Please check the examination details below before entering your candidate information

Candidate surname	Other names

Pearson Edexcel International GCSE (9–1)

Centre Number | Candidate Number

Time 2 hours

Paper reference **4BI1/1B 4SD0/1B**

Biology

UNIT: 4BI1

Science (Double Award) 4SD0

PAPER: 1B

You must have:
Calculator, ruler

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*
- Show all the steps in any calculations and state the units.
- Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Information

- The total mark for this paper is 110.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Write your answers neatly and in good English.
- Try to answer every question.
- Check your answers if you have time at the end.
- Good luck with your examination.

Turn over ▶

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Answer ALL questions.

1 The table lists values that can be obtained in practical investigations.

(a) Complete the table by naming pieces of laboratory apparatus that can be used to help obtain these values.

The first one has been done for you.

(4)

Value	Apparatus
magnification of a red blood cell	microscope
heat produced by germinating seeds	
surface area to volume ratio of a potato cylinder	
breathing rate of a human	
volume of gas produced by yeast in anaerobic respiration	

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(b) The diagram shows a red blood cell viewed through a microscope.



(Source: © Artem_Graf/Shutterstock)

The actual width of this red blood cell is 8 µm.

The magnification of this red blood cell can be calculated using this formula.

$$\text{magnification} = \frac{\text{width of cell in drawing}}{\text{actual width of cell}}$$

Calculate the magnification of this red blood cell.

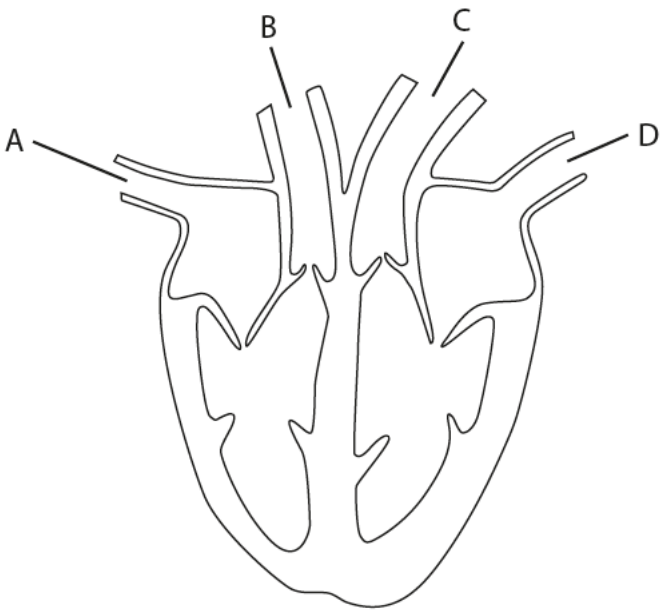
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magnification = ...

(Total for Question 1 = 6 marks)

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2 The diagram shows the human heart with four blood vessels labelled A, B, C and D.



(a) (i) Which blood vessel brings oxygenated blood to the heart?

(1)

- ☒ **A**
- ☒ **B**
- ☒ **C**
- ☒ **D**

(ii) Which blood vessel contains blood at the highest pressure?

(1)

- ☒ **A**
- ☒ **B**
- ☒ **C**
- ☒ **D**

(b) (i) Draw a label line on the diagram to show the position of a semi-lunar valve.

(1)

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(ii) Describe the function of the semi-lunar valves.

(2)

(c) In the heart of a foetus, the two upper chambers (atria) are linked by a hole so that blood can pass between them.

(i) Explain why this hole is normally closed before the baby is born.

(2)

(ii) Sometimes the hole does not close.

Explain what effect this will have on the baby.

(3)

(Total for Question 2 = 10 marks)

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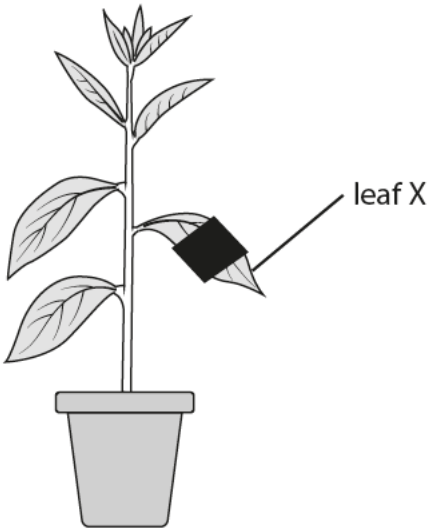
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3 A student investigates factors that affect photosynthesis.

(a) In his first experiment, the student uses this method to investigate the effect of light on photosynthesis.

