ [1]

B _____ [1]

C _____ [1]

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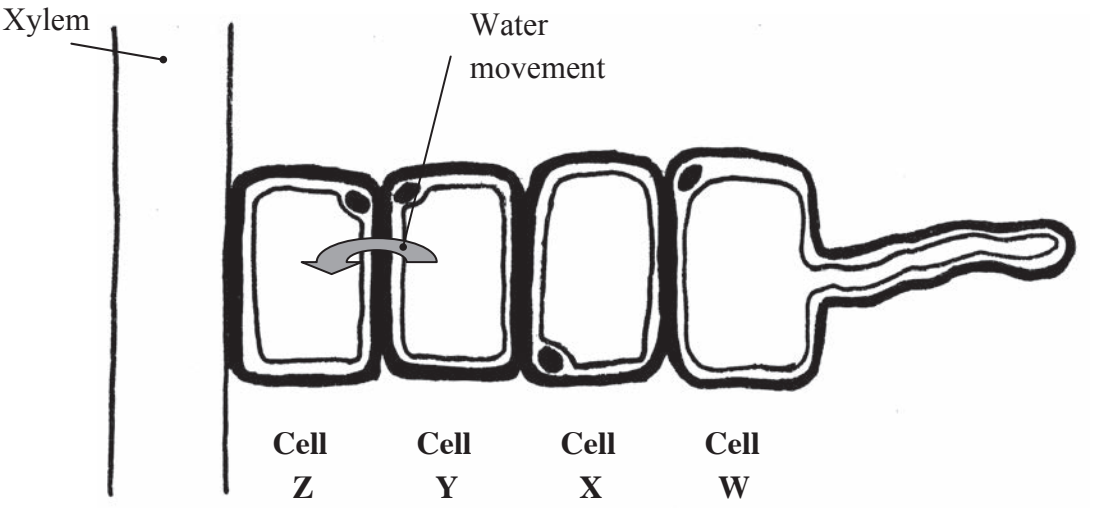
Examiner Only	
Marks	Remark

(ii) Describe the function of phloem.

_____

_____ [2]

The diagram shows an enlarged section through part of the plant root.



(iii) On the diagram draw an arrow to show the direction water moves in the xylem. [1]

(iv) Give the name of this movement of water in the xylem.

_____ [1]

(v) Name the process by which water diffuses from cell Y to cell Z.

_____ [1]

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(vi) Draw cell X enlarged three times.

[3]

(vii) Name cell W and describe how it is adapted for its function.

_____

_____

_____

_____

_____[3]

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Marks	Remark

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Examiner Only	
Marks	Remark

4 **(a)** The table shows the information given on a box of wholegrain breakfast cereal.

	Amount per 100 g
Energy/kJ	1520
Protein/g	9.5
Carbohydrate/g	70.9
Fat/g	5.3
Fibre/g	9.4
Salt/g	0.18
Iron/mg	11.9

(i) Calculate the amount of energy in a 40g serving of this breakfast cereal.
Show your working.

_____ kJ [2]

(ii) Use the table to name the food group which

can be an immediate source of energy for the body.

_____[1]

is made up of long chains of amino acids.

_____[1]

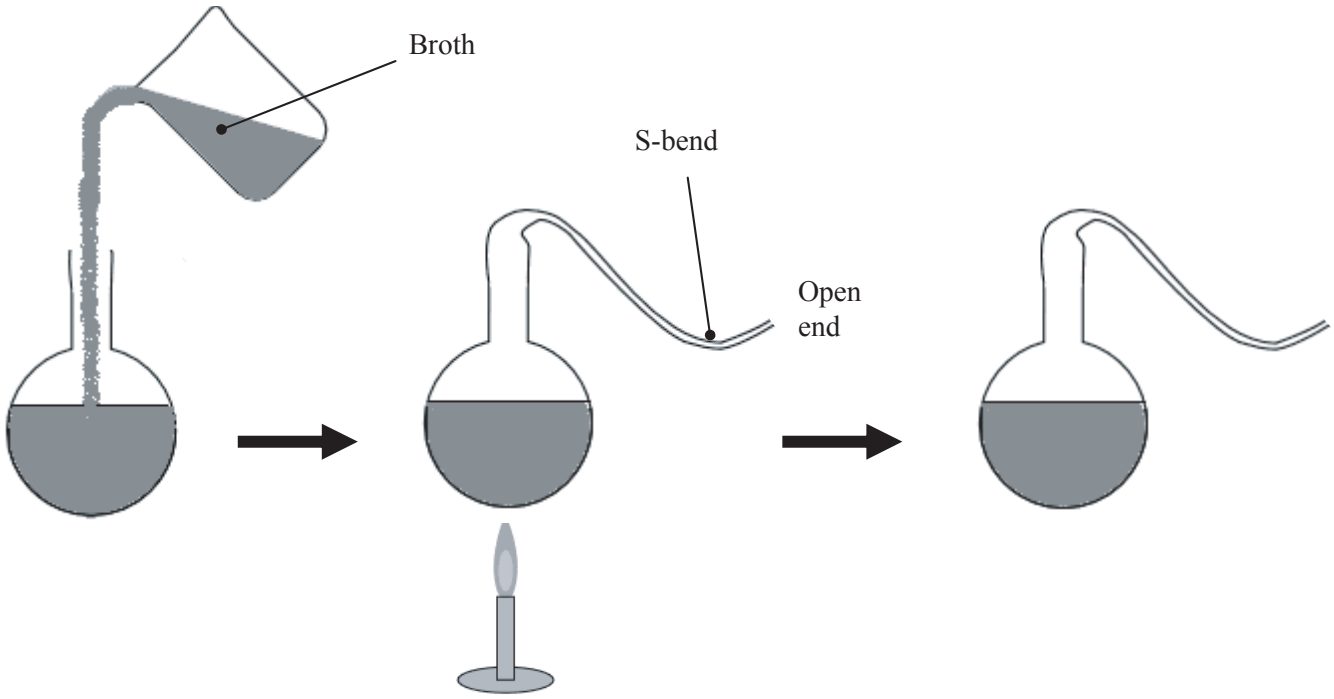
(iii) Explain why children need more protein in their diet than an adult.

_____

_____[1]

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(b) The diagrams show an experiment carried out by Louis Pasteur.



Examiner Only	
Marks	Remark

(i) Explain what is meant by spontaneous generation.

_____

_____

_____[2]

In step 2, Pasteur drew the neck of the flask into a long S-shape leaving it open at the end.

(ii) Explain the purpose of the

S-bend. _____

_____ [1]

open end. _____

_____[1]

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(iii) What would be a suitable control for this experiment?

_____

_____[1]

(iv) Explain why a bottle of milk remains fresh for longer when it is kept in the fridge.

_____

_____

_____[2]

(c) The photograph shows a compost bin.



© iStockphoto / Thinkstock

(i) Suggest a reason for the holes in the sides.

_____

_____[1]

(ii) Give **two other** conditions needed for decomposition.

1. _____[1]

2. _____[1]

Examiner Only

Marks	Remark

(iii) Suggest **two** items of kitchen waste which could be composted.

1. _____[1]

2. _____[1]

(iv) Name one invertebrate detritus feeder, which may be found in a compost bin.

_____ [1]

Examiner Only	
Marks	Remark

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Examiner Only	
Marks	Remark

5 **(a)** Complete the table of diseases caused by microorganisms.

Disease	Type of organism	Method of transfer	Prevention or cure
	H I Virus	Sexual intercourse	
Rubella		Droplet infection	Vaccination
	Bacteria		Cooking food to a high temperature

[5]

(b) **(i)** Name the antibiotic discovered by Alexander Fleming.

_____ [1]

(ii) Describe how he discovered the antibiotic.

_____

_____

_____

_____

_____ [2]

(c) Give **three** ways the body prevents microorganisms from entering.

1. _____ [1]

2. _____ [1]

3. _____ [1]

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(d) The vaccine for Rubella contains an inactivated form of the microorganisms which cause the disease.

Examiner Only	
Marks	Remark

(i) Explain what happens when inactivated Rubella microorganisms are injected into the bloodstream.

_____

_____

_____

_____ [2]

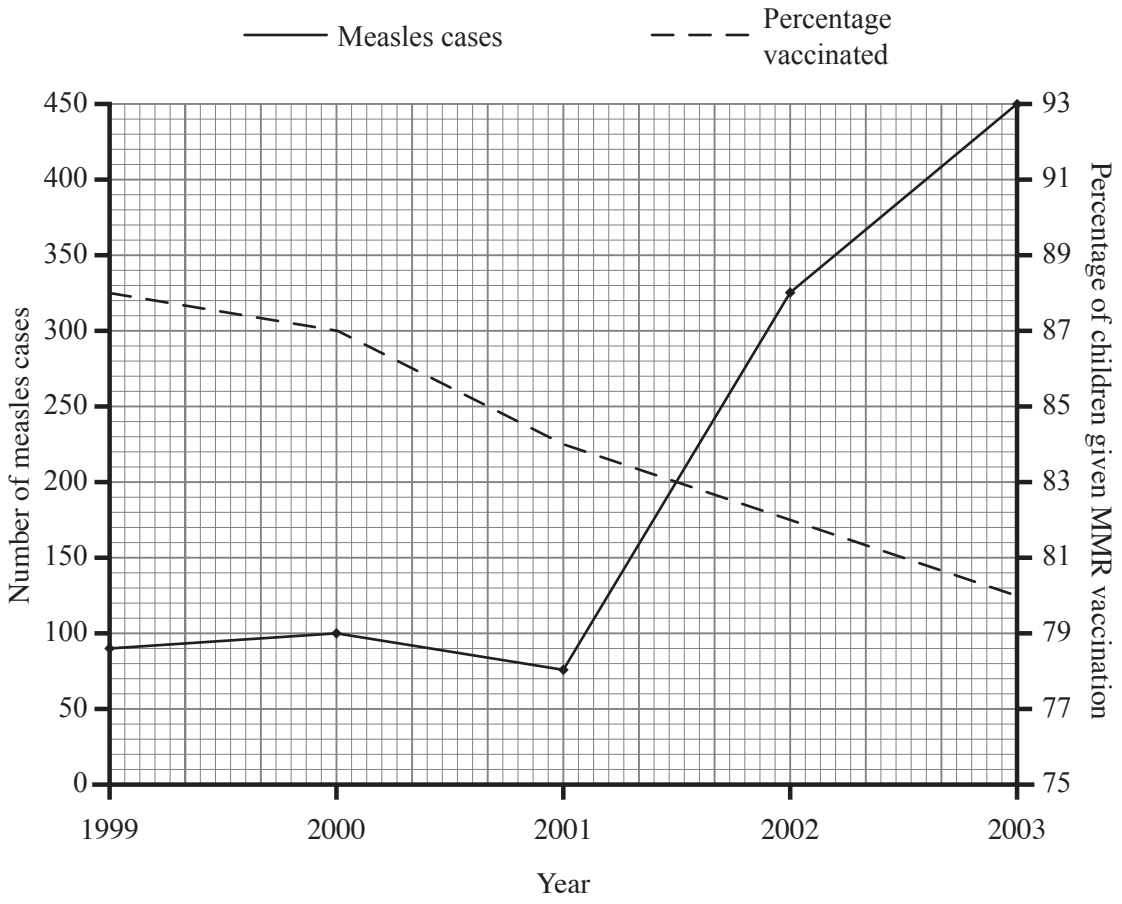
(ii) Explain why it is important to give women the Rubella vaccine before they become pregnant.

_____

_____ [1]

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Rubella vaccine is usually given in combination with vaccines for measles and mumps, known as the MMR vaccine.
The graph shows changes in the percentage of children given the MMR vaccination and the numbers of measles cases in the UK between 1999 and 2003.



(e) (i) What percentage of children were given the MMR vaccination in 2001?

_____ [1]

(ii) Calculate the percentage increase in measles cases between 2001 and 2003.
Show your working.

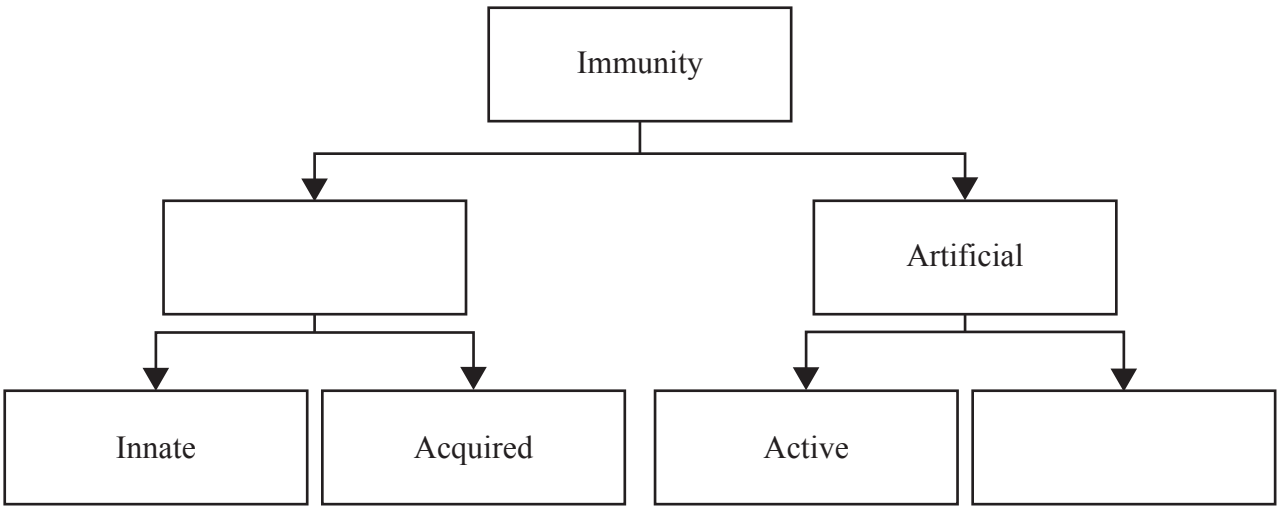
Answer _____ [2]

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Marks	Remark

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(f) (i) Complete the diagram summarising different types of immunity.



