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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 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.
- Good luck with your examination.

Turn over ▶

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Answer ALL questions.

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

Male contraception

Hormonal contraception has been used by women for many years to control their fertility. A recent study investigated a new contraceptive injection to be used by men.

The study was done in seven different countries: the United Kingdom, Australia, Germany, Italy, India, Indonesia and Chile. The researchers investigated a total of 320 healthy men aged between 18 and 45, all with female partners aged between 18 and 38.

All the men had normal sperm counts and produced sperm with no abnormalities in shape or movement. They had no sexually transmitted infections and no medical or mental health illnesses. Their female partners were healthy and did not intend to become pregnant within the next two years. They were willing to accept a low, but unknown, chance of becoming pregnant.

The study had two phases. These were the initial suppression phase lasting 26 weeks, followed by a contraceptive effectiveness testing phase lasting just over one year. In the suppression phase, the men were given injections of a drug called progestin and the hormone testosterone. This was repeated at 8, 16 and 24 weeks. Progestin inhibits sperm production and reduces the release of testosterone. Semen samples were collected every two weeks to monitor the sperm count. During this phase, couples had to use alternative barrier methods of contraception, such as condoms.

When a man had produced two consecutive semen samples with a sperm count of less than one million per cm^3, they began the contraceptive effectiveness testing phase. During this phase, the men continued to receive regular injections every eight weeks for just over one year. Semen samples were taken at the same time as each injection to monitor the sperm count. If the sperm count went above one million per cm^3, the injections were stopped. At this point the men left the trial and other methods of contraception were resumed.

The contraceptive injections prevented pregnancies in the partners of 98.4% of the men. However, a number of men reported side effects. For example, just under half of the men developed acne (skin infections and irritation) and one in five reported mood disorders. In approximately 5% of the men, their sperm count had not returned to normal one year after stopping the injections. Despite the side effects, more than three-quarters of the men, and their partners, said they would be happy to continue to use this new method of contraception.

The scientists concluded that this was a valuable early-stage trial that gave a good indication of the potential safety and effectiveness of the progestin and testosterone injections for male contraception.

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(a) Suggest why the men in the study had to be able to produce sperm with no abnormalities in shape or movement (lines 8 and 9).

(2)

(b) (i) The contraceptive injection contained the drug progestin (lines 15 and 16).

Progestin is similar in structure and function to progesterone.

Describe the roles of progesterone in the human female body.

(2)

(ii) Suggest why the injections also contain the hormone testosterone (lines 15 and 16).

(1)

(iii) State where in the male body testosterone is produced.

(1)

(c) (i) Give the purpose of the initial suppression phase of the study (line 13).

(1)

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(ii) State why the sperm count is monitored during the suppression phase (lines 18 and 19).

(1)

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(iii) State why alternative contraception was used during the suppression phase (lines 19 and 20).

(1)

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(d) Suggest why sperm count continues to be monitored during the testing phase (lines 25 and 26).

(1)

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(e) Calculate the number of men whose partners became pregnant during the study (lines 6 and 28).

(2)

number of men = ...

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(f) Evaluate the use of progestin and testosterone injections as a method of contraception.

(4)

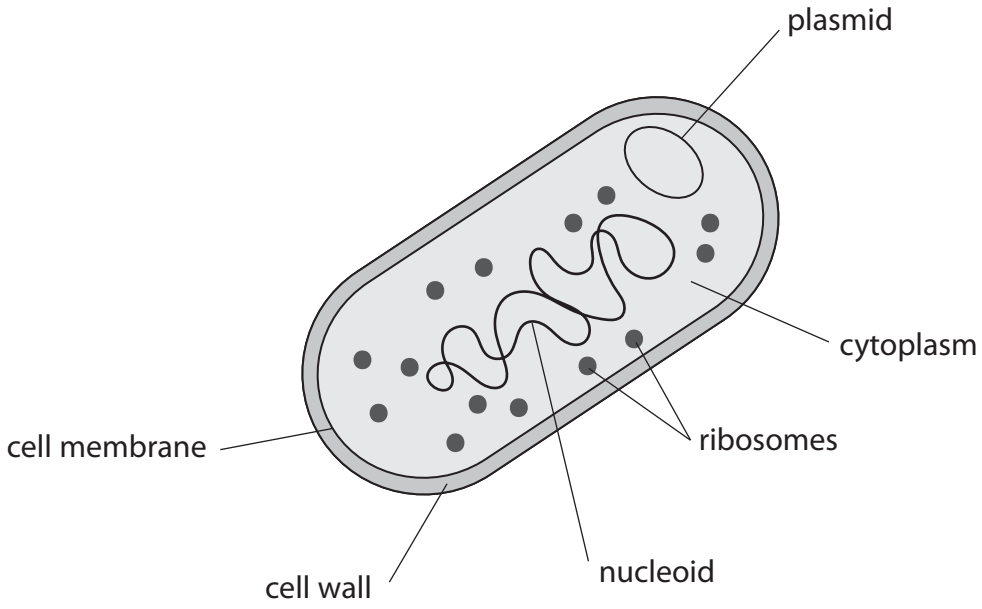
(Total for Question 1 = 16 marks)

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2 *P. multocida* is a bacterium that causes cholera in chickens.