- place a plant in the dark for 24 hours
- cover part of leaf X with black paper
- place the plant in the light for 24 hours

The diagram shows the plant in the light.



Describe how the student tests leaf X to show the effect of light on photosynthesis.

(4)

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(b) In his second experiment, the student uses a water plant to investigate the effect of carbon dioxide concentration on the rate of photosynthesis.

He does the experiment at two different light intensities.

The table shows the student's results.

Carbon dioxide concentration in arbitrary units	Rate of photosynthesis in bubbles per minute	
	low light intensity	high light intensity
0.00	0	0
0.02	20	20
0.04	29	35
0.06	35	47
0.08	39	68
0.10	42	84
0.12	45	89
0.14	46	90
0.16	46	90
0.18	46	90

(i) Explain the student's results.

(4)

(ii) Describe how the student could change the light intensity in this investigation.

(1)

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(iii) Give the dependent variable in this investigation.

(1)

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(iv) Give one way in which the student could control the biotic variable in this investigation.

(1)

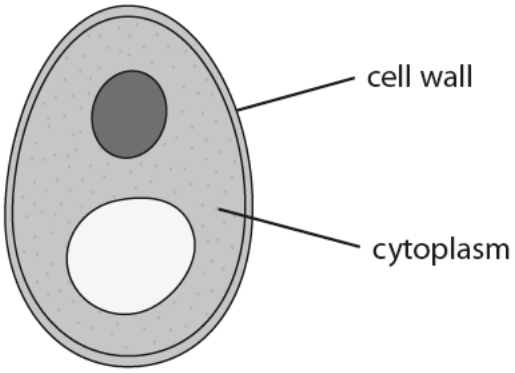
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(Total for Question 3 = 11 marks)

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4 The diagram shows a yeast cell.



(a) (i) Which row of the table is correct for this yeast cell?

(1)

		Substance in cell wall	Substance stored in cytoplasm
☒	**A**	cellulose	glycogen
☒	**B**	cellulose	starch
☒	**C**	chitin	glycogen
☒	**D**	chitin	starch

(ii) Which type of organism is a yeast cell?

(1)

☒ **A** a bacterium

☒ **B** a fungus

☒ **C** a plant

☒ **D** a protoctist

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(b) Biofuel is made from ethanol.

Scientists use genetically modified (GM) yeast to produce biofuel.

The GM yeast contains an enzyme that digests plant cell walls to produce glucose.

The yeast uses the glucose in respiration to produce ethanol.

(i) Which of these equations shows the respiration in the yeast?

(1)

☒ **A** glucose → ethanol

☒ **B** glucose → ethanol + carbon dioxide

☒ **C** glucose + oxygen → ethanol

☒ **D** glucose + oxygen → ethanol + carbon dioxide

(ii) Name an enzyme used by scientists to genetically modify the yeast.

(1)

.....

(iii) The GM yeast is a recombinant strain.

State what is meant by the term **recombinant**.

(1)

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(iv) Suggest why biofuel produced using glucose from plants could reduce global warming.

(2)

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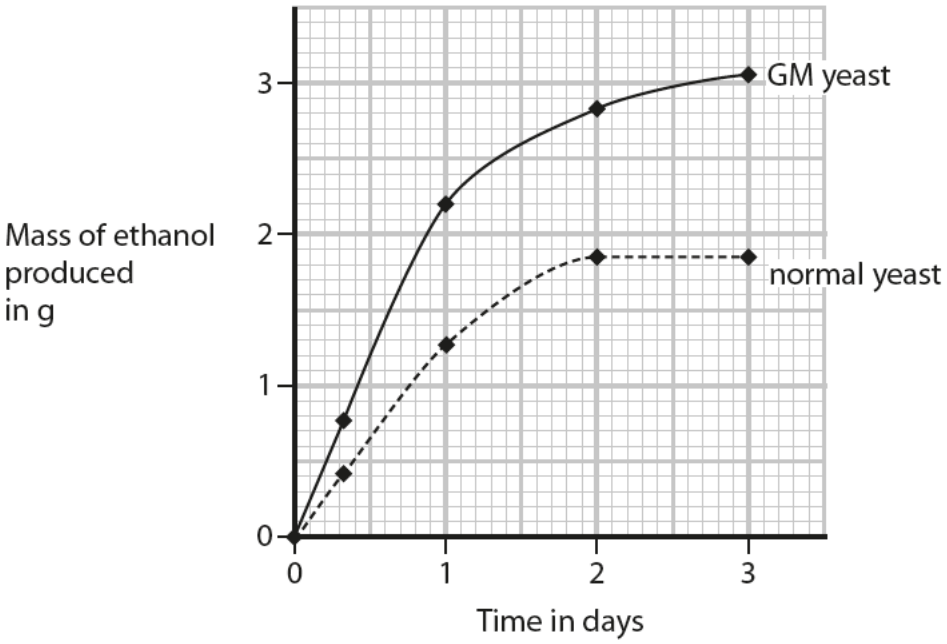
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(c) The graph shows the mass of ethanol produced by GM yeast and by normal yeast over a period of 3 days.