[2]

Examiner Only	
Marks	Remark

(ii) Give **two** similarities between acquired and active immunity.

_____

_____

_____[2]

(iii) Explain innate immunity.

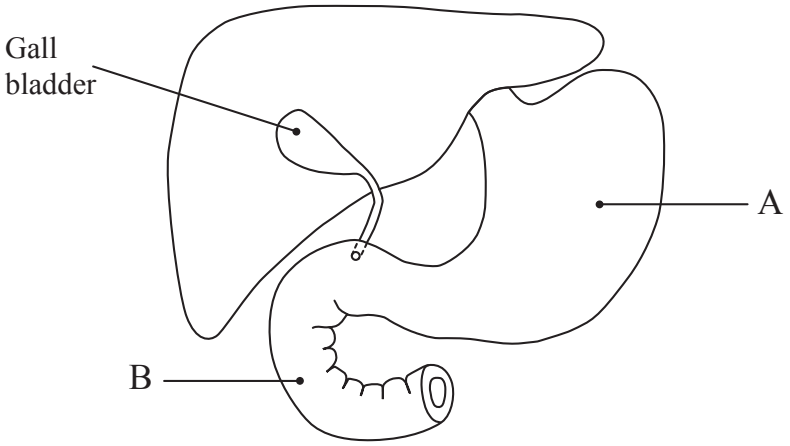
_____

_____[1]

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Examiner Only	
Marks	Remark

6 **(a)** The diagram shows part of the digestive system.



© Adapted from: GCSE human biology by Morton Jenkins, published by Letts Educational, 1997, ISBN 1857585844. Reproduced by permission of HarperCollins publishers.

(i) Name parts A and B.

A _____ [1]

B _____ [1]

The gall bladder stores bile.

(ii) Give the function of bile and name the organ which produces it.

_____

_____

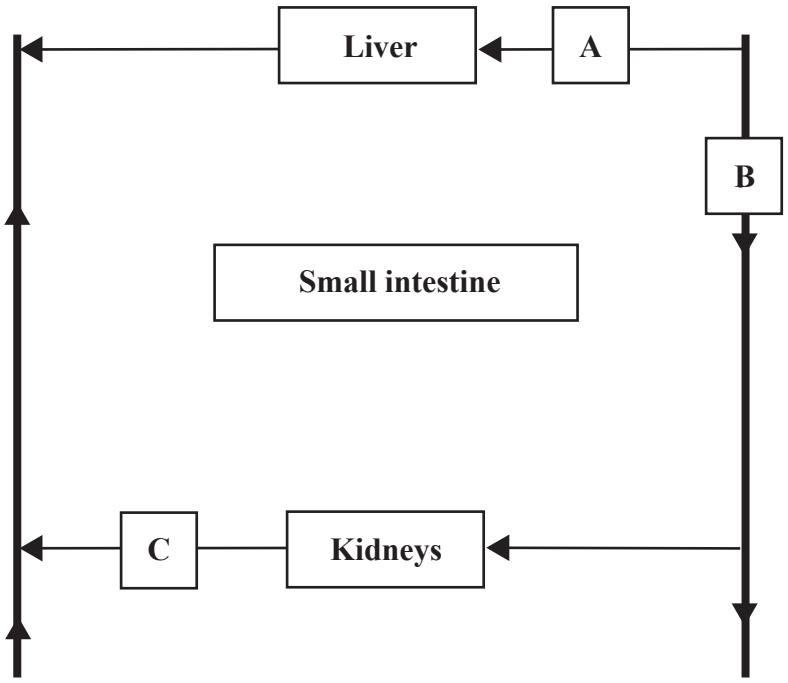
_____ [2]

(iii) Name the process which pushes food along the intestine.

_____ [1]

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(b) The diagram shows the blood supply to part of the human abdomen.



(i) **Complete the diagram** to show the blood supply to and from the small intestine. [3]

(ii) Name blood vessels A, B and C.

A _____ [1]

B _____ [1]

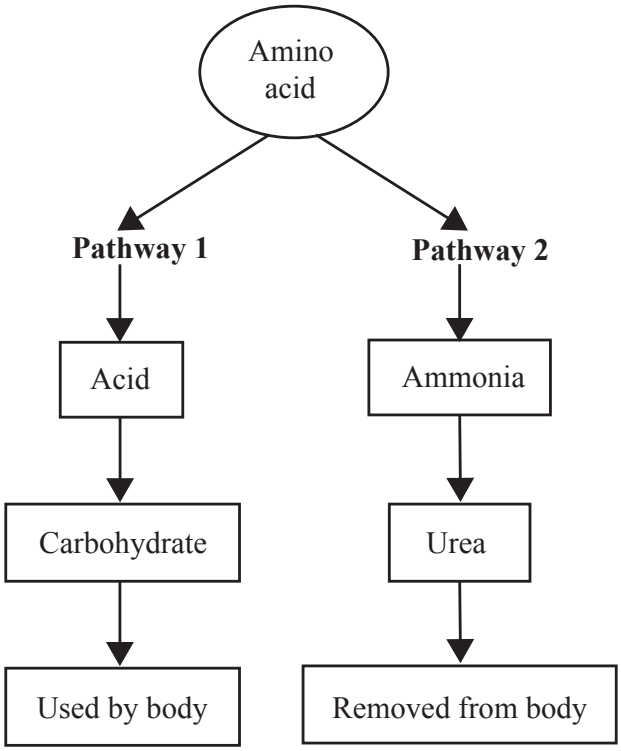
C _____ [1]

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Marks	Remark

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(c) The diagram summarises the breakdown of excess amino acids.



(i) Name the process which breaks down excess amino acids.

_____ [1]

(ii) Name the organ where this process occurs. _____ [1]

(iii) Use the diagram to help explain what happens to the part of the amino acid broken down in Pathway 1.

_____

_____

_____ [2]

(iv) Suggest why urea is removed from the body and describe how this occurs.

_____

_____

_____

_____

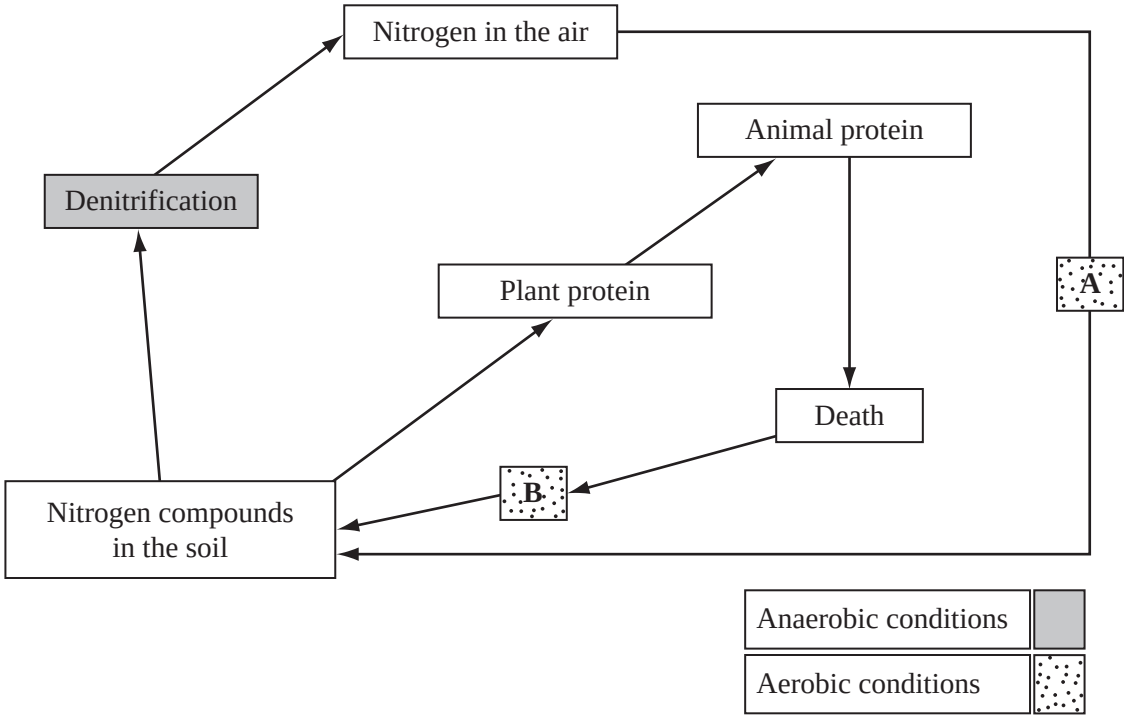
_____ [3]

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Marks	Remark

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7 **(a)** The diagram shows part of the nitrogen cycle.



(i) Name the processes A and B.

A _____ [1]

B _____ [1]

(ii) Use the diagram to help suggest how flooding decreases the concentration of nitrogen compounds in the soil.

_____

_____

_____ [2]

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In the soil ammonium compounds can be converted into nitrates.

(iii) Name this process.

_____ [1]

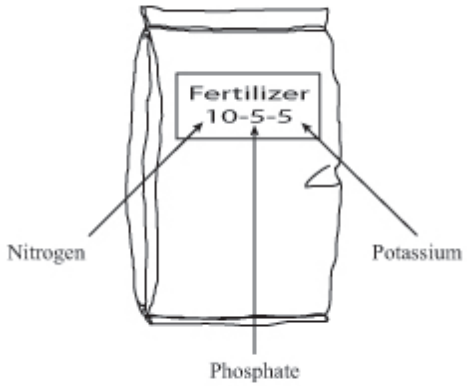
(iv) Why is nitrate content of the soil important to plants?

_____

_____

_____ [2]

(b) The diagram shows some artificial fertilizer.



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(i) Explain why farmers apply fertilizers to their fields.

_____

_____

_____ [2]

Examiner Only

Marks	Remark

(ii) Give **two** reasons why some farmers use artificial fertilizer instead of natural fertilizer.

1. _____

_____[1]

2. _____

_____[1]

Application of excess fertilizers may cause water pollution.

(iii) Explain how fertilizers can enter river water.

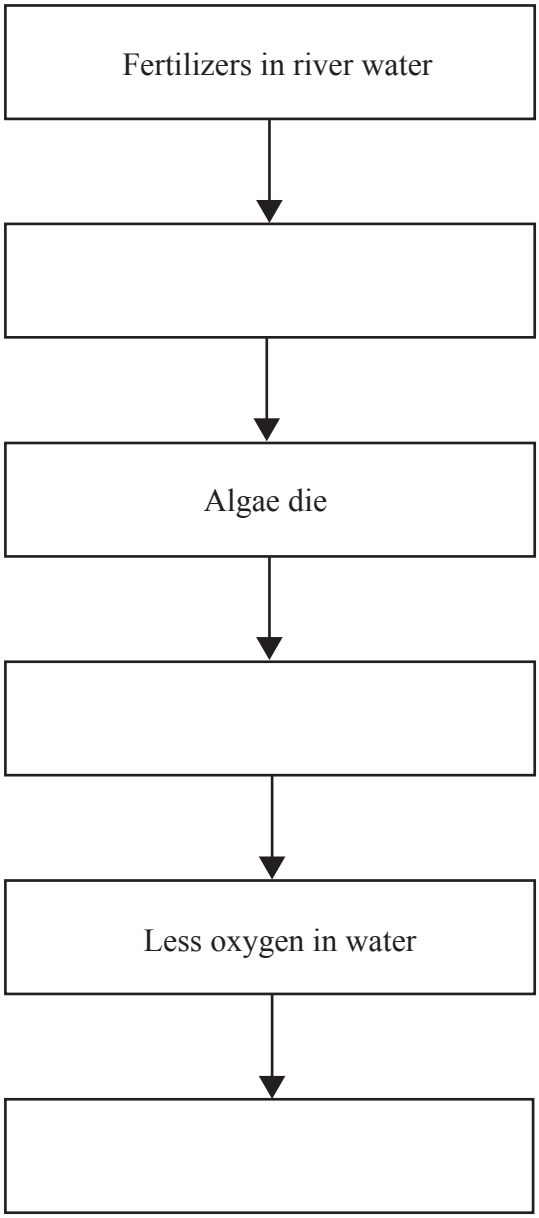
_____

_____

_____[2]

Examiner Only	
Marks	Remark

(iv) Complete the diagram showing the effects of applying an excess of fertilizers.



