Biology

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

Total Marks

Time: 2 hours

In the boxes below, write your name, centre number and candidate number.

Surname	
Other names	
Centre Number	
Candidate Number	

X72471A

Pearson

YOU MUST HAVE

Ruler, calculator

YOU WILL BE GIVEN

Diagram Booklet

INSTRUCTIONS

Answer ALL questions.

Answer the questions in the spaces provided in this Question Paper or in the separate Diagram Booklet – there may be more space than you need.

If pencil is used for diagrams / sketches / graphs it must be dark (HB or B).

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.

There may be spare copies of some diagrams.

Turn over

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.

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 **Look at the diagram for Question 1 in the Diagram Booklet. It shows a flower from an apple tree, with some structures labelled.**

(a) (i) **This apple tree is able to self-pollinate. Which is the correct transfer of pollen during pollination?**
(1 mark)

☐ **A** **P to Q**

☐ **B** **P to T**

☐ **C** **V to P**

☐ **D** **V to S**

1(a)   continued.

(ii)   Which structure does the pollen tube grow down?
(1 mark)

☐ **A   Q**

☐ **B   U**

☐ **C   V**

☐ **D   R**

(continued on the next page)

1(a)   continued.

(iii) **Which structure develops into the seed?**
(1 mark)

☐ **A   P**

☐ **B   S**

☐ **C   T**

☐ **D   V**

(continued on the next page)

1 continued.

(b) The flower from an apple tree is insect-pollinated.

Give three differences between the structure of this apple flower and the structure of a wind-pollinated flower such as grass.
(3 marks)

Answer lines continue on the next page.

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1(b)   continued.

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1   continued.

(c) **The seeds of many plants are surrounded by sweet-tasting fruit.**

Suggest how this enables the plants to spread their seeds.
(2 marks)

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(Total for Question 1 = 8 marks)

Turn over

2 Look at the diagram for Question 2 in the Diagram Booklet. It shows a transverse section through a human heart.

(a) (i) Draw an X on the diagram to show the position of the septum.
(1 mark)

(ii) State two differences between the composition of the blood in the coronary artery and the composition of the blood in the coronary vein.
(2 marks)

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2 _____

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(continued on the next page)

2(a)   continued.

(iii) **Explain the differences between the left ventricle wall and the right ventricle wall. (3 marks)**

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(continued on the next page)

2   continued.

(b) The development of coronary heart disease is linked to a number of factors.

Explain how these factors can increase the risk of developing coronary heart disease.
(4 marks)

Answer lines continue on the next page.

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2(b)   continued.

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(Total for Question 2 = 10 marks)

3   The table shows the nutritional content of two non-dairy milk products, oat milk and almond milk.

Oat milk	Almond milk
225 g	225 g
502 kJ	251 kJ
5 g fat (0·5 g saturated)	2·5 g fat (0·5 g saturated)
100 mg sodium	150 mg sodium
16 g carbohydrate	8 g carbohydrate
of which 7g is sugar	of which 7g is sugar
2 g fibre	1 g fibre
2 g protein	1 g protein

(a) (i)   A person is told by their doctor that they need to lose weight. Use the information from the milk contents and your own knowledge to discuss which milk would be the most suitable for this person.
(5 marks)

Answer lines continue on the next 2 pages.

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3(a)(i)   continued.

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3(a)(i) continued.

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3(a)   continued.

(ii) **Suggest why a person might drink a non-dairy milk such as oat or almond milk rather than cow's milk.**
(1 mark)

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(continued on the next page)

3 **continued.**

(b) **Describe how a student could test a milk sample for glucose.**
(2 marks)

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3   continued.

(c) Human breast milk contains special proteins that give immunity to the baby.

Explain how these proteins can help protect the baby from disease.
(3 marks)

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3(c)   continued.

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(Total for Question 3 = 11 marks)

4   Look at the images for Question 4 in the
      Diagram Booklet.

      The peppered moth is found in many countries.

      Two different forms of the peppered moth are a
      light-coloured moth and a dark-coloured moth.

      The dark-coloured moth was first observed in cities
      when pollution, from burning coal, stained tree
      trunks black.

(continued on the next page)

4   continued.

Scientists trapped moths in a city location from 1992 to 1998.

The table shows the scientists' results.

Year	Number of light-coloured moths	Number of dark-coloured moths
1992	9	27
1993	11	18
1994	11	7
1995	5	1
1996	1	4
1997	8	1
1998	13	9

(continued on the next page)

4   continued.

(a) Calculate the difference between the percentage of moths that are dark-coloured in 1992 and the percentage of moths that are dark-coloured in 1998.
(3 marks)

difference = _____%

(continued on the next page)

4 **continued.**

(b) (i) Look at the grid for Question 4(b)(i) in the Diagram Booklet. Plot a line graph to show the number of light-coloured moths and the number of dark-coloured moths from 1992 to 1998.