(i) Calculate the percentage increase in the mass of ethanol produced by GM yeast compared to normal yeast after 1 day.

(2)

percentage increase = ... %

(ii) Give two reasons why the rate of ethanol production decreases after 1 day.

(2)

1 .....

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2 .....

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(Total for Question 4 = 11 marks)

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5 Weeds are plants that compete with crop plants.

A scientist investigates the use of two different ways of reducing the population of weeds.

This is her method.

- use chemical control in one field by spraying herbicides, a type of pesticide, that kill the weeds
- use biological control in another field by releasing insects that eat the weeds
- measure the mean (average) number of weeds in each field once a month from February to August

The table shows the scientist's results.

Month	Mean number of weeds per m^2	
	chemical control	biological control
February	2	12
March	16	8
April	3	4
May	20	3
June	3	4
July	18	3
August	2	3

(a) Describe a method to measure the mean number of weeds per m^2 in each field.

(3)

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(b) The scientist concludes that biological control is a better way of controlling weeds than chemical control.

Discuss this conclusion.

Use data from the table and your own knowledge to support your answer.

(5)

(Total for Question 5 = 8 marks)

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6 A student studies the organisms in a pond community.

(a) Which of these is the correct description of a community?

(1)

- ☒ **A** the living organisms together with their non-living environment
- ☒ **B** the area where organisms live
- ☒ **C** the organisms of all species in a habitat
- ☒ **D** the organisms of one species in a habitat

(b) The table shows the number of organisms per m^2 at different trophic levels in a pond community.

It also shows the total biomass of these organisms per m^2.

Trophic level	Number of individuals per m^2	Total biomass in g per m^2
secondary consumers	100	1.0
primary consumers	1.5×10^4	2.5
producers	7.2×10^{10}	17.5

(i) Calculate the mean mass in g of a single primary consumer.

Give your answer in standard form.

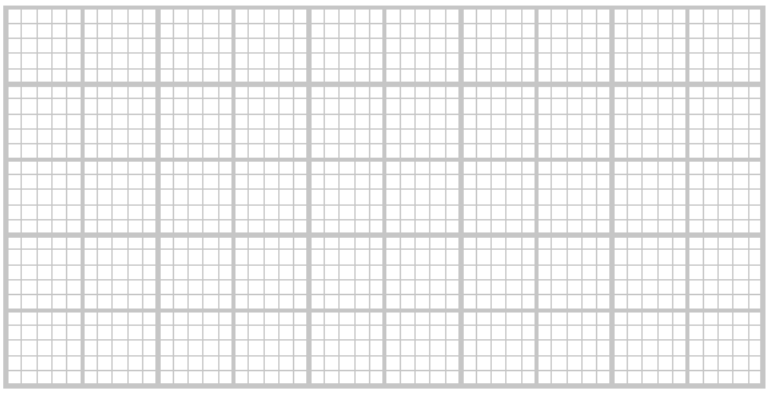
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mean mass = ... g

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(ii) Use the grid to draw a pyramid of biomass for the pond community.

(2)



(c) The number of secondary consumers is low because energy transfer is not 100% efficient.

(i) Explain why egestion is one reason why energy transfer is not 100% efficient.

(2)

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(ii) Give two other reasons why energy transfer is not 100% efficient.

(2)

1 .....

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2 .....

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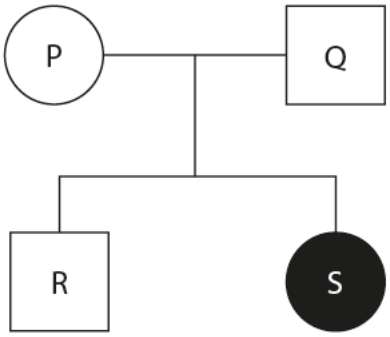
(Total for Question 6 = 10 marks)

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7 Inherited conditions may be caused by a dominant allele (D) or by a recessive allele (d).

The diagram shows a family pedigree for an inherited condition.

The shaded circle shows a female with the condition.