The diagram shows the bacterium.



(a) Give two structures in this bacterium that are also found in all eukaryotic cells.

(2)

1 .....

2 .....

(b) Scientists investigated the survival of chickens injected with normal *P. multocida* or with weakened *P. multocida*.

The table shows the scientists' results.

Type of injection	Result
normal *P. multocida*	chickens die
weakened *P. multocida*	chickens stay alive

(i) What is a correct conclusion about *P. multocida* from these results?

(1)

☒ **A** they are decomposers

☒ **B** they are pathogens

☒ **C** they are microscopic

☒ **D** they are non-living

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(ii) The scientists took the living chickens that had been injected with weakened *P. multocida* and then injected them with normal *P. multocida*.

The chickens did not die, as they were now immune.

Explain why these chickens did not die.

(4)

(Total for Question 2 = 7 marks)

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3 Plant root hair cells absorb water from the soil by osmosis.

(a) (i) Explain how the structure of a root hair cell is adapted to absorb water.

(2)

(ii) Give one difference between osmosis and diffusion.

(1)

(b) A student investigates the effect of light on the volume of water taken up and lost by a plant shoot in one hour.

The table shows the student's results.

	Volume of water in cm^3	
	taken up	**lost**
Dark	2.0	1.6
Light	10.2	9.1

(i) Explain these results.

(3)

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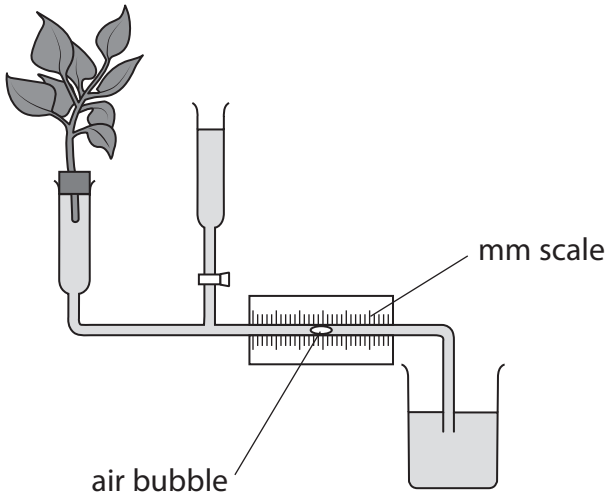
(ii) Give two abiotic variables the student should control.

(2)

1 .....

2 .....

(c) Another student uses this apparatus and a stop clock to find the mean (average) rate of water taken up by a plant shoot.



(i) Name the apparatus used by the student.

(1)

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(ii) Describe how the student could use this apparatus to find the mean rate of water taken up by the plant.

(3)