Use a ruler to join the points with straight lines.
(5 marks)

(continued on the next page)

4(b)   continued.

(ii) In the 1990s, many cities introduced laws that prevented the burning of coal.

Comment on the changes in the number of light-coloured moths and the number of dark-coloured moths between 1992 and 1998. (5 marks)

Answer lines continue on the next 2 pages.

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4(b)(ii)   continued.

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4(b)(ii)   continued.

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(Total for Question 4 = 13 marks)

5 The chromosomes in a human cell can be photographed and then arranged in pairs to show the karyotype.

White blood cells are often used to show the chromosomes in the karyotype.

The chromosomes in white blood cells are larger and easier to see when the white blood cells divide.

Look at Diagram 1 for Question 5(a) in the Diagram Booklet. It shows a karyotype.

(a) (i) Explain why a red blood cell cannot be used to show a karyotype.
    (2 marks)

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Turn over

5(a)   **continued.**

   (ii) State the type of cell division that occurs in white blood cells.
   (1 mark)

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   (iii) The karyotype in diagram 1 is from a male.

   State how this can be deduced from the diagram.
   (1 mark)

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(continued on the next page)

Turn over

5   continued.

(b) Look at Diagram 2 for Question 5(b) in the Diagram Booklet. It shows a karyotype from a white blood cell of another person.

The karyotype is from a female, and the person has a condition called Turner syndrome.

This condition affects the development of the ovaries so they may not produce normal quantities of sex hormones.

(i)   Comment on the differences between the karyotypes shown in diagram 1 and diagram 2 and the effects Turner syndrome will have on the person.

Use information from the question and your own knowledge in your answer.
(4 marks)

Answer lines continue on the next page.

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5(b)(i)   continued.

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5(b) **continued.**

    (ii) **Suggest how the difference in the chromosomes of people with Turner syndrome may have been produced.**
        (1 mark)

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(Total for Question 5 = 9 marks)

6   A student uses this method to investigate osmosis in potato tissue.

- cut three 5·0 cm long cylinders from a raw potato

- dry the cut surfaces using filter paper

- measure the mass of each cylinder using a balance

- place one cylinder in a test tube containing $10\,cm^3$ of concentrated sucrose solution, one cylinder in a test tube containing $10\,cm^3$ of distilled water and one cylinder in an empty test tube

- put a bung in each test tube and leave them for one hour

- remove the cylinders and dry them with filter paper

- measure the mass of each cylinder again

- measure their lengths using a ruler

Look at the diagram for Question 6 in the Diagram Booklet.

Turn over

6 **continued.**

    (a) **(i)** **Describe what is meant by the term OSMOSIS.**
            (2 marks)

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       (ii) **State the independent variable in the student's investigation.**
              (1 mark)

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6 continued.

(b) Osmosis is affected by the surface area and volume of the cylinders, so the student keeps the original surface area and volume of each cylinder the same.

At the start of the experiment each cylinder had a radius of 0·25 cm and a length of 5·0 cm.

(i) Calculate the surface area of each cylinder using this formula.
(2 marks)

surface area = $2\pi rl + 2\pi r^2$

[l = length of cylinder, r = radius of cylinder and π = 3·14]

surface area = _____ cm^2

(continued on the next page)

6(b) **continued.**

    (ii) **Explain how surface area would affect the rate of osmosis.**
        (2 marks)

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    (iii) **State another variable the student should control in the investigation.**
        (1 mark)

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Turn over

6 **continued.**

(c) **The table shows the student's results for the mass of the cylinders.**

Tube contents	Original mass in g	Final mass in g	Change in mass in g
concentrated sucrose solution	2·1	1·8	–0·3
distilled water	2·1	2·3	0·2
air	2·2	2·1	–0·1

(i) **Explain the changes in the mass of the potato cylinder in each test tube.**
(3 marks)

Answer lines continue on the next page.

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6(c)(i)   continued.

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6(c)   continued.

(ii) **The student also measured the change in length of each potato cylinder.**

Assuming the length has the same percentage change as the mass, calculate the final length of the cylinder in the concentrated sucrose solution.
(3 marks)

length = _____ cm

(Total for Question 6 = 14 marks)

7   Look at the diagram for Question 7 in the Diagram
     Booklet. It shows a food web from an ecosystem
     in Africa.

     (a) (i)   Which organism is a primary consumer?
                (1 mark)

                ☐ A   acacia

                ☐ B   lion

                ☐ C   star grass

                ☐ D   zebra

          (ii) Which of these has the least efficient
                energy transfer?
                (1 mark)

                ☐ A   giraffe to cheetah

                ☐ B   star grass to baboon

                ☐ C   wildebeest to wild dog

                ☐ D   zebra to lion

(continued on the next page)

Turn over

7(a) **continued.**

(iii) **Which organism will be least affected by a reduction in the population of star grass?**
(1 mark)

☐ **A** **baboon**

☐ **B** **gazelle**

☐ **C** **wildebeest**

☐ **D** **zebra**

(continued on the next page)

7   **continued.**

(b) (i)   Explain why only a small proportion of the
          energy contained within one trophic level is
          transferred to the next trophic level.
          (4 marks)

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7(b)(i) continued.