[3]

(v) Name this type of water pollution.

_____[1]

Examiner Only

Marks	Remark

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(vi) Suggest **three** ways to reduce this type of pollution.

1. _____

_____[1]

2. _____

_____[1]

3. _____

_____[1]

(vii) Suggest **two** ways in which natural fertilizers are beneficial to the soil.

_____

_____

_____

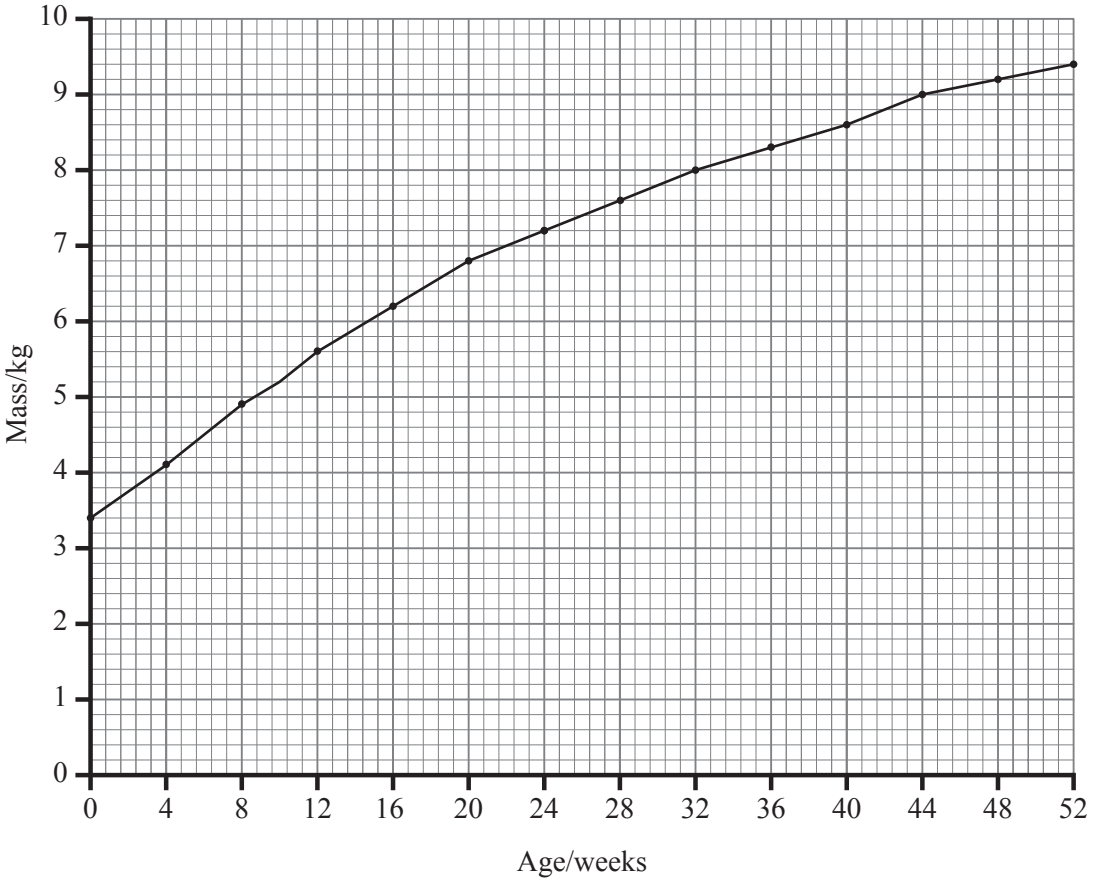
_____[2]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

8 **(a)** Mass can be used as a measure of growth.

The graph shows how the mass of a baby girl increases from birth to one year old.



(i) Calculate the **rate** of increase in mass over the first 10 weeks.
Show your working.

Answer _____ [2]

(ii) Describe what happens to the **rate** of growth over the 52 weeks.

_____

_____ [1]

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(iii) Name the **mineral** needed for the growth of bones.

_____[1]

(iv) Describe the most appropriate way to measure the growth of a tree._____[1]

population of single-celled organisms such as yeast.

_____[1]

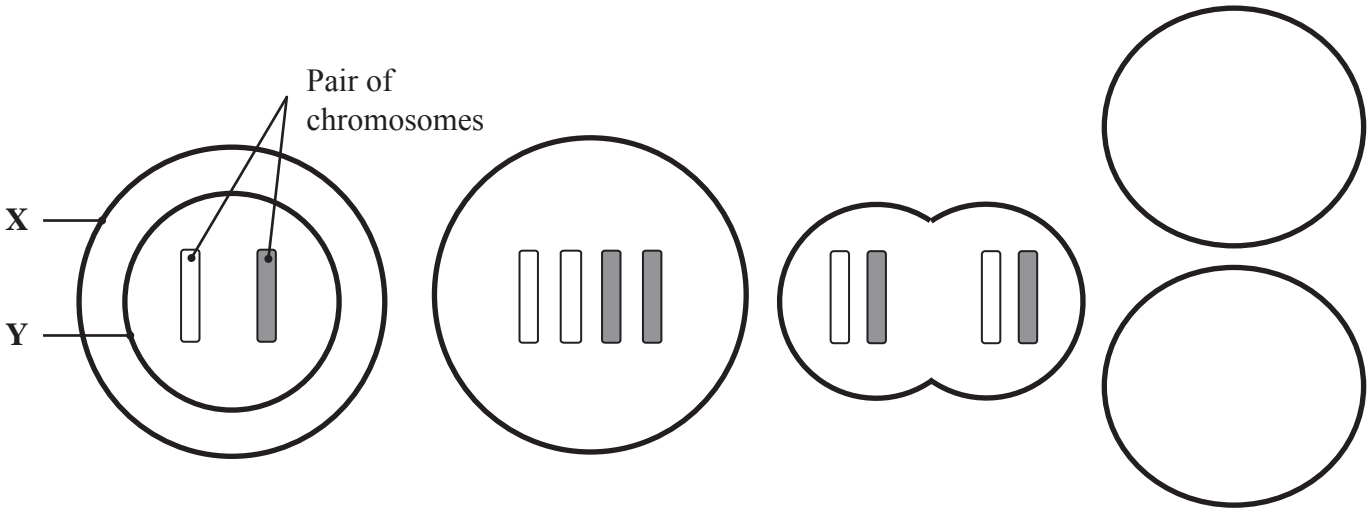
Examiner Only

Marks	Remark

(b) (i) Name the type of cell division involved in growth.

_____[1]

The diagrams show different stages during the division of a growing animal cell containing one pair of chromosomes.



Stage A **Stage B** **Stage C** **Stage D**

Examiner Only	
Marks	Remark

(ii) Complete the diagram to show the cells at stage D. [2]

(iii) Name parts X and Y.

X _____ [1]

Y _____ [1]

(iv) Describe **two** differences between the cell at stages A and B.

_____

_____

_____[2]

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(c) Use the passage about genetic engineering to help answer the questions.

Examiner Only

Marks	Remark

Human growth hormone (HGH) is a protein which stimulates cell growth. Low production of this protein during childhood results in dwarfism. This can be treated with genetically engineered HGH. **1** **3**

The HGH gene is cloned and inserted into a circular DNA from a bacterial cell. This DNA is then put back into the bacterium. **6**

The bacterium is then placed into a biodigester where it reproduces asexually to form a large population of identical bacteria. These bacteria use the HGH gene to produce large amounts of the HGH protein which is released from their cells into the growth medium. **9**

This genetically engineered HGH can be used to restore normal height to children with HGH deficiency. **12**

(i) Describe the role of a hormone in the human body.

_____

_____[1]

(ii) Explain what is meant by cloning the HGH gene (line 5).

_____

_____[1]

(iii) Explain why it is important that the bacterium reproduces asexually when it is placed into the biodigester (line 8).

_____

_____

_____[1]

(iv) Describe the structure of a gene.

_____

_____

_____

_____[3]

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(v) Suggest **one** advantage of the HGH protein being released from the bacterial cells into the growth medium (lines 10 and 11).

_____

_____[1]

(vi) Suggest **two** advantages of using bacteria, rather than other organisms, for genetic engineering.

_____

_____

_____

_____[2]

Examiner Only

Marks	Remark

THIS IS THE END OF THE QUESTION PAPER

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111037

Rewarding Learning

General Certificate of Secondary Education
2011

Science: Biology

Paper 2
Higher Tier

[G0904]

THURSDAY 2 JUNE, MORNING

MARK SCHEME

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					AVAILABLE MARKS
1	(a)	(i)	Less light;	[1]	
		(ii)	Absorbed by plant/as energy source/chlorophyll;	[1]	
			(During) photosynthesis/produce glucose/starch;	[1]	
		(iii)	*Any **TWO** from:* Temperature; Water/drainage/rainfall/humidity; pH; Minerals/nitrates/fertilizer; CO_2; wind exposure;	[2]	
		(iv)	*x*-axis label – Sample Areas	[1]	
			Accurate plots (×2);	[2]	
	(b)	(i)	A, C, D;	[1]	
		(ii)	*Any **TWO** from:* Wings; Body temperature not constant; Lay eggs No backbone;	[2]	
		(iii)	Arthropods;	[1]	
		(iv)	Legs;	[1]	
	(c)	(i)	Death rate **higher/faster**;	[1]	
			Than birth rate;	[1]	
		(ii)	People leaving Ireland/ moving away from/moving out of (Ireland);	[1]	
		(iii)	*Any **TWO** from:* Improved food supply; Improved medical care/less disease; Improved sanitation/housing/standard of living; Increased immigration/birth rate/decreased death rate;	[2]	18

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					AVAILABLE MARKS
2	**(a)**	**(i)**	Support/protection/movement;	[1]	
			Digestive system;	[1]	
			Transport/explained;	[1]	
			Nervous;	[1]	
		(ii)	Group of organs working together;	[1]	
		(iii)	Air is warmed/moistened; Mucus traps dust/bacteria/air filtered (by hairs);	[2]	
	(b)	**(i)**	**A** – Trachea;	[1]	
			B – Bronchiole;	[1]	
		(ii)	*Any **THREE**:* Large surface area; good blood supply; Thin; moist; good diffusion/concentration gradient; permeable;	[3]	
			Quality of written communication	[2]	
	(c)	**(i)**	120,000	[1]	
		(ii)	83;	[1]	
			Heart disease;	[1]	
			Lung cancer; 82;	[1]	
		(iii)	10 cigarettes per day 8 times risk of dying compared to non smokers; 30 per day have 25 times the risk;	[2]	
		(iv)	Tar;	[1]	
		(v)	Addiction to nicotine;	[1]	22

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						AVAILABLE MARKS
3	**(a)**	Cell wall	✓	✗	[1]	
		Cytoplasm	✓	✓	[1]	
		Chloroplast	✓	✗	[1]	
		Vacuole	✓	✗	[1]	
	(b)	**(i)** **A** – Epidermis;			[1]	
		B – Cortex;			[1]	
		C – Vascular bundle;			[1]	
		(ii) Transport; sucrose/sugar/products of photosynthesis/food;			[2]	
		(iii) Arrow pointing ***up*** in xylem;			[1]	
		(iv) Transpiration;			[1]	
		(v) Osmosis;			[1]	
		(vi) Size of cell; shape/size of vacuole; position of nucleus;			[3]	
		(vii) Root hair (cell); large surface area to absorb water/minerals;			[3]	18
4	**(a)**	**(i)** (1520 ÷ 100) × 40; = 608 (kJ);			[2]	
		(ii) Carbohydrate;			[1]	
		Protein;			[1]	
		(iii) Needed for growth;			[1]	
	(b)	**(i)** Living organisms are formed/arise; from non-living matter;			[2]	
		(ii) Traps/prevents entry of microorganisms;			[1]	
		Allows air/oxygen to enter/leave;			[1]	
		(iii) Open flask with no swan neck/sealed;			[1]	
		(iv) Low temperature (4 °C); slows reproduction/growth;			[2]	

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			AVAILABLE MARKS
(c)	**(i)**	Allows oxygen to enter or allows carbon dioxide/heat to leave; [1]	
	(ii)	*Any **TWO** from:* Warmth; Neutral pH; Oxygen/air (if not given in i); Moisture; Microbes/bacteria; [2]	
	(iii)	*Any **TWO** from:* Fruit vegetable peelings; (crushed) egg shells; grass cuttings/plants; Teabags/coffee grounds; (shredded) paper; animal hair/vacuum dust/wood ash; [2]	
	(iv)	Earthworm/springtail/woodlouse/other appropriate example; [1]	18
5	**(a)**	AIDS; [1] (Use) condom; [1] Virus; [1] Salmonella; [1] Eating infected food/described; [1]	
	(b)	**(i)** Penicillin; [1]	
		(ii) *Any **TWO**:* While growing/culturing bacteria; Fungus on plate; Found clear areas around fungus/fungus killed bacteria; [2]	
	(c)	*Any **THREE** from:* Skin; Blood clotting/platelet plugs; Mucus membranes; Tears; Acid; [3]	
	(d)	**(i)** *Any **TWO** from:* Antigens (on inactive microorganisms); Stimulate antibody production; Antigen-antibody reaction described/causes clumping; [2]	
		(ii) *Any **ONE** from:* (Rubella) can pass to baby/through placenta; causes brain damage in foetus/miscarriage/stillbirth/blindness/deafness/heart defects/slower than normal growth; [1]	