(a) Complete the table by giving the genotype of each individual.

One has been done for you.

(3)

Individual	Genotype
P	
Q	
R	Dd
S	

(b) The parents have a third child.

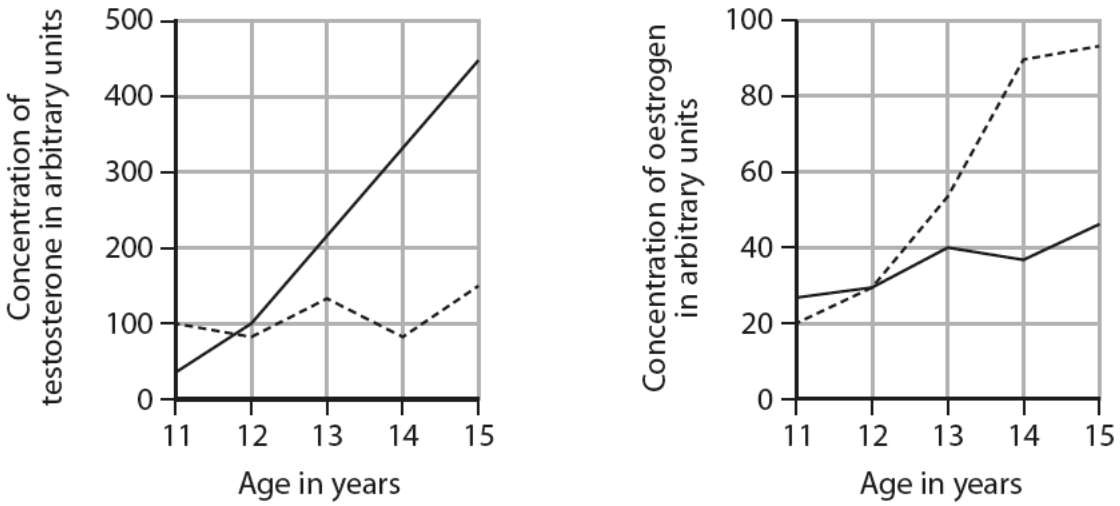
Calculate the probability that this third child is female and has the condition.

(1)

probability = ...

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(c) The graphs show changes in the concentrations of the hormones testosterone and oestrogen in child R and in child S between the ages of 11 to 15.



Explain how the changes in hormone concentrations affect the development of each child.

(4)

(Total for Question 7 = 8 marks)

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8 The table gives the percentage composition by mass of human breast milk, and of cow's milk.

Substance	Percentage by mass (%)	
	Breast milk	Cow's milk
water	87.0	88.0
vitamins	trace	trace
fat	3.8	5.0
carbohydrate	7.9	3.0
minerals	0.2	0.7
protein	1.0	3.3

(a) Discuss whether cow's milk is a suitable alternative to breast milk for young babies.

Use data from the table and your own knowledge to support your answer.

(6)

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(b) Human breast milk may contain insufficient vitamin D for a growing child.

Give two ways that additional vitamin D could be provided for the child.

(2)

1 .....

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2 .....

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(c) Describe how a sample of cow's milk could be tested for protein.

(2)

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(Total for Question 8 = 10 marks)