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7(b) **continued.**

      (ii) **Describe how a scientist could compare the population size of star grass in two areas of the ecosystem.**
           (4 marks)

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7(b)(ii)   continued.

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7 **continued.**

(c) **Wild dogs hunt a variety of prey species. They usually eat the weak and sick animals.**

Explain how this behaviour may benefit the species the dogs hunt.
(3 marks)

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7(c) **continued.**

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(Total for Question 7 = 14 marks)

8   Yeast can be used in food production.

(a) (i) Which group of organisms does yeast
belong to?
(1 mark)

☐ A   bacteria

☐ B   fungi

☐ C   plants

☐ D   protoctists

(ii) Which substance is the cell wall of a yeast cell
made of?
(1 mark)

☐ A   cellulose

☐ B   chitin

☐ C   sucrose

☐ D   starch

(continued on the next page)

Turn over

8   continued.

(b) **A teacher sets up an experiment to investigate the effect of temperature on the rate of respiration in yeast.**

Look at the diagram for Question 8(b) in the Diagram Booklet. It shows part of the apparatus the teacher uses.

(continued on the next page)

8(b) **continued.**

    (i) **Explain what additional apparatus the teacher will need to investigate the effect of temperature on the rate of respiration in this experiment.**
       (2 marks)

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(continued on the next page)

8(b) continued.

(ii) State the purpose of the liquid paraffin on the surface of the glucose solution.
(1 mark)

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(iii) Give the name of a suitable chemical that could be used as indicator X to show that the yeast is respiring.
(1 mark)

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(continued on the next page)

8(b) **continued.**

    (iv) **Diazine green changes colour from blue to pink as the oxygen levels in the yeast and glucose solution reduce.**

        Explain how this colour change gives information about the respiration in the yeast. (2 marks)

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(continued on the next page)

Turn over

8   continued.

(c) Explain why the rate of respiration in the yeast will change as the temperature is increased.
(4 marks)

Answer lines continue on the next page.

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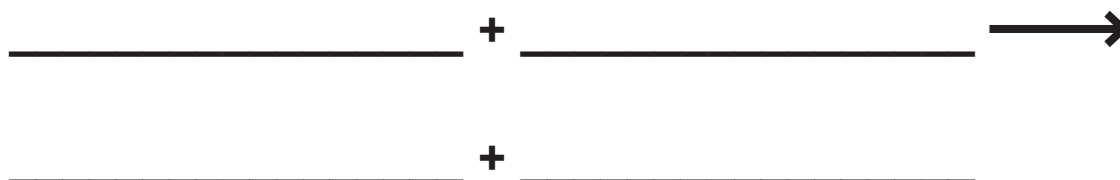**8(c) continued.**

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(Total for Question 8 = 12 marks)

9 **Plants need light for photosynthesis.**

(a) **Give the balanced chemical symbol equation for photosynthesis.**
(2 marks)

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_____ + _____

(b) **Look at the graph for Question 9(b) in the Diagram Booklet. It shows the effect of light intensity on the rate of photosynthesis in a water plant.**

The rate of photosynthesis is measured by counting the number of bubbles of gas released per minute.

The light intensity is decreased by moving a lamp further away from the water plant.

The light intensity is calculated as

= 1÷ (distance in cm of lamp from plant)^2

(continued on the next page)

Turn over

9(b) **continued.**

(i) Using information from the graph, calculate the distance of the lamp from the plant when the rate of photosynthesis is 78 bubbles per minute.
(2 marks)

distance = _____ cm

(continued on the next page)

9(b) **continued.**

      (ii) **Describe the relationship between the number of bubbles per minute and light intensity.**
            (3 marks)

Answer lines continue on the next page.

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Turn over

9(b)(ii)   continued.

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9(b) continued.

      (iii) Explain the rate of photosynthesis between a light intensity of 0·4 arbitrary units and a light intensity of 0·8 arbitrary units.
      (2 marks)

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(Total for Question 9 = 9 marks)

Turn over

10 **(a)** Look at the table for Question 10(a) in the Diagram Booklet. It gives some information about enzymes in the human digestive system.

Complete the table by giving the missing information.
(4 marks)

(b) Some scientists have investigated the effect of vinegar (a weak acid) on the digestion of starch.

Design an investigation to discover the effect of vinegar on the digestion of starch.

Include experimental details in your answer and write in full sentences.
(6 marks)

Answer lines continue on the next 2 pages.

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Turn over

10(b) **continued.**

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10(b) **continued.**

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(Total for Question 10 = 10 marks)

TOTAL FOR PAPER = 110 MARKS
END OF PAPER