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				AVAILABLE MARKS
(e)	**(i)**	84(%);	[1]	
	(ii)	450-75/ = 375; increase ÷ 75 × 100/= 500%;	 [1] [1]	
(f)	**(i)**	Natural; Passive;	[1] [1]	
	(ii)	*Any **TWO** from:* Body produces the antibodies; Memory cells remain in system (blood)/long lasting; Does not take effect immediately;	 [2]	
	(iii)	Antibodies received from mother/in breast milk;	[1]	22
6 **(a)**	**(i)**	**A** – stomach; **B** – duodenum;	[1] [1]	
	(ii)	Emulsifies (fats)/neutralises stomach acids; Liver;	 [2]	
	(iii)	Peristalsis;	[1]	
(b)	**(i)**	Line to small intestine from aorta B; Line from small intestine to liver; Correct arrows on both lines;	[1] [1] [1]	
	(ii)	**A** – Hepatic artery; **B** – Aorta; **C** – Renal vein;	[1] [1] [1]	
(c)	**(i)**	Deamination;	[1]	
	(ii)	Liver;	[1]	
	(iii)	(Acid) converted to carbohydrate; used for energy/stored/changed to fat;	 [2]	
	(iv)	Toxic/poisonous (waste product); Maximum of TWO from: Urea transported to kidneys/in blood; Ultrafiltration/urine formed; (Urine) passed down ureters/stored in bladder; (Urine) excreted through urethra;	[1] [2]	18

						AVAILABLE MARKS
7	**(a)**	**(i)**	A – Nitrogen fixation; B – Decomposition;		[1] [1]	
		(ii)	Anaerobic conditions; Denitrification occurs;	*OR*	Nitrates dissolve; Washed away/leached; [2]	
		(iii)	Nitrification;		[1]	
		(iv)	Needed for amino acids/proteins; For growth/repair;		[2]	
	(b)	**(i)**	Add (extra) nutrients/replace nutrients removed with harvest; Increase crop growth/yield/profit;		[2]	
		(ii)	*Any **TWO** from:* Known content/amount of nitrogen; Easy to store/handle; Released/absorbed faster;		[2]	
		(iii)	Dissolves in rainwater; Leach/run off into rivers/streams/lakes/ponds;		[2]	
		(iv)	**Algal**/bloom; Decomposition/decay; Death of fish/aquatic organisms;		[3]	
		(v)	Eutrophication;		[1]	
		(vi)	*Any **THREE** from:* Less fertilizers; Spread when not raining; Spread only during growing season; Spread away from waterways;		[3]	
		(vii)	*Any **TWO** from:* Adds humus; Improves soil texture/drainage/aeration; Slower release/longer effect;		[2]	22

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				AVAILABLE MARKS
8	**(a)**	**(i)** 5.2 – 3.4 ÷ 10; 0.18 kg per week	[2]	
		(ii) Rate slows down/described;	[1]	
		(iii) Calcium;	[1]	
		(iv) Height/length; Number of cells;	[1] [1]	
	(b)	**(i)** Mitosis	[1]	
		(ii) Nuclear membranes drawn in <u>both</u> cells; 1 white, 1 black chromosome in **each** *cell*;	[2]	
		(iii) **X** – Cell membrane; **Y** – Nuclear membrane;	[1] [1]	
		(iv) Stage B has no nucleus/nuclear membrane/nuclear membrane has disappeared; Chromosomes have doubled/replicated/stage B has 2 pairs of chromosomes;	[2]	
	(c)	**(i)** Chemical messenger;	[1]	
		(ii) Making <u>identical</u> copy;	[1]	
		(iii) Offspring will all contain the **HGH gene/produce HGH**;	[1]	
		(iv) *Any **<u>THREE</u** from:* Gene is a length of DNA/part of a chromosome; In a double helix; Made up of base pairs; (Sequence of bases) codes for an amino acid/protein;	[3]	
		(v) Easier to extract/purify;	[1]	
		(vi) *Any **<u>TWO</u** from:* Fast growing/easy to grow; Can be grown on cheap substrate/carbohydrate; No nucleus so DNA easy to find/modify; No ethical issues;	[2]	22
			Total	**160**

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GCSE

Science: Biology

Summer 2010

Mark Schemes

Issued: October 2010

Rewarding Learning

General Certificate of Secondary Education
2010

Science: Biology

Paper 2
Higher Tier

[G0904]

THURSDAY 3 JUNE, MORNING

MARK SCHEME

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					AVAILABLE MARKS
1	(a)	(i)	Sun;	[1]	
		(ii)	Leaves/grass;	[1]	
		(iii)	Leaves, thrush, hawk; Arrows;	[2]	
		(iv)	Breakdown; Recycle/release nutrients;	[2]	
		(v)	Feeding/energy level;	[1]	
		(vi)	Hawk;	[1]	
		(vii)	Hawk numbers will **increase**; More food/rabbits/thrush to eat;	[2]	
	(b)	(i)	Net;	[1]	
		(ii)	Bars drawn (×2) Line + labels;	[3]	
	(c)	(i)	Any **two** from: Gills; Fins; Scaley skin;	[2]	
		(ii)	Reptiles and birds lay eggs with **shells**; Fish eggs are jelly-like need water/could dry out on land; or Gametes (egg/sperm) need water; or External fertilization;	[2]	18
2	(a)	(i)	Water; Oxygen; Glucose/starch;	[3]	
		(ii)	(Green area) contains chlorophyll; Which absorbs light;	[2]	
		(iii)	Any **three** from: Thin; Large surface area; Stomata (in lower epidermis)/air spaces (in spongy mesophyll); No chloroplasts in epidermis; Chloroplasts (concentrated/broadside) in mesophyll; Palisade cells end on; Xylem/phloem **short distance** from mesophyll;	[3]	
		(iv)	Diffuses through stomata;	[1]	

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				AVAILABLE MARKS
(b)	**(i)**	Boil in water; Remove chlorophyll; Test/add **iodine** solution;	[3]	
	(ii)	Leaf dipped in water; To soften it;	[2]	
(c)	**(i)**	Peripheral area without chlorophyll not shaded; Central part of covered strip not shaded and green area above/below shaded;	[2]	
	(ii)	**Dark**; For 48 hours;	[2]	18
3 **(a)**	**(i)**	A – Liver; B – Colon; C – Rectum;	[3]	
	(ii)	X on anus; Y on stomach;	[2]	
	(iii)	Any **two** from: Large surface area; Long; Thin lining; Folds; Villi; Microvilli; Permeable membrane; Many capillaries/good blood supply;	[2]	
	(iv)	Mechanical digestion/crush food/described; increase surface area/for enzyme action;	[2]	
(b)	**(i)**	A – Dentine; B – Pulp (cavity);	[2]	
	(ii)	Harden **enamel**/plaque more easily **removed**;	[1]	
	(iii)	Contains calcium; Needed for growth of teeth;	[2]	
	(iv)	Any **three** from: Sugar forms plaque; Bacteria feed on sugar; Bacteria produce acid; Erodes **enamel**;	[3]	
			QWC [2]	

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					AVAILABLE MARKS
	(c)	**(i)**	Food gets trapped in pocket/more difficult to clean;	[1]	
		(ii)	Bone recedes; Tooth not anchored/becomes wobbly;	[2]	22
4	**(a)**	**(i)**	A – Anther/stamen; B – Ovary;	[2]	
		(ii)	To attract insects; Colourful/large **petals**; Nectaries/scent; Insects attracted/covered in pollen; Sticky pollen/stigma;	[3]	
		(iii)	Large surface area; To catch pollen;	[2]	
		(iv)	Any **three** from: Size of flower/petal; Shape/position or number of stamens; Apple flowers single/grass flowers in groups; Size/amount/shape of pollen;	[3]	
	(b)	**(i)**	Correct position; Pointing downwards within testa;	[2]	
		(ii)	Testa;	[1]	
	(c)	**(i)**	Wind; Explosive/self; Animals;	[3]	
		(ii)	To prevent overcrowding; Colonise new areas;	[2]	18
5	**(a)**	**(i)**	A – **Upper** epidermis; B – Palisade (mesophyll);	[2]	
		(ii)	Cuticle – waterproof; Prevents **evaporation**; **Stomata** close;	[3]	
		(iii)	Any **three** from: (Water) **evaporates** from the cell (surface); **Diffuses**; Through/across the (intercellular) space/stomata;	[3]	
		(iv)	Thickened wall/large lumen/described;	[1]	

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					AVAILABLE MARKS
		(v)	Minerals/nitrates/named example;	[1]	
		(vi)	Transport **sugar/products of photosynthesis**; **from the leaves**;	[2]	
	(b)	**(i)**	Reset/zero the bubble/move bubble to start of the scale;	[1]	
		(ii)	Bubble would move to the left/towards the plant; water loss from the leaves/shoot; Causes shoot to absorb/take up water (from the potometer);	[3]	
		(iii)	Place potometer at varying/different distances from a fan;	[1]	
		(iv)	27 ÷ 10; = 2.7; mm/minute;	[3]	
		(v)	Correct **humidity** difference/described; Appropriate effect;	[2]	22
6	**(a)**	**(i)**	Virus;	[1]	
		(ii)	Artificial/active/acquired;	[1]	
		(iii)	Still possess **antigens**;	[1]	
		(iv)	**Lymphocyte/white blood cell** recognises antigen; Starts to make antibodies;	[2]	
		(v)	**More** antibodies in blood; Faster response; Longer lasting/remains high for longer; (Any two)	[2]	
		(vi)	More expensive/may not get second dose/takes longer/ may catch disease between doses;	[1]	
		(vii)	Clumps them/stops them spreading/reproducing;	[1]	
		(viii)	Phagocyte; Engulfs; Digests;	[1] [2]	
	(b)	**(i)**	Flemming;	[1]	
		(ii)	Fungus/mould;	[1]	
		(iii)	11;	[1]	

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					AVAILABLE MARKS
		(iv)	Antibiotic diffused out; Killed bacteria;	[2]	
		(v)	Antibiotic A	[1]	18
7	**(a)**	**(i)**	A – Denitrification; B – Ingestion/feeding; C – Nitrification/decomposition;	[3]	
		(ii)	Nitrates;	[1]	
		(iii)	Any **two** from: Nitrogen fixation bacteria (in root nodules); Changes **nitrogen gas** to nitrates; For growth/protein/amino acids;	[2]	
	(b)	**(i)**	Any **two** from: Saprophytic; Releases enzymes; External digestion; Products absorbed;	[2]	
		(ii)	Points plotted = 2 marks; Label + line;	[3]	
		(iii)	7mm (no units –1); **Earthworms and other invertebrates** enter the bag; Break down leaf litter faster/quicker;	[3]	
	(c)	**(i)**	Some paper may need ink removed/not suitable for recycling; Presses/flattens/dries paper;	[2]	
		(ii)	Reduces deforestation; Less landfill/incineration; Saves energy in paper making process;	[3]	
		(iii)	Transport/collection; Sorting/workforce; Bleaching/machinery;	[2]	
		(iv)	poor quality;	[1]	22
8	**(a)**	**(i)**	A – Chromosome; B – Protein;	[2]	
		(ii)	(Amino acid) **3** incorporated instead of **1**; **Different** protein/structure B; Protein does not work;	[2]	

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				AVAILABLE MARKS
	(iii)	CAT and TAT both code for **same amino acid**;	[1]	
	(iv)	Radiation/UV light;	[1]	
(b)	**(i)**	Franklin/Wilkins;	[1]	
	(ii)	Double helix;	[1]	
	(iii)	Watson **and** Crick (need both) Model building;	[2]	
	(iv)	Bases form pairs; A pairs with T; or C; G pairs with T; or C;	[2]	
(c)	**(i)**	No change/stayed same; **More** (fish with) black/larger spots;	[2]	
	(ii)	Better/improved camouflage/described;	[1]	
	(iii)	Large-spotted fish suffer less **predation**; More (large-spotted) fish **survive/reproduce**; To pass **genes** to next generation; Allow converse for small-spotted fish	[3]	
	(iv)	Breed large fish together; Repeats the process over a number of generations;	[2]	
	(v)	Any **two** from: Food value/meat quality; Hardiness; disease resistance; (Not size/markings/colour)	[2]	22
			Total	**160**

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Rewarding Learning

Centre Number

71	

Candidate Number

General Certificate of Secondary Education
2009

Science: Biology

Paper 2
Higher Tier

[G0904]

G0904

THURSDAY 28 MAY, 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 **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	
6	
7	
8	
Total Marks	

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1 **(a)** The graph shows the daily energy requirements for humans at different ages.