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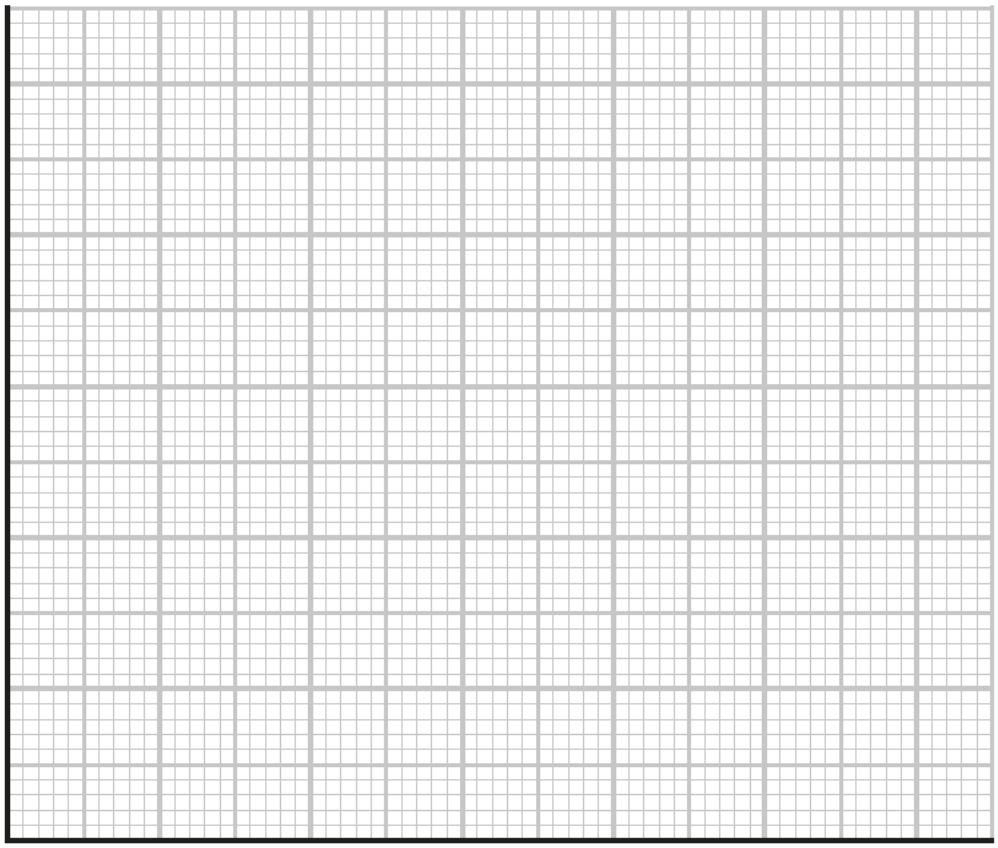
9 The scientist, Richard Doll, collected data about deaths from cancer in the 1950s.

The table shows data for four groups.

Cause of death	Number of deaths				
	non-smokers	light smokers	medium smokers	heavy smokers	total
lung cancer	0	12	11	13	36
other cancers	15	35	24	18	92
all deaths	82	345	206	157	790

(a) (i) Plot a bar chart to show the number of deaths from lung cancer and from other cancers for each of the four groups.

(5)



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(ii) Calculate the difference in the percentage of all deaths caused by lung cancer in heavy smokers compared to the percentage of all deaths caused by lung cancer in light smokers.

(3)

difference = ... %

(b) This table gives no information about the age of the people who died.

Suggest why age may affect the likelihood of dying from lung cancer.

(2)

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(c) Explain one effect, other than lung cancer, that smoking has on health.

(2)

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(Total for Question 9 = 12 marks)

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10 Humans can control their internal environment.

(a) State the term used to describe the control of an organism's internal environment.

(1)

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(b) Coordination uses hormones and nerves.

Some responses are simple reflex arcs.

Describe the structure and functioning of the withdrawal reflex of a finger from a hot object.

(4)

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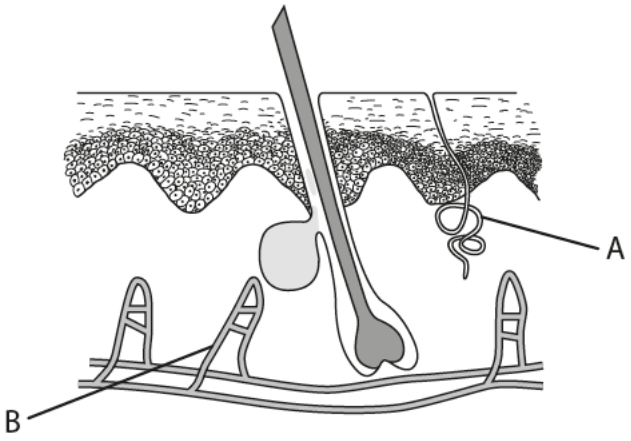
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(c) Humans use their skin to regulate their body temperature. The diagram shows a section through the skin with two structures labelled A and B.



Changes take place in the skin when a person moves from a warm environment to a cold environment.

(i) Explain the changes that take place in structure A as a person enters a cold environment.

(2)

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(ii) Explain the changes that take place in structure B as the person enters a cold environment.

(3)

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(d) Modern humans have less body hair than their ancestors.

Explain how this evolutionary change was brought about by natural selection.

(4)

(Total for Question 10 = 14 marks)

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11 Pollution of air or water can affect ecosystems.

(a) (i) Explain the biological consequences of air pollution by sulfur dioxide.

(3)

(ii) State how sulfur dioxide pollution can be reduced.

(1)

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(b) Some scientists have suggested that adding hydrogencarbonate solution to soil, instead of adding water, can increase plant growth.

Design an investigation to discover the effect that adding hydrogencarbonate solution has on the growth of seedlings.

Include experimental details in your answer and write in full sentences.

(6)

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(Total for Question 11 = 10 marks)

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