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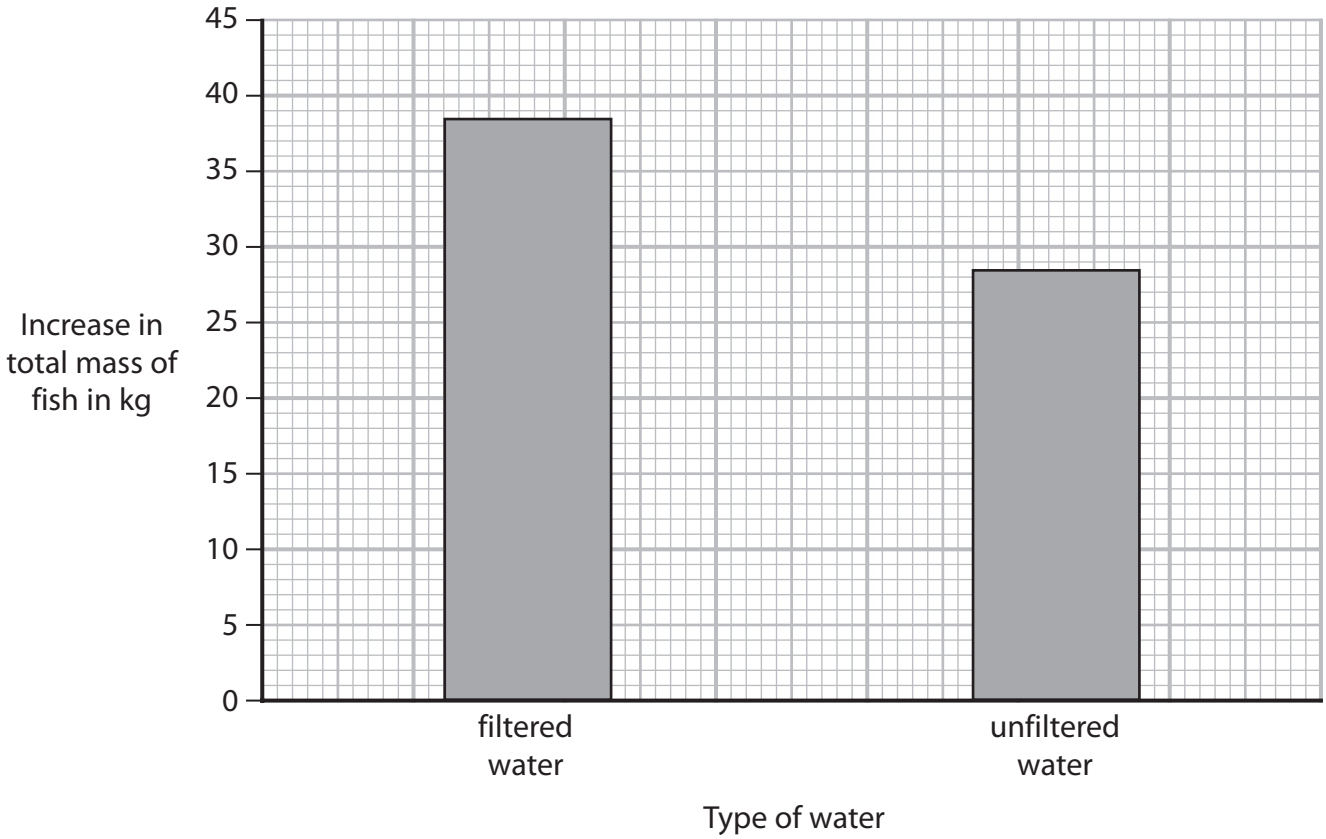
(Total for Question 3 = 12 marks)

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4 A scientist uses this method to investigate the effect of water quality on the growth of fish.

- fill a pond with filtered water
- fill another pond with unfiltered water
- place the same mass of fish of the same species in each pond
- determine the increase in total mass of fish in each pond after 180 days

The graph shows the scientist's results.



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(a) The mean rate of increase in total mass of the fish in the filtered water is 0.214 kg per day.

Calculate the difference between the mean rate of increase in the total mass of the fish in filtered and unfiltered water.

(3)

difference in mean rate = ... kg per day

(b) Unfiltered water contains more bacteria.

Explain why unfiltered water containing more bacteria affects the growth of fish.

(3)

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(c) Give one biotic variable the scientist controlled in the investigation.

(1)

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(d) Give a method the scientist could use to control interspecific predation in the ponds.

(1)

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(Total for Question 4 = 8 marks)

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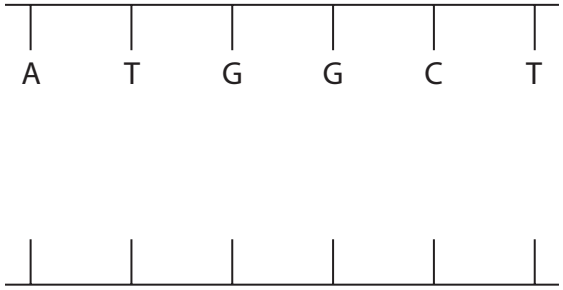
5 Decomposer bacteria are involved in the nitrogen cycle.

The bacteria release an enzyme called urease.

(a) The diagram shows part of one strand of DNA used to make urease.