Image of graph not available due to copyright

(i) At what age do females have their highest energy requirement?

_____ years [1]

(ii) What is the highest energy requirement for males?

_____ kJ [1]

(iii) Explain why the female energy requirements are lower than those for males.

_____

_____ [1]

(iv) Give **one other** factor which affects the energy requirements of adults.

_____ [1]

(v) Explain what would happen to a 25-year-old female if her daily energy intake was 8000 kJ.

_____

_____

_____ [2]

(vi) Name the process in cells which releases the energy in food.

_____ [1]

(vii) Give **one** other substance produced by this process

_____ [1]

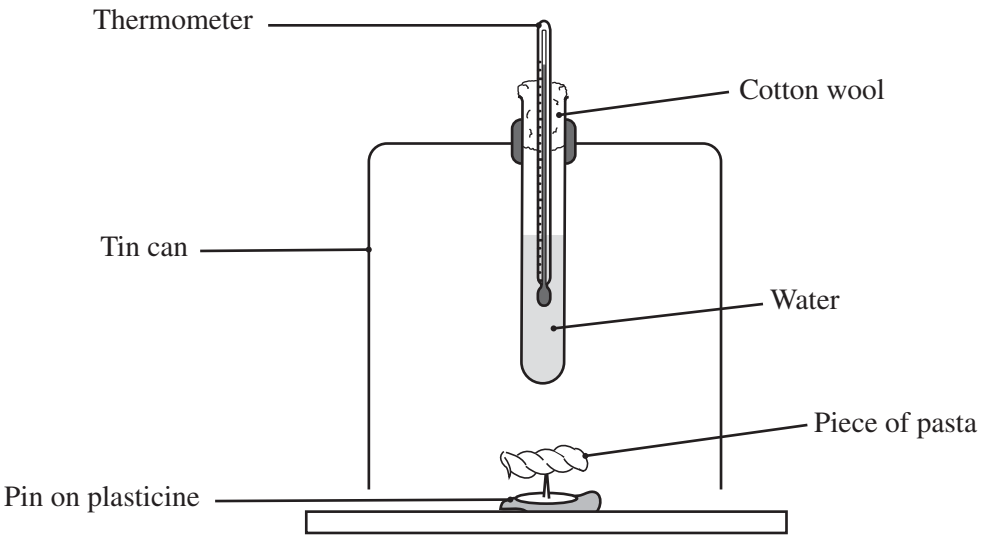
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Marks	Remark

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Examiner Only	
Marks	Remark

(b) The apparatus shown was used to calculate the energy in a piece of pasta.



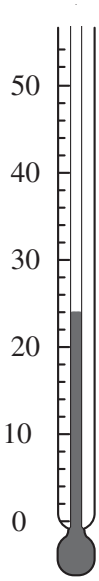
© Biology Lives by Morton Jenkins, published by Hodder & Stoughton Ltd, 1999, ISBN 0340790512, Reproduced by permission of Hodder & Stoughton Ltd

The thermometers show what happened when the pasta was burned.

Temperature of water at **start**



Temperature of water **after** burning a piece of pasta



(i) Use this information in the diagrams to help calculate the temperature rise.
Show your working.

Answer _____°C [2]

(ii) Suggest **one** reason why not all the energy in the pasta was used to heat the water.

_____

_____ [1]

(c) The table summarises the nutritional information for pasta and the daily requirements for a 17-year-old male.

	Pasta/100 g	**Recommended daily amount**
Energy/kJ	1515	15 000
Protein/g	12.3	50
Carbohydrate/g	74.0	300
Fat/g	1.0	65
Fibre/g	3.0	25
Salt/g	Less than 0.1	6
Calcium/mg	18.0	1000
Iron/mg	1.0	18

Adapted from: http://dietandfitnesstoday.com/calories-nutrition-facts.php?id=20420

(i) Using **one** piece of information from the table, suggest why eating 100 g of pasta, as part of a healthy diet, reduces the risk of

heart disease. _____

_____ [1]

constipation. _____

_____ [1]

(ii) Explain how

fat is used in the body.

_____

_____ [1]

iron is used in the body.

_____

_____

_____ [2]

calcium is used in the body.

_____

_____ [1]

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Marks	Remark

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(iii) Explain what is meant by a balanced diet.

Examiner Only	
Marks	Remark

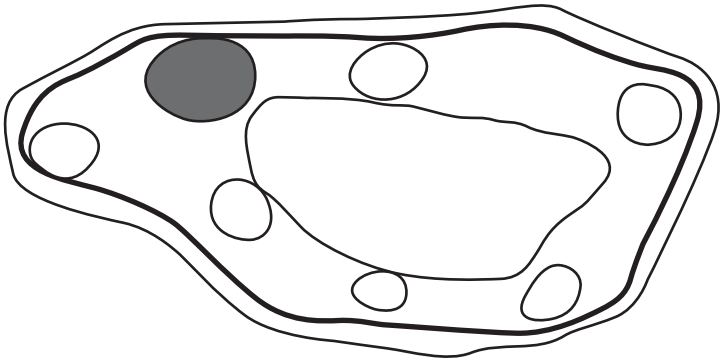
_____

_____ [1]

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Marks	Remark

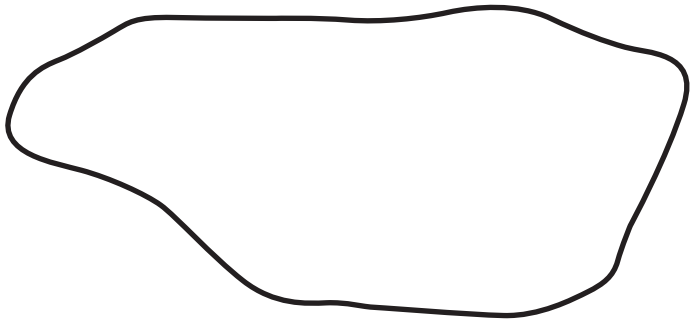
2 **(a)** The drawing shows a leaf cell magnified 2500 times.



© *Exploring Science by M Levesley, S Baggley, Julian Clark, Steve Gray and Mark Pimbert, published by Longman, 2002, ISBN 058240362-6 Reproduced by permission of Pearson Education Ltd, publishers*

(i) **On the drawing** label a chloroplast. [1]

(ii) **On the outline below, draw and label** the cell wall and vacuole. [4]



(iii) Explain how this leaf cell is adapted for photosynthesis.

_____

_____

_____ [2]

(iv) Give **two** similarities and **two** differences between this leaf cell and an animal cell.

Similarities:

1. _____ [1]

2. _____ [1]

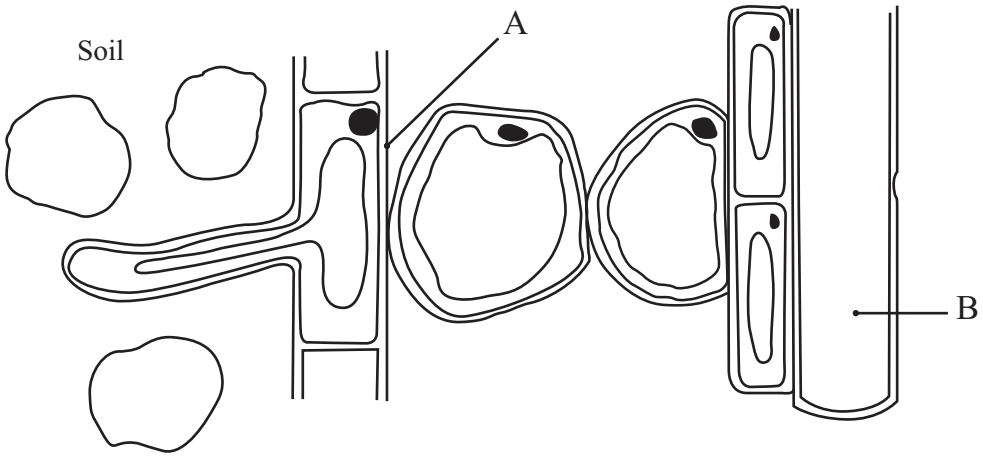
Differences:

1. _____ [1]

2. _____ [1]

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(b) The diagram shows part of a root.



(i) Name cell A and explain how it is adapted to carry out a specific function.

Cell A _____

Adaptation _____

_____ [3]

Tissue B carries water up to the leaves.

(ii) Name tissue B.

_____ [1]

(iii) Explain how water moves from the soil to tissue B.

_____

_____

_____

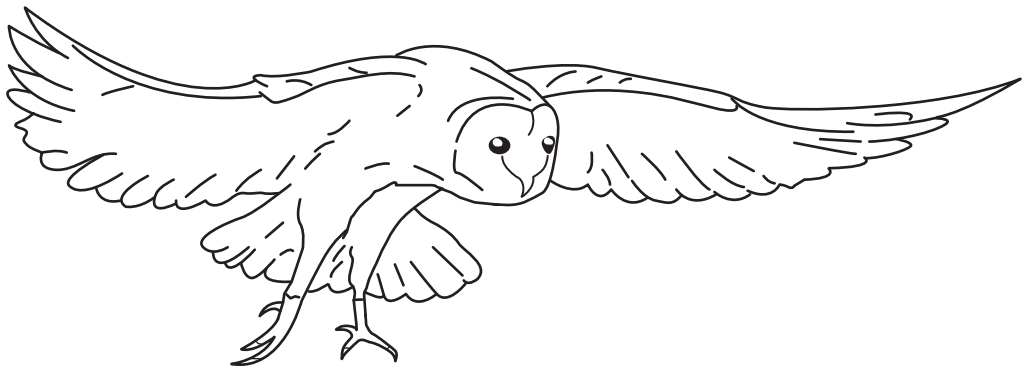
_____ [3]

Examiner Only

Marks	Remark

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3 **(a)** The diagram shows an owl.



Owls belong to the bird group of chordates.

(i) What is a chordate?

_____

_____ [1]

Birds skin is covered in feathers.

(ii) Suggest **two** functions of feathers.

_____

_____ [2]

(iii) Name **one** feature shown in the diagram which adapts the owl to hunting and explain how this adaptation helps the owl catch its prey.

Feature _____ [1]

Adaptation _____

_____ [1]

(iv) Give **two other** features of birds.

1. _____ [1]

2. _____ [1]

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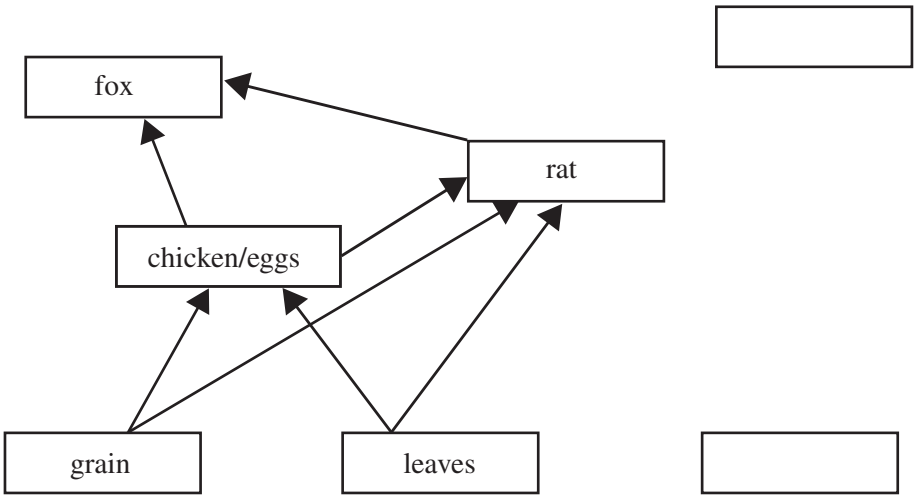
Marks	Remark

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Examiner Only	
Marks	Remark

(b) Owls hunt rats which feed on chicken eggs, grain, leaves and root vegetables.
Chickens also eat grain and leaves.
Rats and chickens are preyed on by foxes.

(i) Use this information to **complete the food web**.



[3]

(ii) Name a producer from this food web.

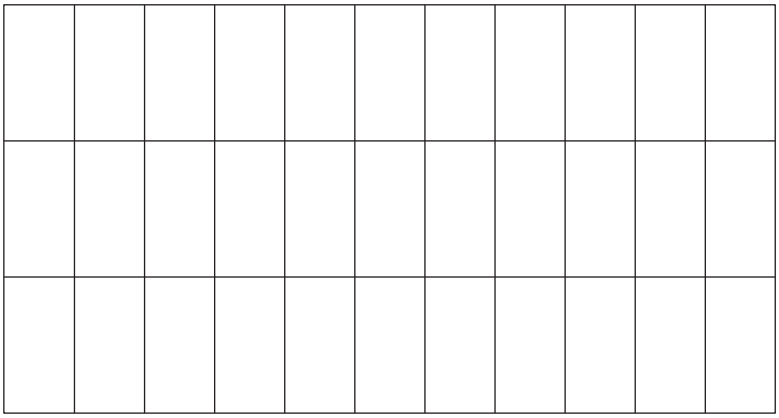
_____ [1]

(iii) At what trophic **level** do chickens feed?

