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 | | | | |

Monday 1 June 2020

Afternoon (Time: 1 hour 15 minutes) | Paper Reference **4BI1/2B**

Biology

Unit: 4BI1

Paper: 2B

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 70.
- 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.

Turn over ▶

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P 6 2 0 3 9 R A 0 1 2 0

Pearson

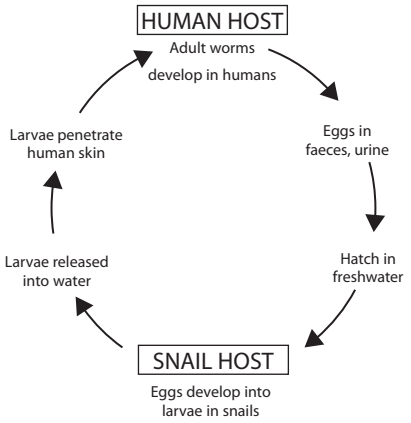
Answer ALL questions.

1 Read the passage below. Use the information in the passage and your own knowledge to answer the questions that follow.

Schistosomiasis

Schistosomiasis is an infection caused by a parasitic worm called a schistosome. The immature or larvae of the worm live in rivers and lakes in tropical parts of the world.

The diagram shows the life cycle of the schistosome worm.



Some people in tropical parts of the world use water from these rivers and lakes for their daily lives. These people risk infection because the larvae burrow into their skin. The larvae are then transported to other parts of the body where they damage organs such as the kidneys, intestines, lungs and brain. The larvae develop into adult worms.

The adult worms lay eggs in the human body. Some of these eggs are destroyed by the immune system, but most eggs survive. These eggs can get into water if faeces or urine from infected people pass into rivers or lakes. In the water, the eggs develop into small larvae which grow inside freshwater snails. Larvae are released from the snails and infect any person they contact. These larvae develop into adult worms inside the human body.

Doctors diagnose schistosomiasis when they find eggs in the faeces or urine of infected people. Infected people also have blood cells in their urine and antibodies for the pathogen in their blood.

At present, the drug praziquantel is used to kill the worms. A dose of 0.040 g per kg of body mass is usually effective. With no treatment, affected organs can be permanently damaged, leading to death. It is estimated that 240 million people (in the world) have schistosomiasis. Every year 8×10^{-4} per cent of infected people die from the disease.

A vaccine is being developed using a plasmid. The plasmid has DNA inserted that makes a protein found on the body surface of the adult schistosome worm.

In one investigation, a vaccine made using the DNA plasmid was given to a group of infected people. The results showed a mean number of 21.53 worms per person in this group. In the control group, a mean number of 40.53 worms per person was found.

(a) Which process is affected if kidneys are damaged (line 8)?

(1)

- ☒ **A** digestion
- ☒ **B** mutation
- ☒ **C** ultrafiltration
- ☒ **D** vaccination

(b) Suggest three ways to reduce the risk of being infected by schistosomes.

(3)

1 .....

.....

2 .....

.....

3 .....

.....

(c) Name two different blood cells that would be found in the urine of infected people (line 17).

(2)

1 .....

2 .....

(d) An infected person has a body mass of 120 kg.

What dose of drugs would be effective for this person (lines 19 to 20)?

(1)

- ☒ **A** 0.04 mg
- ☒ **B** 4.8 mg
- ☒ **C** 40 mg
- ☒ **D** 4800 mg

(e) Using the estimated number of people in the world who have schistosomiasis (lines 21 to 22), calculate the number of people who die each year from schistosomiasis.

(2)

number = ...

(f) Which of these is the correct description of a plasmid?

(1)

- ☒ **A** a circle of DNA
- ☒ **B** a circle of mRNA
- ☒ **C** a circle of protein
- ☒ **D** a circle of tRNA

(g) Explain how a vaccine could protect people from schistosomiasis (lines 24 to 25).

(3)

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.....

(h) (i) Suggest what is given to the control group (lines 27 to 29).

(1)

.....

.....

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(ii) A scientist claims that the investigation proves the vaccine is effective against schistosomiasis (lines 27 to 29).

Comment on this claim.

(3)

(Total for Question 1 = 17 marks)

2 Blood clotting is an important process in humans.

The process is controlled by enzymes.

(a) (i) Give two reasons why blood clotting is important.

(2)

1 .....

