Please check the examination details below before entering your candidate information

Candidate surname	Other names

Centre Number | Candidate Number

Pearson Edexcel International GCSE (9–1)

Monday 6 November 2023

Morning (Time: 2 hours)

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

Biology

UNIT: 4BI1
Science (Double Award) 4BI1/4SD0
PAPER: 1B

You must have:
Ruler, calculator

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- If pencil is used for diagrams/sketches/graphs it must be dark (HB or B).
- **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.

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.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

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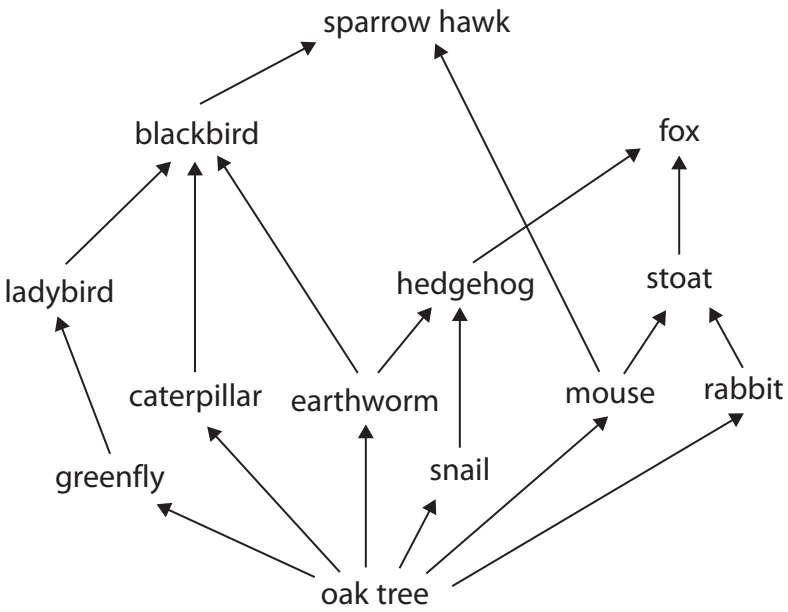
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Pearson

Answer ALL questions.

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 ☒.

1 This food web comes from a woodland ecosystem.



(a) (i) Which organism is the producer?

(1)

☒ **A** caterpillar

☒ **B** earthworm

☒ **C** oak tree

☒ **D** stoat

(ii) Which organism is a secondary consumer?

(1)

☒ **A** caterpillar

☒ **B** earthworm

☒ **C** fox

☒ **D** ladybird

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(iii) Which organism is both a secondary and a tertiary consumer?

(1)

- ☒ **A** blackbird
- ☒ **B** earthworm
- ☒ **C** fox
- ☒ **D** stoat

(b) A farmer is using a pesticide in fields next to the woodland.

The pesticide is reducing the numbers of greenfly and caterpillars in the woodland.

(i) Explain what effect this may have on the blackbirds in the woodland.

(3)

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(ii) Describe a different method the farmer could use to reduce the number of greenfly on his crops.

(3)

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(Total for Question 1 = 9 marks)

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2 A student investigates the effect of different concentrations of sucrose on potato tissue.

The student first makes a series of sucrose solutions using this dilution table.

Test tube	Volume of 1 molar sucrose solution in cm^3	Volume of distilled water in cm^3	Concentration of sucrose solution in mole per litre
1	20	0	1.0
2	16		0.8
3	12	8	0.6
4	8	12	0.4
5	4	16	0.2
6	0	20	0.0

(a) Complete the table by writing the volume of distilled water for test tube 2.

(1)

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(b) This is the student's method.