_____ [1]

An examination of owl pellets over a period of time showed that one owl weighing 300 g ate 400 g of rats. These rats consumed about 600 g of food in the same period of time.

(iv) Draw and label a pyramid of biomass for this owl.



[3]

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Examiner Only	
Marks	Remark

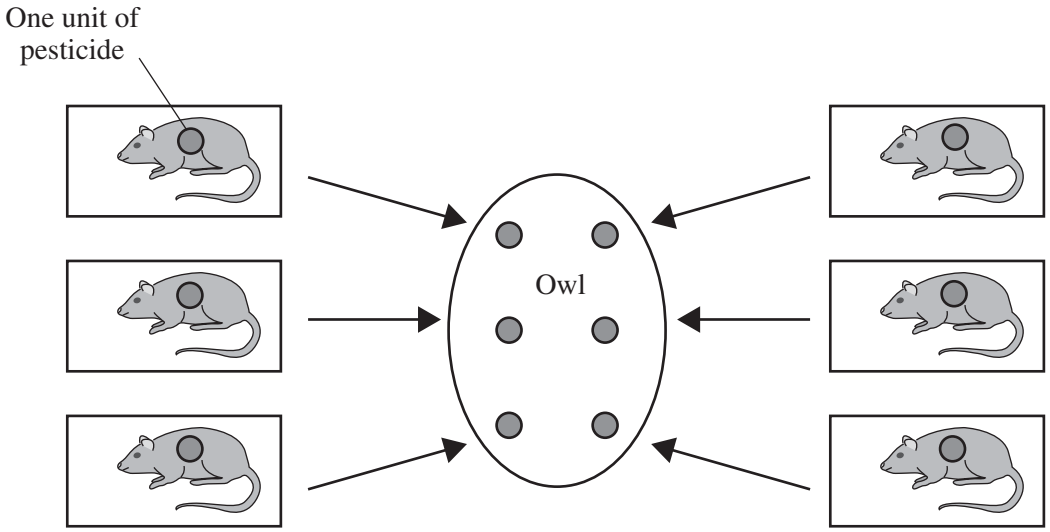
(c) Farmers use pesticides to control the number of rats.
Over-use of pesticides has led to rats building up resistance.

(i) What is a pesticide?

_____

_____ [2]

The diagram shows how the over-use of pesticides in rats can result in the death of an owl.



(ii) Use the diagram to help explain how the over-use of pesticides in rats can result in the death of an owl, but not that of rats.

_____

_____

_____

_____

_____

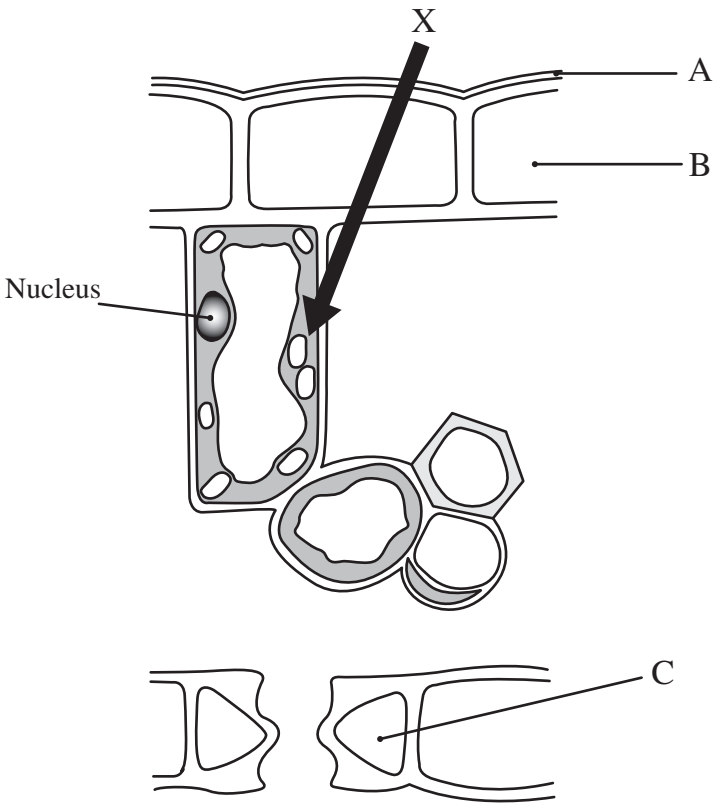
_____ [3]

Quality of written communication [2]

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Marks	Remark

4 **(a)** The diagram shows part of a leaf.



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(i) What does arrow X represent?

_____ [1]

(ii) Name parts A, B and C.

A _____ [1]

B _____ [1]

C _____ [1]

(iii) Name the layer of cells where most photosynthesis occurs.

_____ [1]

(iv) Describe how carbon dioxide enters the leaf.

_____

_____

_____ [2]

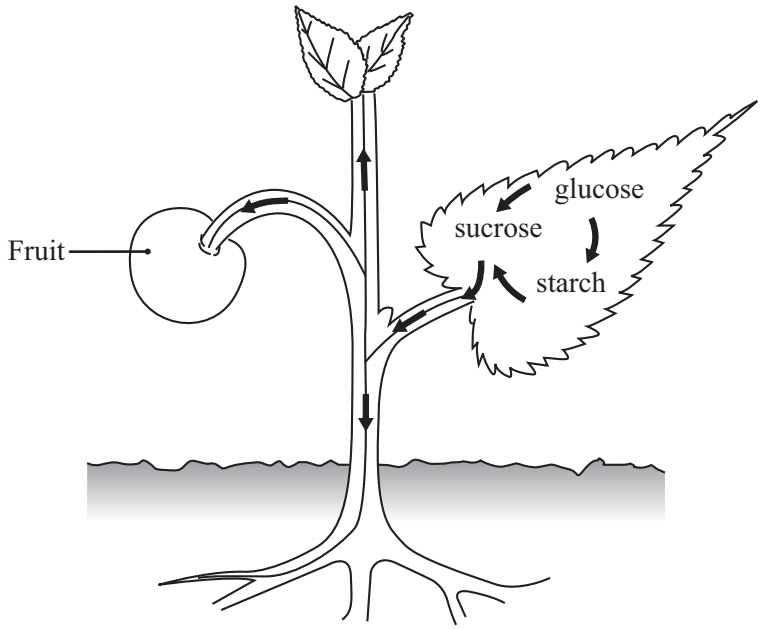
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(b) Complete the table.

Adaptation of leaf	Function
1. Large surface area	
2.	To allow sunlight to reach all cells
3.	

[4]

(c) The diagram shows what happens to the products of photosynthesis.



© Biology by G & M Jones, published by Cambridge University Press, 1987. ISBN 0521338697

Use the diagram to explain **three** ways the products of photosynthesis can be used by a plant.

_____

_____

_____

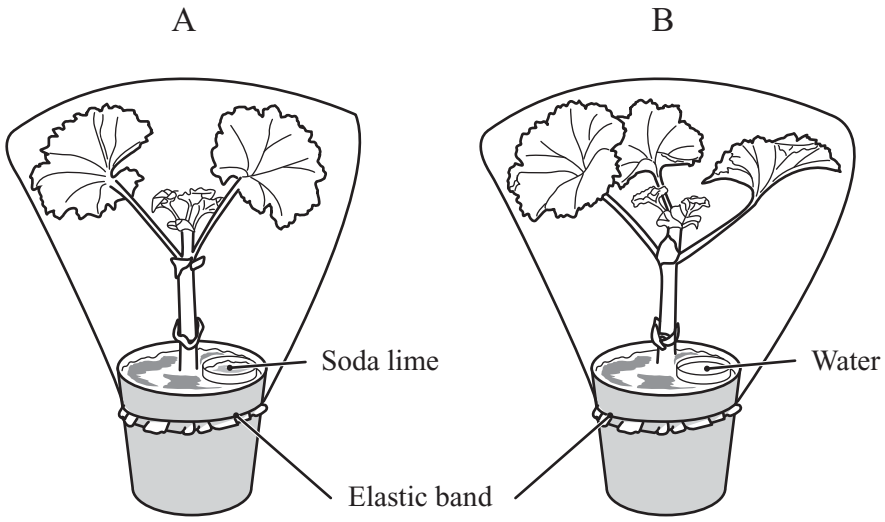
_____ [3]

Examiner Only

Marks	Remark

Examiner Only	
Marks	Remark

(d) The diagram shows a photosynthesis experiment.
Both plants were destarched and then left in the light for 48 hours.



© Reproduced with the permission of Nelson Thornes Ltd from Biology for Life, 2nd edition ISBN 0-17-448096-2 first published in 1986

(i) Explain why soda lime is present.

_____ [1]

(ii) Why is plant B required?

_____ [1]

The table shows the results of the experiment.

Plant	Colour of leaf after starch test	Starch present/absent
A	Orange/brown	Absent
B	Blue/black	Present

(iii) Explain these results.

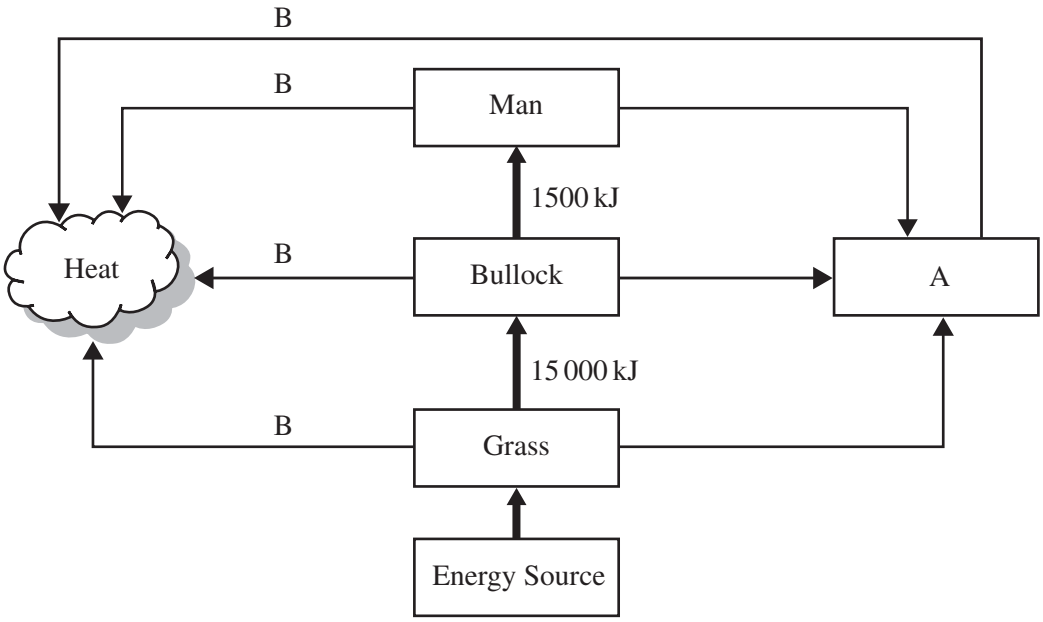
_____

_____

_____ [2]

Examiner Only	
Marks	Remark

5 **(a)** The diagram represents the energy flow through a short food chain.



(i) Give the source of energy for the food chain.

_____ [1]

(ii) Name organism A and process B.

Organism A _____ [1]

Process B _____ [1]

(iii) Calculate the percentage of the energy in the grass that is transferred to the growth of the bullock.
Show your working.

Answer _____ [2]

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Farmers can increase the percentage of the energy used by their bullocks for growth, by keeping them in cattle sheds during the winter.

(iv) Suggest **two** reasons why bullocks kept in cattle sheds in the winter could grow faster.