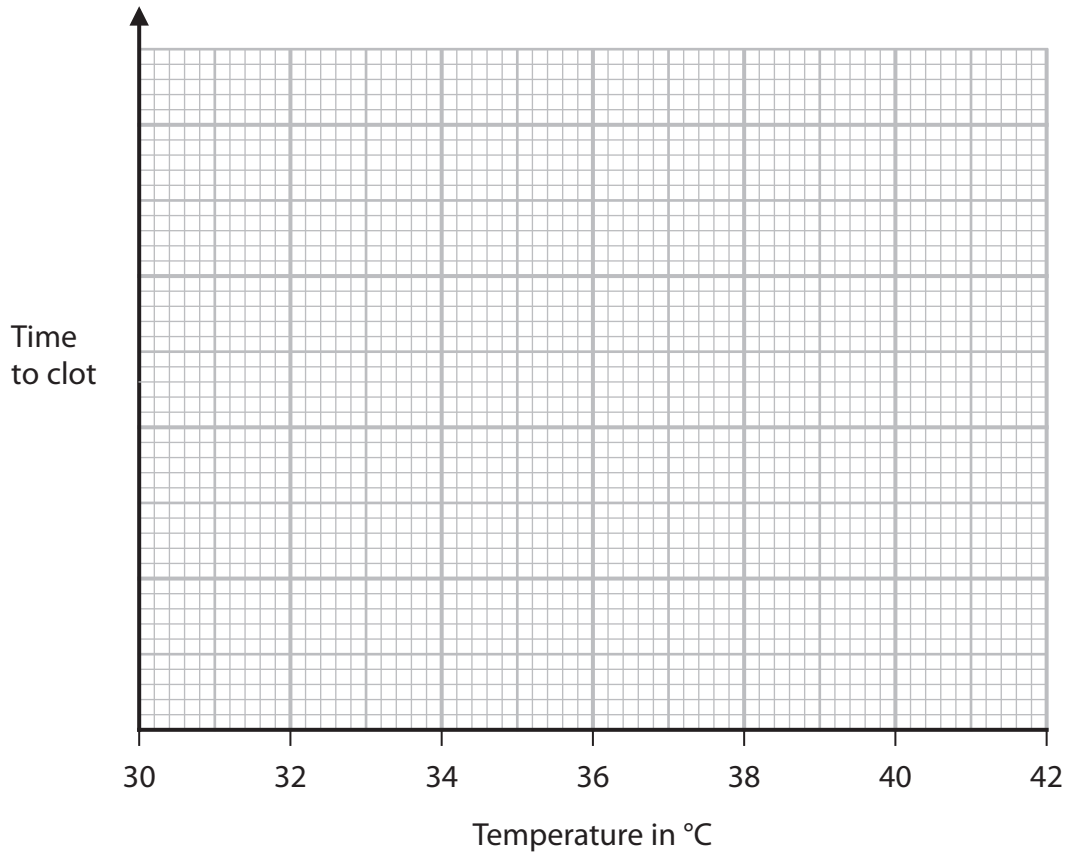
.....

2 .....

.....

(ii) The optimum temperature for the enzymes involved in blood clotting is 37 °C.
Sketch a graph to show how temperature affects the time taken for blood to clot.

(1)



(b) Some people cannot make the proteins needed for blood clotting.

Cloning is used to produce large numbers of transgenic mammals.

These transgenic mammals can make the human blood-clotting proteins. The human blood-clotting proteins can then be removed from the mammals' milk and injected into people who cannot make the proteins.

(i) Explain why these mammals are described as transgenic.

(2)

(ii) Describe how a mammal is cloned.

(6)

(Total for Question 2 = 11 marks)

3 The brain is part of the central nervous system.

(a) Name the other part of the central nervous system.

(1)

.....

(b) Huntington's disease (HD) is caused by a mutation in the gene for making a protein called huntingtin.

This protein damages nerve cells in the brain.

HD is caused by a dominant allele.

A heterozygous parent and a homozygous recessive parent have a child.

(i) What is the probability of this child having HD?

(1)

☒ **A** 0.0

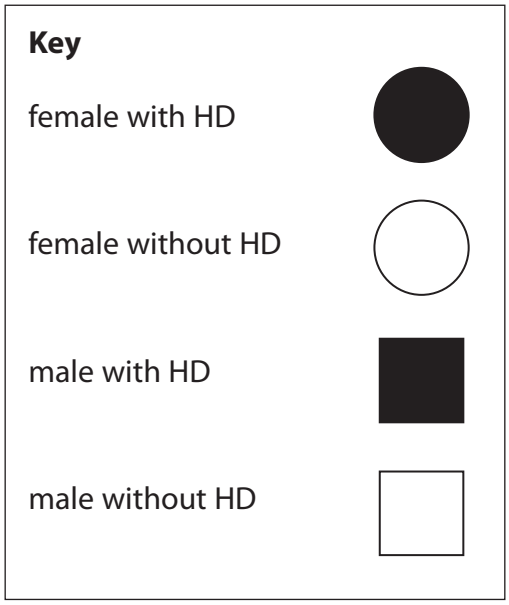
☒ **B** 0.25

☒ **C** 0.5

☒ **D** 1.0

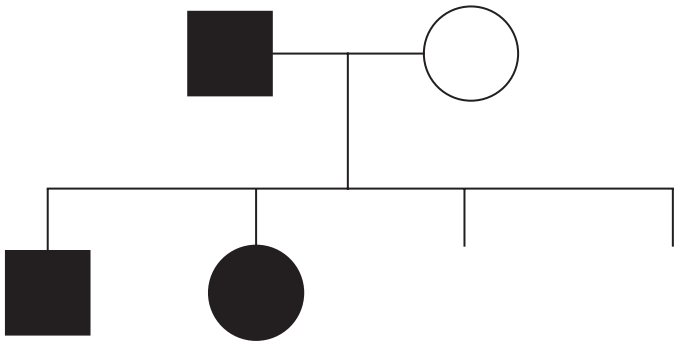
(ii) These parents have three more children.