Step 1 cut six equal-size cylinders of potato each 5 cm in length

Step 2 dry the cut surfaces using filter paper

Step 3 measure the mass of each cylinder

Step 4 place one cylinder of potato in each of the six test tubes containing

- 20 cm^3 of 1 molar (1.0 mole per litre) sucrose solution
- 20 cm^3 of 0.8 molar sucrose solution
- 20 cm^3 of 0.6 molar sucrose solution
- 20 cm^3 of 0.4 molar sucrose solution
- 20 cm^3 of 0.2 molar sucrose solution
- 20 cm^3 of distilled water

Step 5 put a bung in each test tube and leave the test tubes for one hour

Step 6 remove the cylinders from each test tube

Step 7 dry the cylinders with filter paper

Step 8 measure the mass of each cylinder again

Explain the reason for step 7 in the student's method.

(2)

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(c) The table shows the student's results.

Concentration of sucrose solution in mole per litre	Original mass in g	Final mass in g	Change in mass in g	Percentage change in mass (%)
1.0	2.1	1.8	–0.3	–14
0.8	2.1	1.9	–0.2	–9.5
0.6	2.2	2.2	0.0	0.0
0.4	2.2	2.3		
0.2	2.1	2.2	0.1	4.8
0.0	2.1	2.3	0.2	9.5

(i) Calculate the percentage change in mass for the 0.4 mole per litre sucrose solution.

(2)

percentage change = ...%

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(ii) Comment on the effect of the different concentrations of sucrose on the potato tissue.

(5)

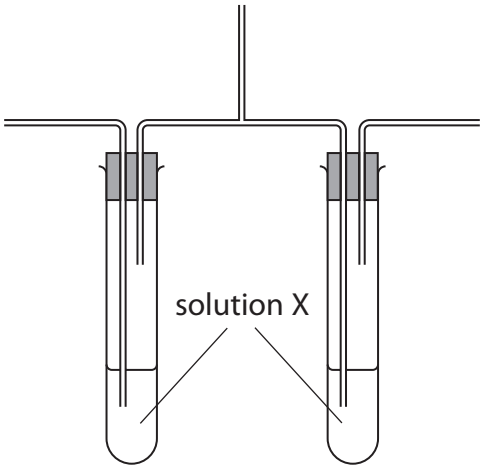
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3 (a) A student investigates the differences between inhaled and exhaled air using this apparatus.



(i) They use solution X to compare the concentration of carbon dioxide in inhaled and exhaled air.

Give the name of solution X.

(1)

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(ii) Explain the changes that will take place in solution X in test tube A and in test tube B.

(3)

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(iii) Other than concentration of carbon dioxide, state one other difference between exhaled air and inhaled air.

(1)

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(b) Another student investigated the effect of the duration of exercise on their breathing rate.

These are their results.

Duration of exercise in seconds	Breathing rate in breaths per minute
0	22
30	26
60	28
90	32
120	35
150	38
180	42
210	40
240	40

(i) Give the independent variable in this investigation.

(1)