_____

_____

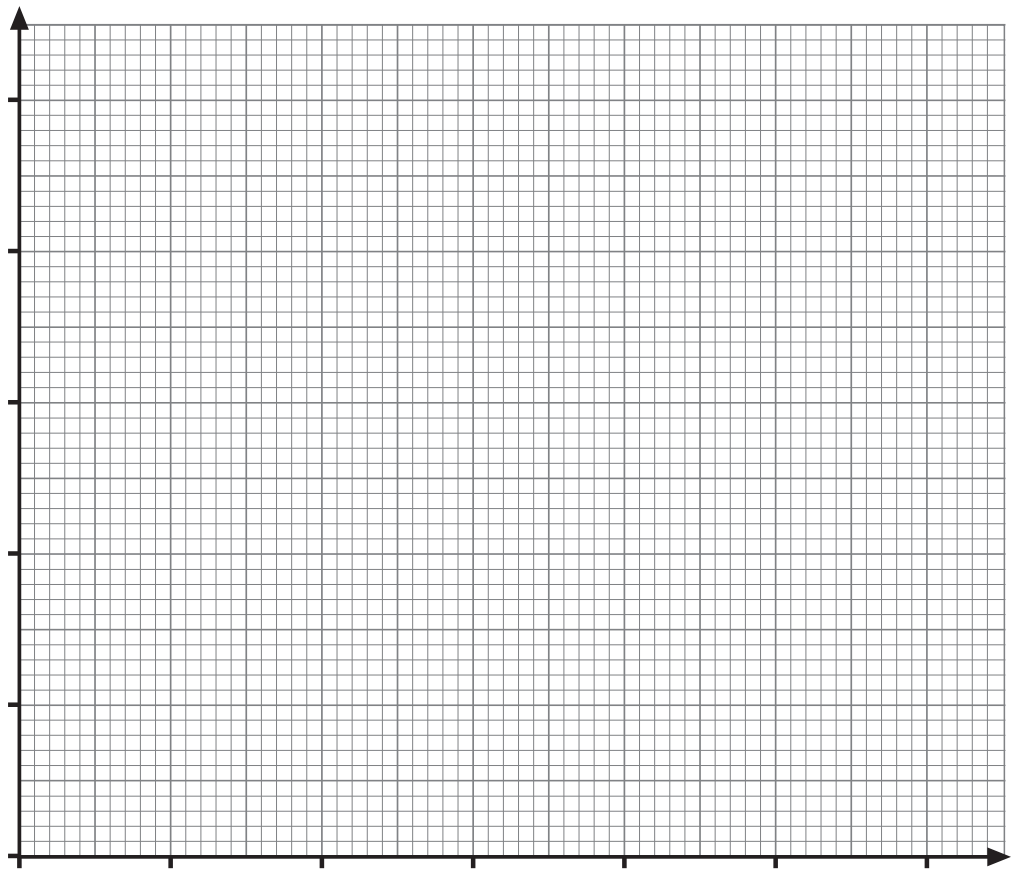
_____ [2]

(b) The table shows the estimated mass of spawning herring between 1998 and 2003.

Year	Mass of spawning herring/thousands of tonnes
1998	700
1999	850
2000	800
2001	1200
2002	1600
2003	2250

Adapted from: http://www.cefas.co.uk/media/31684/herringnorthsea.pdf © Crown Copyright

(i) Draw a histogram of the mass of spawning herring.



[4]

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Marks	Remark

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(ii) Explain in terms of birth rate and death rate the change in the mass of the spawning herring population.

Change _____[1]

Explanation _____

_____

_____ [2]

The change in the mass of spawning herring has been caused by the strategies introduced by the European Union, to prevent overfishing.

(iii) Explain overfishing.

_____

_____ [1]

(iv) Complete the table by describing and explaining some of these strategies.

Strategy	Explanation
Quota	
Closed season	
	Allows smaller, immature fish to escape.

[3]

Examiner Only

Marks	Remark

(c) The human population is estimated to rise to 6 000 000 000 in 2010.

Examiner Only	
Marks	Remark

(i) Suggest **two** factors which have helped increase the human population.

_____

_____

_____ [2]

(ii) Suggest **two** factors which can cause a decrease in the human population.

1. _____
[1]

2. _____
[1]

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6 **(i)** Complete the table to show the processes involved in the nitrogen cycle.

Process	Chemical reaction	
	From	**To**
	ammonia (ammonium compounds)	nitrates
Denitrification	nitrates	
Nitrogen fixation		
	protein	ammonia

[5]

(ii) Explain why nitrates are needed for plant growth.

_____

_____ [1]

Farmers plough fields to aerate the soil.

(iii) Suggest **two** ways ploughing may improve crop yield.

_____

_____

_____ [2]

Over-use of fertilizers can result in eutrophication.

(iv) Give **two** examples of natural fertilizers.

1. _____ [1]

2. _____ [1]

Examiner Only	
Marks	Remark

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(v) Explain how the risks of eutrophication can be reduced by

applying the fertilizer only during periods of plant growth.

_____

_____

_____ [2]

avoiding application of fertilizer during periods of heavy rain.

_____

_____

_____ [2]

(vi) Suggest **one other** advantage of using natural fertilizer rather than artificial fertilizer to the

soil. _____

_____ [1]

farmer. _____

_____ [1]

(vii) Suggest **two** advantages of artificial fertilizer.

_____

_____

_____ [2]

Examiner Only	
Marks	Remark

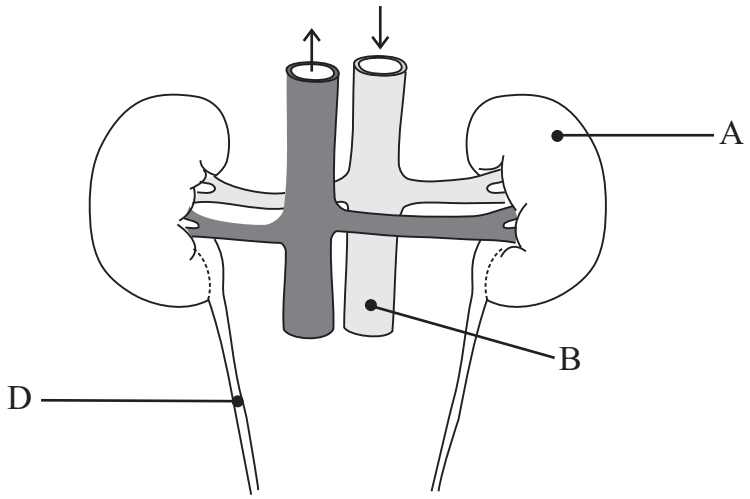
Examiner Only	
Marks	Remark

7 (a) (i) What is excretion?

_____

_____ [2]

The diagram shows part of the human excretory system.





(ii) Complete the diagram to show the bladder. [2]

(iii) Name parts A, B, C and D.

A _____ [1]

B _____ [1]

C _____ [1]

D _____ [1]

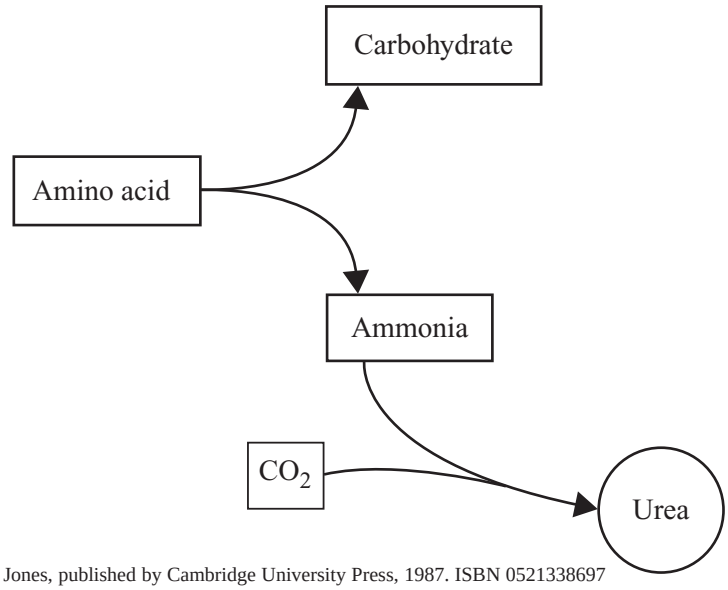
(iv) Give the function of the sphincter muscle.

_____

_____ [1]

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(b) The diagram shows urea production.



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(i) Describe what happens to excess amino acids in the blood.

_____ [1]

(ii) Name the organ which

produces urea.

_____ [1]

removes urea from the blood.

_____ [1]

(iii) Give **two** uses of the carbohydrate produced.

1. _____

2. _____ [2]

(iv) Explain why the volume of urine produced is greater in winter than in summer.

_____

_____ [2]

(v) Give the term used to describe the homeostatic control of water in the blood.

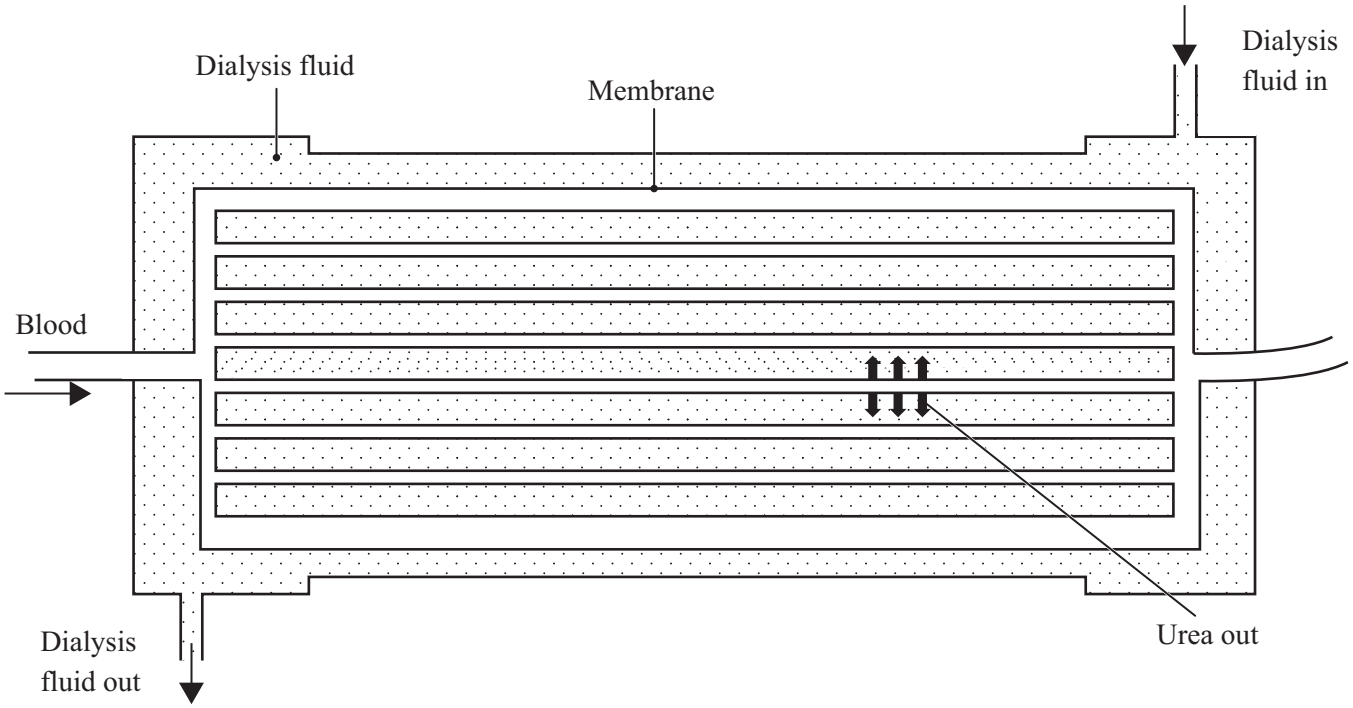
_____ [1]

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Marks	Remark

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(c) The diagram shows part of a kidney dialysis machine.



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Examiner Only	
Marks	Remark

(i) Name **two** substances which would be in the same concentration in the blood and in the dialysis fluid.

1. _____ [1]

2. _____ [1]

(ii) Explain why urea moves into the dialysis fluid.

_____

_____ [2]

(iii) Suggest why the dialysis fluid must be continually replaced.

_____ [1]

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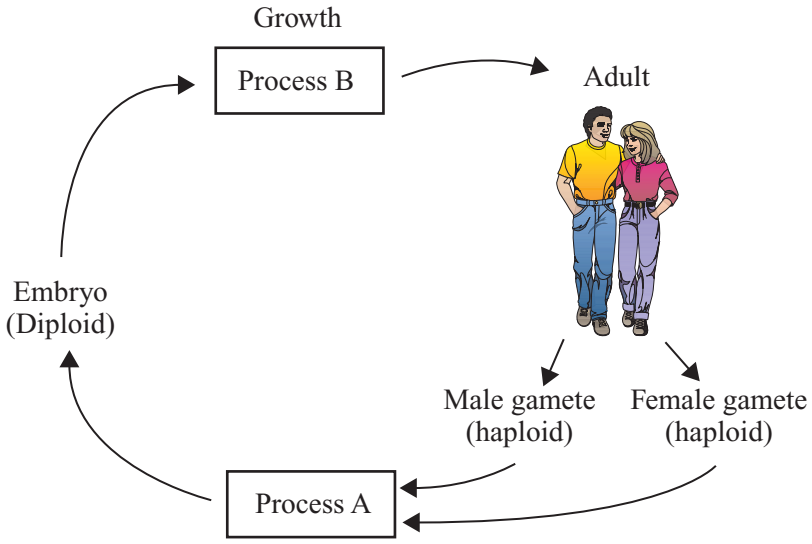
8 (a) (i) Complete the table.

Description	Mitosis	Meiosis
Example	Skin	
Genetic information		Gives rise to variation
Number of divisions		
Number of daughter cells		

[4]

Examiner Only	
Marks	Remark

The diagram shows a human life cycle.



(ii) Mark with an X on the diagram where in the life cycle meiosis occurs. [1]

(iii) Name processes A and B.