The key shows the possible sex and phenotype of the individuals with or without HD.



The family pedigree gives the predicted sex ratio and the predicted phenotype ratio for two of the children. Complete the family pedigree by giving the predicted sex ratio and predicted phenotype ratio for the other two children.

(2)



(c) A drug can reduce the damage to nerve cells in the brains of people with HD.

The drug binds to messenger RNA produced by the mutated gene for huntingtin protein.

Suggest ways that this drug reduces damage to nerve cells in people with HD.

(3)

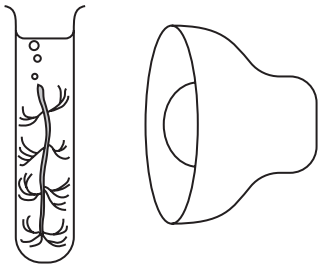
(Total for Question 3 = 7 marks)

4 A student investigates the effect of different colours of light on the rate of photosynthesis in a water plant.

This is the student's method.

- place a 1% sodium hydrogen carbonate solution in a boiling tube
- cut a 5 cm length of pondweed and place it in the tube
- place a lamp 10 cm from the tube containing the pondweed
- leave the pondweed for 10 minutes until it starts to produce bubbles from the cut end
- count the bubbles produced in one minute
- count the bubbles for two more one minute periods

The student repeats the experiment three more times using filters in front of the lamp that let through either red light, blue light or green light.



These are the student's results.

Colour of filter	Number of bubbles per minute			
	Test 1	Test 2	Test 3	Mean
no filter	47	84	80	
red	48	48	42	46
blue	55	56	50	54
green	9	8	10	9

(a) Write the balanced symbol equation for photosynthesis.

(2)

(b) (i) Anomalous results are not included in the calculation of the mean.

Calculate the mean number of bubbles per minute for the lamp with no filter.

(2)

number = ... bubbles per minute

(ii) Explain the student's results.

(4)

(iii) Give two abiotic variables that the student should control in her experiment.

(2)

1 .....

2 .....

(c) (i) Explain why measuring the rate of photosynthesis by counting bubbles may not be an accurate method to use.

(2)

(ii) Suggest an alternative method that the student could use to measure the rate of photosynthesis in her experiment.

(2)

(Total for Question 4 = 14 marks)

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5 (a) The table gives information about some hormones involved in the menstrual cycle.

Complete the table by giving the missing information.

(6)

Hormone	Name of structure that secretes hormone	Functions of hormone
FSH	.....	1 ..... 2 stimulates oestrogen secretion
.....	pituitary	1 ..... 2 stimulates development of corpus luteum
.....	ovaries	1 repairs lining of uterus 2 stimulates LH secretion
progesterone	.....	1 maintains the lining of uterus 2 inhibits LH

(b) State what is meant by the term **menstruation**.

(1)

.....

.....

(c) A girl starts to ovulate at the age of 12 years and continues to ovulate until she reaches the age of 51 years.

[Assume her menstrual cycle is 28 days and she releases one egg per cycle.]

Estimate the maximum number of eggs she could release in her lifetime.

Give your answer to two significant figures.

(3)

number of eggs = ...

(d) Give a reason why a female does not produce as many offspring as the number of eggs she releases.

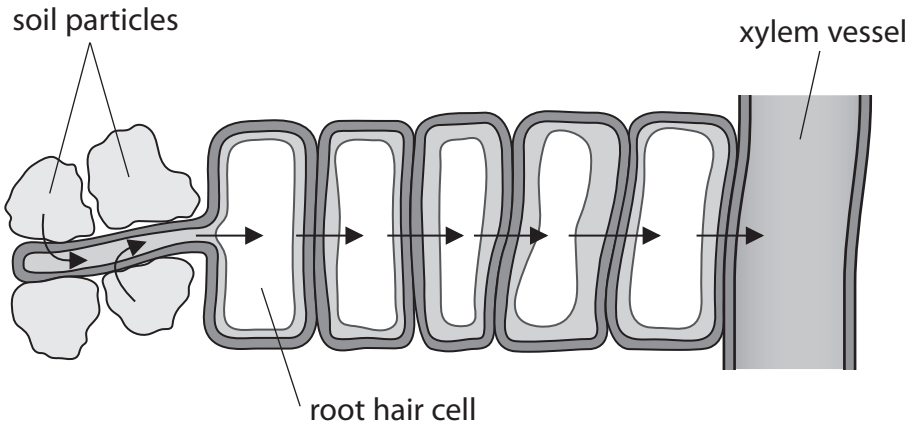
(1)

.....

.....

(Total for Question 5 = 11 marks)

6 The diagram shows the path that the water takes when it is absorbed from the soil into the xylem of a plant.



(a) (i) Explain how root hair cells are adapted for efficient absorption of water.

(2)

(ii) Explain how water is transported from the soil to the leaves.

(4)

(b) Describe how you could determine the rate of water loss from a leafy shoot.

(4)

(Total for Question 6 = 10 marks)

TOTAL FOR PAPER = 70 MARKS