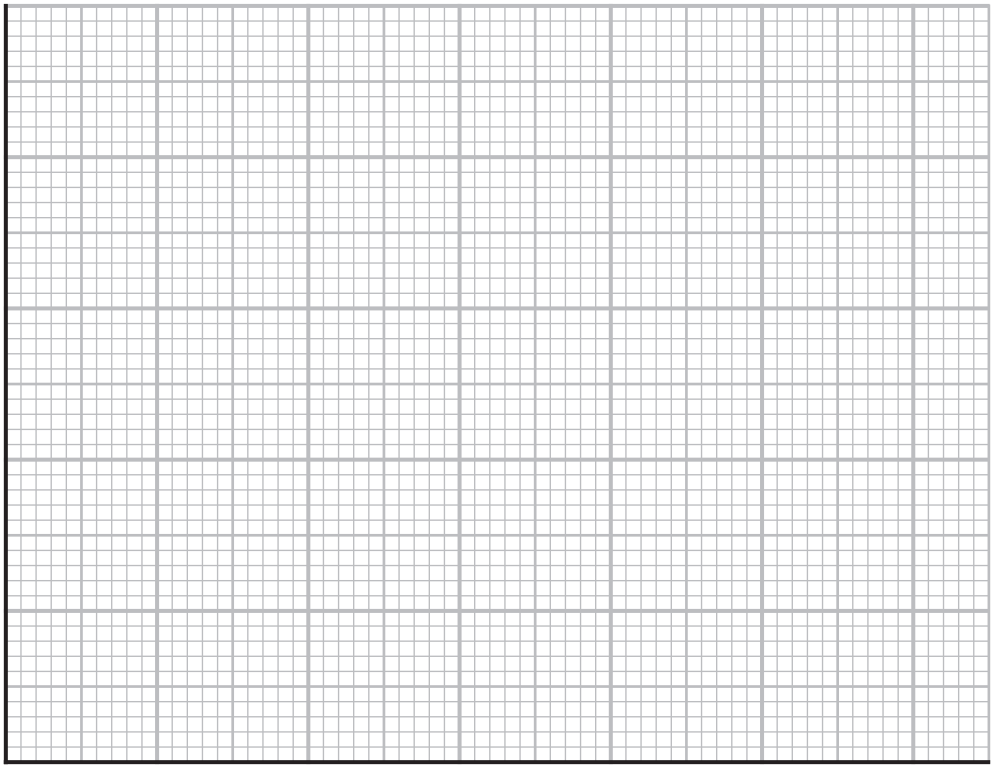
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(ii) Plot a line graph to show the effect of duration of exercise on breathing rate.

Join the points with straight lines.

(5)



(iii) Describe the effect of duration of exercise on breathing rate.

(2)

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(iv) Give one way the student could improve the reliability of their investigation.

(1)

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(Total for Question 3 = 14 marks)

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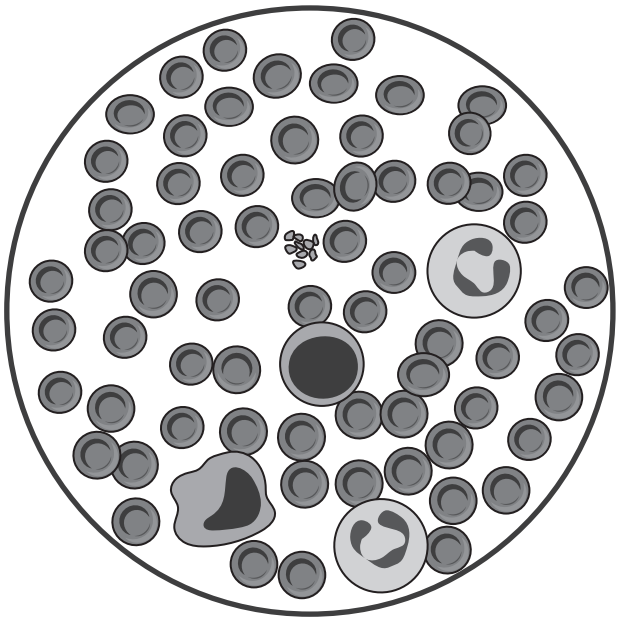
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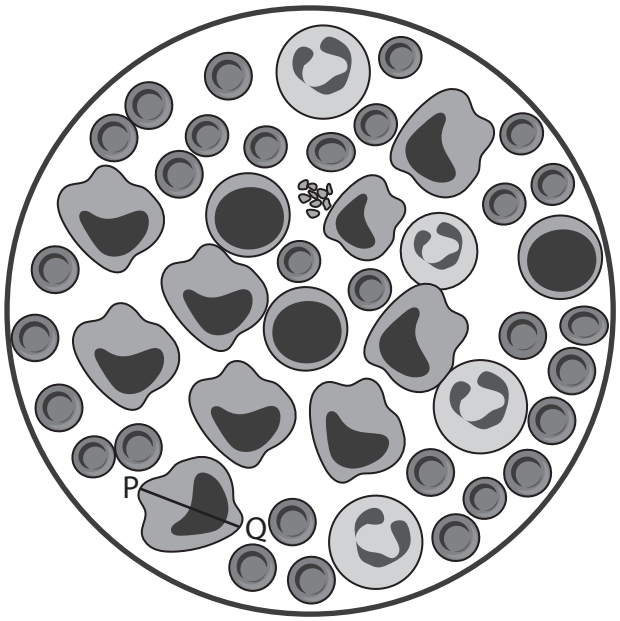
4 The diagram shows two samples of blood seen using a high power microscope.