A _____ [1]

B _____ [1]

Gametes are described as haploid.

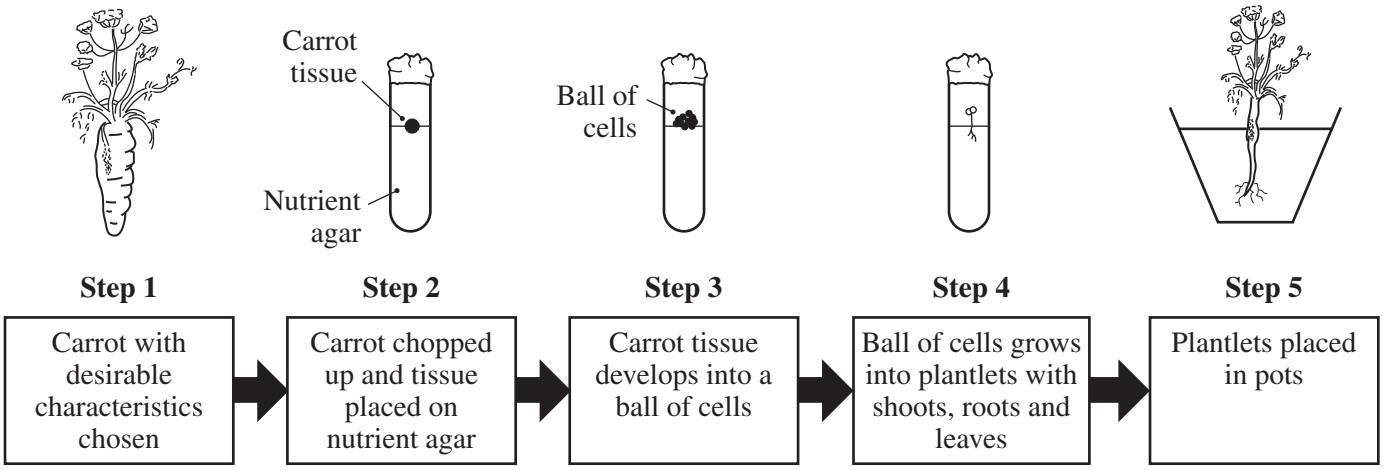
(iv) Explain what is meant by haploid.

_____

_____ [1]

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(b) The diagram shows a modern cloning technique used in carrots.



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Marks	Remark

(i) Give the name of this cloning technique.

_____ [1]

(ii) Suggest **two** features of carrots a grower might select in step 1, to make the carrot attractive to consumers.

_____

_____ [2]

(iii) Explain why the offspring produced by this technique are described as clones.

_____

_____

_____ [2]

(iv) Give **one other** advantage of cloning.

_____

_____ [1]

(v) Suggest **two** disadvantages of this technique.

_____

_____

_____ [2]

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Examiner Only	
Marks	Remark

(c) Carrot crops are often damaged by carrot flies.
Growers use insecticides to kill these pests but some of the flies are resistant to the insecticide.

(i) Explain what is meant by resistance.

_____

_____

_____ [1]

(ii) Explain how natural selection may lead to an increase in the number of resistant flies.

_____

_____

_____

_____

_____ [3]

(iii) Suggest **two** ways the development of pesticide resistance in the carrot fly population may be expensive for growers.

_____

_____

_____ [2]

THIS IS THE END OF THE QUESTION PAPER

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GCSE

Science: Biology

Summer 2009

Mark Schemes

Issued: October 2009

Rewarding Learning

General Certificate of Secondary Education
2009

Science: Biology

Paper 2
Higher Tier

[G0904]

THURSDAY 28 MAY, MORNING

MARK SCHEME

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					AVAILABLE MARKS
1	**(a)**	**(i)**	14;	[1]	
		(ii)	15 000;	[1]	
		(iii)	Males more **muscle**; (allow converse)	[1]	
		(iv)	Activity; (Not: Age/Gender)	[1]	
		(v)	Any **two** from: Below required energy; Starvation; Lose weight/tired;	[2]	
		(vi)	Respiration;	[1]	
		(vii)	CO_2/water;	[1]	
	(b)	**(i)**	24 – 16; 8;	[2]	
		(ii)	Heat loss from around the sides of the boiling tube/tin can/to air/ converted to light/any example described; Pasta not burning completely; (Any **one**)	[1]	
	(c)	**(i)**	Low fat/low salt/low energy; (Accept values from table) High fibre;	[1] [1]	
		(ii)	Source/storage of **energy**/insulation/protection;	[1]	
			To make haemoglobin; For red blood cells/O_2 transport;	[2]	
			For bones/teeth;	[1]	
		(iii)	Contains a full range of food molecules/groups in the required quantities;	[1]	18
2	**(a)**	**(i)**	Labelled chloroplast;	[1]	
		(ii)	Draw vacuole; cell wall drawn; Labels – vacuole; cell wall;	[4]	
		(iii)	Chloroplasts; to trap sunlight;	[2]	
		(iv)	Similarities: cytoplasm; nucleus; cell membrane; (Any **two**)	[2]	
			Differences: Vacuole; cell wall; chloroplasts; (Any **two**)	[2]	

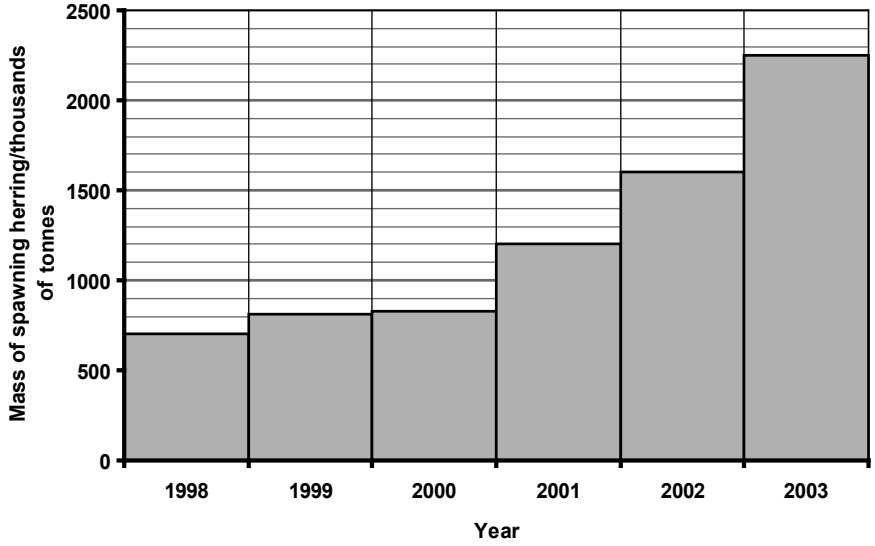
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				AVAILABLE MARKS
	(b)	**(i)**	Root hair cell; Large surface area; to absorb water/minerals; [3]	
		(ii)	Xylem; [1]	
		(iii)	(Moves in) by osmosis; down a concentration gradient; (Diffuses) from cell to cell; through a selectively permeable membrane; (Any **three**) [3]	18
3	**(a)**	**(i)**	Animal with a backbone; [1]	
		(ii)	Insulation/warmth; flight; [2]	
		(iii)	Beak/claws/talons; catch/kill/hold/carry/tear prey; Eyes (forward facing); judge distance/pinpoint prey; (not 'see' UQ) feathers/wings; silent/speedy flight; (Any **two**: Feature + appropriate adaption) [2]	
		(iv)	Internal fertilisation; lay <u>shelled</u> eggs/external development; One pair of wings (and one pair of legs); beak (if not given in **(iii)**); (Any **two**) [2]	
	(b)	**(i)**	Arrow; Root vegetables at first trophic level; Owl at third trophic level; [3]	
		(ii)	Grain/leaves/root vegetables; [1]	
		(iii)	Second/primary consumer; [1]	
		(iv)	Order and labels; Size of bar; Bars centred; [3]	
	(c)	**(i)**	Chemical; used to kill/poison pests; [2]	
		(ii)	Small amount of pesticides does not kill rat; Pesticide stays in rats; Pesticide becomes concentrated in owl; Pesticide reaches lethal level in owl; (Any **three**) [3]	
			Quality of written communication [2]	22

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					AVAILABLE MARKS
4	**(a)**	**(i)**	Sunlight;	[1]	
		(ii)	A – Cuticle; B – (Upper) epidermis; C – Guard cell;	[3]	
		(iii)	Palisade;	[1]	
		(iv)	Diffusion; through stoma;	[2]	
	(b)		Trap as much **light** as (possible); Thin; Air spaces; to allow gases to circulate Any reasonable adaptation; + function;	[4]	
	(c)		Stored as starch; transported as sucrose; glucose respired; growth of fruit; (Any **three**)	[3]	
	(d)	**(i)**	To remove/absorb carbon dioxide;	[1]	
		(ii)	Control/comparison;	[1]	
		(iii)	Starch produced/present in plant B; Photosynthesis requires carbon dioxide;	[2]	18
5	**(a)**	**(i)**	Sun/light;	[1]	
		(ii)	A – Decomposer/named example; B – Respiration;	[2]	
		(iii)	(1500 × 100) ÷ 15 000; 10%;	[2]	
		(iv)	Less energy used/lost/wasted; NL as heat/to maintain body temperature/for movement;	[1] [1]	

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			AVAILABLE MARKS
(b)	**(i)**		
		axis and labels; [2] scales (app); accurately plotted; histogram with bars; [4]	
	(ii)	Increase; [1]	
		Birth rate higher; than death rate; [2]	
	(iii)	More fish caught than replaced (by reproduction); [1]	
	(iv)	Smaller/reduced quantity of **fish** caught; Species has time to **breed/reproduce**; Larger **mesh**/hole in nets; [3]	
(c)	**(i)**	Lack of sex education/contraception/cultural ref; Medical advances; Increased food availability; Improved housing/sanitation/sewage disposal; (Any **two**) [2]	
	(ii)	Career/education/contraception; Lack of food/starvation/famine/drought; War; Disease; Natural disaster; (Any **two**) [2]	22

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				AVAILABLE MARKS
6	(i)	Nitrification; Nitrogen (gas); Nitrogen (gas); nitrates/nitrites; Decompostion/decay;	[5]	
	(ii)	To make proteins;	[1]	
	(iii)	Reduce the growth of denitrifying bacteria/increase nitrifying/nitrogen fixing bacteria; Better drainage/less water logging; More/more active uptake; Less spread of disease; (Any **two**)	[2]	
	(iv)	Slurry/manure; compost;	[2]	
	(v)	Nutrients absorbed by plants; less nutrients enter waterways;	[2]	
		Reduce runoff; and leaching;	[2]	
	(vi)	Improve soil texture/slow release/	[1]	
		Cheap/get rid of waste;	[1]	
	(vii)	Easy to store; mineral composition known correct; fast acting/soluble; (Any **two**)	[2]	18
7	(a) (i)	Removal/elimination; of **toxic** products of (metabolism);	[2]	
	(ii)	Correct size/shape; attached to ureters and urethra;	[2]	
	(iii)	A – kidney; B – aorta/artery; C – urethra; D – ureter;	[4]	
	(iv)	Controls the release of urine;	[1]	
	(b) (i)	Deaminated/separated into ammonia/urea;	[1]	
	(ii)	Liver;	[1]	
		Kidney;	[1]	
	(iii)	Respired/energy; Stored;	[2]	
	(iv)	**Less** sweat; (more) in urine for excretion;	[2]	
	(v)	Osmoregulation;	[1]	
	(c) (i)	Sugar; salt; water; (Any **two**)	[2]	

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					AVAILABLE MARKS
		(ii)	Down a concentration gradient/described; by diffusion; through the selectively permeable membrane; (Any **two**)	[2]	
		(iii)	Maintain diffusion gradient;	[1]	22
8	**(a)**	**(i)**	Testes/ovaries; Identical to parent cells/shows no variation; One, two; Two, four;	[4]	
		(ii)	X on male and/or female gamete production;	[1]	
		(iii)	A – fertilization; B – mitosis;	[2]	
		(iv)	Half the number of **chromosomes**/23 instead of 46 **chromosomes**/ only one from each pair of **chromosomes**;	[1]	
	(b)	**(i)**	Tissue culture;	[1]	
		(ii)	Storage properties; taste/colour/texture; size; hardiness/disease resistance; (Any **two**)	[2]	
		(iii)	Genetically; identical;	[2]	
		(iv)	Quick/large numbers of offspring/only one adult plant required/ produced out of season; disease free;	[1]	
		(v)	Expensive/difficult to carry out; no variation; susceptible to disease; (Any **two**)	[2]	
	(c)	**(i)**	Not killed (by pesticide); (Do not accept ref immunity)	[1]	
		(ii)	Resistance is **genetically** inherited; Resistant flies **survive**; They **reproduce**; Pass resistance **trait on to offspring**; (Any **three** in logical sequence)	[3]	
		(iii)	Crop damage by pests; Larger amounts/stronger/different pesticide has to be used; Different pesticide must be used/new one developed/new method: (Any **two**)	[2]	22
				Total	**160**

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