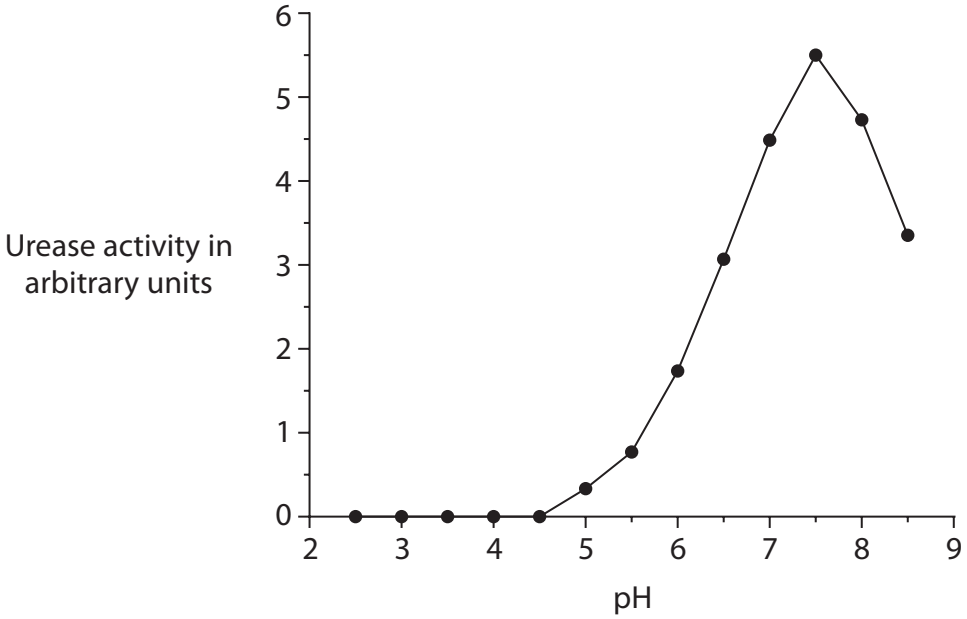
Complete the diagram by giving the missing bases on the other strand of DNA.

(1)



(b) Urease acts on urine to produce ammonia.

The graph shows how pH affects the activity of urease.



(i) Which of these is the optimum pH for urease?

(1)

☒ **A** 2.5

☒ **B** 4.5

☒ **C** 7.5

☒ **D** 8.5

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(ii) Explain the activity of urease at pH 8.5

(2)

(c) Describe the role of the other bacteria involved in the nitrogen cycle.

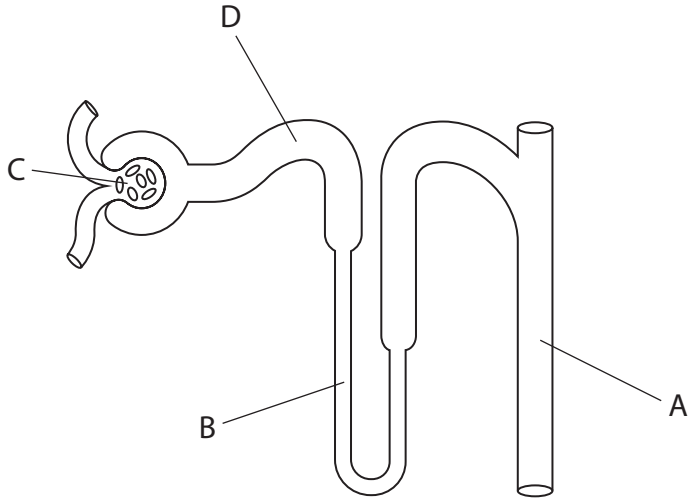
(5)

(Total for Question 5 = 9 marks)

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6 The diagram shows a nephron of a kidney, with some of the structures labelled.



(a) (i) From which structure are substances forced out of the blood by ultrafiltration?

(1)

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

(ii) From which structure is glucose reabsorbed into the blood by selective reabsorption?

(1)

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

(b) In homeostasis, the kidney is involved in the control of blood concentration.

(i) State the name for the control of blood concentration.

(1)

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(ii) Another function carried out by the kidney is excretion.

State what is meant by the term excretion.

(1)

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(c) Diabetes insipidus is a medical condition in which the body is unable to produce ADH.

Explain how diabetes insipidus affects the control of blood concentration.

(4)

(d) Desmopressin is a drug used to reduce the symptoms of diabetes insipidus.

(i) Suggest what effect the drug would have on the nephron.

(1)

(ii) Describe the effects the drug would have on urine production.

(2)

(Total for Question 6 = 11 marks)

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7 The biodiversity in an ecosystem can be determined by counting the number of different species present and the number of individuals of each species present.

(a) Give the term that describes the number of individuals of one species present in a habitat at one time.

(1)

.....

(b) Students compared the biodiversity of two fields, A and B.

They determined the number of individual plants of three species in each field.

They also calculated the percentage of each species of plant compared to the total number of plants of all three species for each field.

The table shows the results.

Species	Field A		Field B	
	Number of each plant	Percentage (%) of each species	Number of each plant	Percentage (%) of each species
daisy	19	76	15	
dandelion		16	18	38
buttercup		8	14	30
total	25	100	47	100

(i) Complete the table by calculating the missing values.

(2)

(ii) Explain which field has the greater biodiversity.

(2)

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(c) Explain how a shortage of one named mineral could affect the size of plants in the fields.

(2)

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(Total for Question 7 = 7 marks)

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