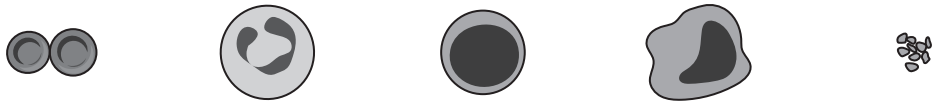
One sample is of normal blood and the other sample is from a patient with a blood condition.

Normal blood



Blood condition





Erythrocytes Neutrophil Lymphocyte Monocyte Platelets

(a) State two differences between the normal blood sample and the sample from the patient with the blood condition.

(2)

1 .....

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2 .....

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(b) The line P–Q shown on the diagram has an actual length of 25 µm.

[1000 µm = 1 mm]

Calculate the magnification of the diagram.

(2)

magnification = × .....

(c) In a healthy person 1 cm^3 of blood contains 5.0×10^9 red blood cells.

An adult has 5.0 litres (5.0 dm^3) of blood in their body.

Calculate the number of red blood cells in the body of a healthy adult.

Give your answer in standard form.

[1 dm^3 = 1000 cm^3]

(2)

number .....

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(d) Using the information from the diagram and your own knowledge, comment on the likely effect of the blood condition on the patient.

(4)

(Total for Question 4 = 10 marks)

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5 Guinea pigs have either long hair or short hair. The hair length is controlled by one gene with two alleles.

The photograph shows a guinea pig with long hair and a guinea pig with short hair.



(Source: © Kallayanee Naloka/Shutterstock)

(a) State what is meant by the term **allele**.

(1)

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(b) A breeder did the following crosses.

Cross 1 a male long-haired guinea pig with a female short-haired guinea pig, this produces five offspring all with short hair

Cross 2 a male short-haired guinea pig with a female long-haired guinea pig, this produces four offspring all with short hair

Cross 3 a male short-haired offspring from cross 1 with a female short-haired offspring from cross 2, this produces some offspring with long hair and some offspring with short hair

(i) Draw a genetic diagram to show the parents, gametes and all possible genotypes and phenotypes of the offspring from cross 3.

(4)

(ii) Calculate the probability that the first offspring born from cross 3 is a male with short hair.

(2)

probability = ...

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(iii) Some short-haired guinea pigs are homozygous and some short-haired guinea pigs are heterozygous.

Explain how a breeder could use a cross to determine the genotype of a short-haired guinea pig.

(2)

(c) Guinea pigs stay completely still and do not move when they sense danger.

Describe how this behaviour has evolved by natural selection.

(4)

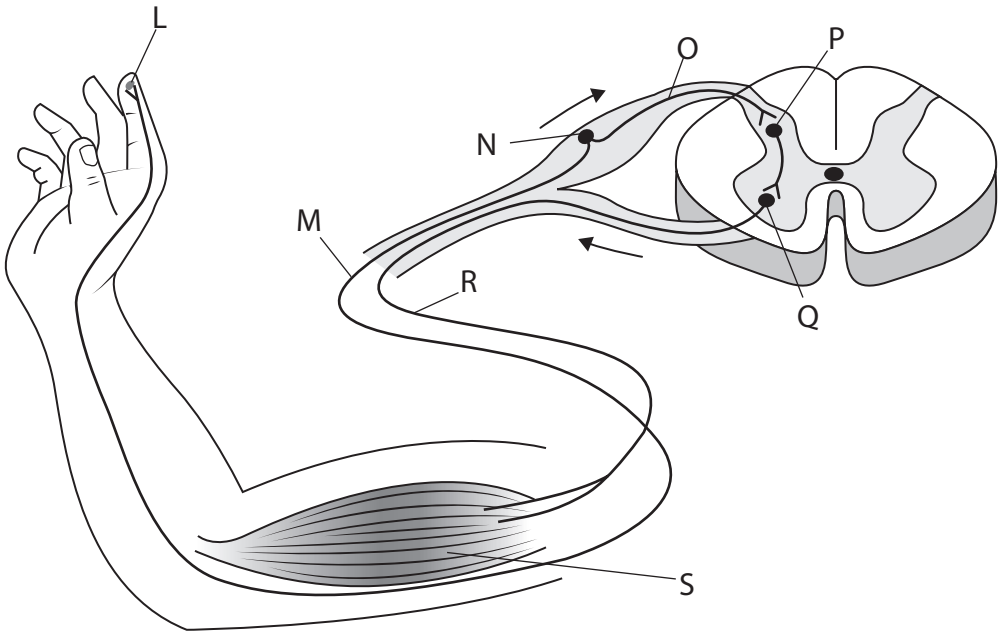
(Total for Question 5 = 13 marks)

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6 The diagram shows a human reflex arc with some structures labelled. It is the withdrawal reflex, which allows a person to remove their hand from a hot object quickly.



(a) (i) Which structure is the sensory receptor?

(1)

- ☒ **A** L
- ☒ **B** P
- ☒ **C** Q
- ☒ **D** S

(ii) Which structure is the cell body of the relay neurone?

(1)

- ☒ **A** L
- ☒ **B** N
- ☒ **C** M
- ☒ **D** P

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(iii) Which structure is the motor neurone?

(1)

- ☒ **A** L
- ☒ **B** M
- ☒ **C** R
- ☒ **D** S

(iv) Which structure is the effector?

(1)

- ☒ **A** L
- ☒ **B** M
- ☒ **C** Q
- ☒ **D** S

(b) A nerve impulse travels at 50 metres per second.

(i) Calculate the time taken for an impulse to travel 180 cm.

(2)

time = ... seconds

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(ii) The length of the nerve pathway in the withdrawal reflex arc is 180 cm.

The time a person takes to remove their hand away from a hot object is called the response time.

Explain why the actual response time is different from the time taken for a nerve impulse to travel 180 cm.

(4)

(Total for Question 6 = 10 marks)

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7 Biologists classify organisms into different groups. Two of these groups are bacteria and fungi.

(a) Complete the passage about bacteria by writing a suitable word or words in each blank space.

(8)

Bacteria are small ..... celled organisms. They have a cell membrane and a cell ....., made of peptidoglycan.

Some bacteria are able to use the energy from the Sun to carry out ..... but other bacteria are ..... and feed on dead and decaying organisms.

Bacterial cells do not have a nucleus but most of their genetic material is contained in a circular ..... of DNA. They also have small circles of DNA called ..... in their cytoplasm.

Some bacteria are used by humans in food production. An example is using ..... to make yoghurt.

Other bacteria, such as *Pneumococcus*, cause disease and so are called ..... .

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(b) A microscopic single-celled fungus, yeast, is used in the production of bread.

Describe how yeast is used to produce bread.

(4)

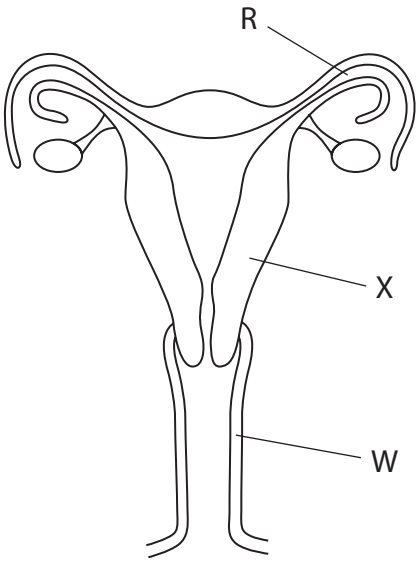
(Total for Question 7 = 12 marks)

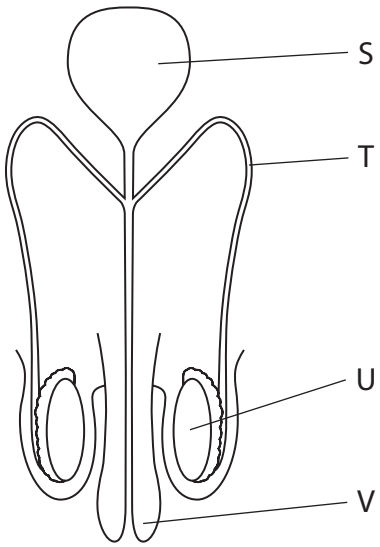
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8 The diagrams show the female reproductive system and the male reproductive system with some structures labelled.





(a) (i) Which structure produces gametes?

(1)

- ☒ **A** R
- ☒ **B** S
- ☒ **C** U
- ☒ **D** X

(ii) Which structure is the site of fertilisation?

(1)

- ☒ **A** R
- ☒ **B** S
- ☒ **C** W
- ☒ **D** X

(iii) In which structure does the placenta usually develop?

(1)

- ☒ **A** R
- ☒ **B** S
- ☒ **C** W
- ☒ **D** X

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(b) Some males have an operation called a vasectomy. This means that they do not release sperm.

This involves cutting and sealing the sperm ducts (vas deferens) inside the man's scrotum.

(i) On the diagram draw two lines to show where the cuts are made.

(1)

(ii) Explain why this operation can be used as a permanent way of preventing pregnancy.

(2)

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(c) Female sterilisation is another operation that can be used as a permanent way of preventing pregnancy. This involves cutting and sealing the fallopian tubes (oviducts).

Scientists compared female and male sterilisation, looking at the outcomes of the operations.

This is their data.

Outcome	Values are per 100 000 operations	
	female sterilisation	male sterilisation
number of deaths during operation	2.29	0
number of deaths following operation	0.06	0
number of major complications	6170	43
number of sterilisation failures	326	160
short-term costs in millions of US dollars	198.5	49.5

The scientists concluded that male sterilisation should be recommended for most couples considering a permanent way of preventing pregnancy.

Discuss this conclusion using data from the table.

(4)

(Total for Question 8 = 10 marks)

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9 Farmers and scientists have worked together for the last 50 years to develop crop plants and farm animals with desired characteristics.

(a) Explain why selective breeding with crop plants is easier and quicker than selective breeding with farm animals.

(3)

(b) Selective breeding in cattle has been used to improve features such as higher milk yield, longer life and increased muscle mass.

Describe how selective breeding can be used to improve milk yield in dairy cattle.

(4)

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(c) Scientists and farmers are also selecting animals based on behaviour and temperament.

(i) Suggest why an animal with a calmer temperament may be more suitable for the farmer on a dairy farm.

(2)

(ii) Cattle behaviour is also affected by the hormone adrenaline. When cattle are more stressed, they have higher levels of adrenaline.

The effect of adrenaline on the cattle nervous system is similar to the effect of adrenaline in humans.

Describe the production of adrenaline and its effects on the body.

(4)

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(iii) Stress in cattle can also affect their reproductive system, leading to damage to the placenta.

Describe the role of the placenta in reproduction.

(3)

(Total for Question 9 = 16 marks)

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10 Plants absorb light energy for photosynthesis.

Some colours of light result in a higher rate of photosynthesis than other colours of light.

Devise an investigation to discover which colour of light results in a higher rate of photosynthesis.

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

(6)

(Total for Question 10 = 6 marks)

TOTAL FOR PAPER = 110 MARKS

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