



Please write clearly in block capitals.

Centre number

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Surname

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I declare this is my own work.

A-level BIOLOGY

Paper 1

Thursday 4 June 2026

Afternoon

Time allowed: 2 hours

Materials

For this paper you must have:

- a ruler with millimetre measurements
- a scientific calculator.

Instructions

- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).
- Show all your working.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information

- The marks for the questions are shown in brackets.
- The maximum mark for this paper is 91.

For Examiner's Use	
Question	Mark
1	
2	
3	
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9	
10	
TOTAL	



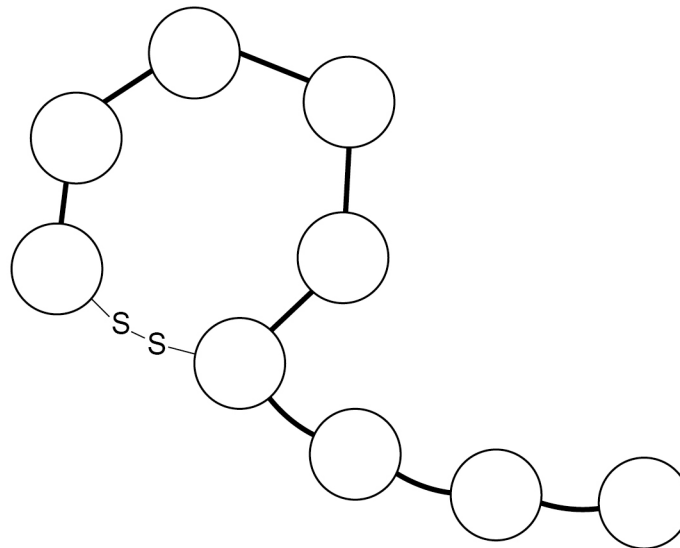
J U N 2 6 7 4 0 2 1 0 1

Answer **all** questions in the spaces provided.

0 1

Figure 1 shows a molecule of antidiuretic hormone (ADH).

Figure 1



Key

— Peptide bond

○ Amino acid

The ADH molecule is made up of nine amino acids joined by peptide bonds.

0 1 . 1

Use information in **Figure 1** to describe **two** other structural features of ADH.

[2 marks]

1 _____

2 _____



0 1 . 2 Name the biochemical test used to detect ADH in a solution.

Describe the positive result.

[2 marks]

Name of test _____

Positive result _____

ADH is produced when enzymes hydrolyse the preproprotein, AVP. This hydrolysis produces three smaller polypeptides, ADH, Copeptin and NPII.

0 1 . 3 A scientist determined that ADH contains 6.38% of the amino acids in an AVP preproprotein. He counted 39 amino acids in the Copeptin protein.

Calculate the number of amino acids in the NPII polypeptide.

Use **Figure 1** to help you answer this question.

[1 mark]

Answer _____

0 1 . 4 The hydrolysis of AVP by these enzymes always produces ADH, Copeptin and NPII polypeptides.

Explain why.

[2 marks]

7

Turn over for the next question

Turn over ►



0 2 . 1

Explain why the genetic code is described as universal **and** degenerate.**[2 marks]**

Universal _____

Degenerate _____

Table 1 shows information about the genome of a human sperm cell.**Table 1**

Log ₁₀ (total number of nucleotide pairs)	9.5
Percentage of nucleotide pairs not coding for polypeptide	98.5
Total number of genes coding for polypeptides	20 000

0 2 . 2

Use information in **Table 1** to calculate the mean number of nucleotide pairs coding for a polypeptide per gene in a sperm cell.

Show your working.

[3 marks]

Answer _____

0 2 . 3

What term is used to describe nucleotide pairs within a gene that do **not** code for an amino acid sequence?**[1 mark]**



0 2 . 4

The mean DNA mass in a sperm cell is 3.8 pg

$$1 \text{ pg} = 1 \times 10^{-12} \text{ g}$$

Which quantity is equal to 3.8 pg?

Tick (✓) **one** box.

[1 mark]

$$3.8 \times 10^{-3} \text{ mg}$$

☐

$$3.8 \times 10^{-6} \text{ mg}$$

☐

$$3.8 \times 10^{-9} \text{ mg}$$

☐

$$3.8 \times 10^{-15} \text{ mg}$$

☐

7

Turn over for the next question

Turn over ►



[6 marks]

[illegible]

0 3 . 2

A scientist measured the number of ATP molecules in the nuclei and in the cytoplasm of mouse cells. He did this at the start of interphase and at the end of interphase of the cell cycle.

Table 2 shows his results.

Table 2

	Mean number of ATP molecules / nmol per 10^6 cells	
	Nuclei	Cytoplasm
Start of interphase	2.2	6.8
End of interphase	1.9	9.7

Name the enzyme that changed the number of ATP molecules in the **nuclei**.

Describe **one** way ATP is used in **nuclei**.

[2 marks]

Enzyme _____

Description _____

0 3 . 3

The length of interphase in the mouse cells is 18 hours.

Use information in **Table 2** to calculate the mean rate of increase in number of ATP molecules per hour in the mouse **cells**.

Show your working.

[2 marks]

Answer _____ nmol per 10^6 cells per hour

10

Turn over for the next question

Turn over ►



0 4 . 1

Complete **Table 3** with ticks (✓) showing the statements that are true for these cell types.

[2 marks]

Table 3

Statement	Cell types		
	Phagocytes	B cells	Body cells infected with virus
Stimulated by helper T cells (T_H cells)			
Engulf and hydrolyse pathogens			

0 4 . 2

In deer, tuberculosis (TB) is caused by infection with the bacterium *Mycobacterium bovis*. Other species of harmless *Mycobacterium* are also found in the deer's environment.

TB is a contagious disease and is detected using a skin test.

In the skin test, antigens are injected under the skin at two locations on the deer.

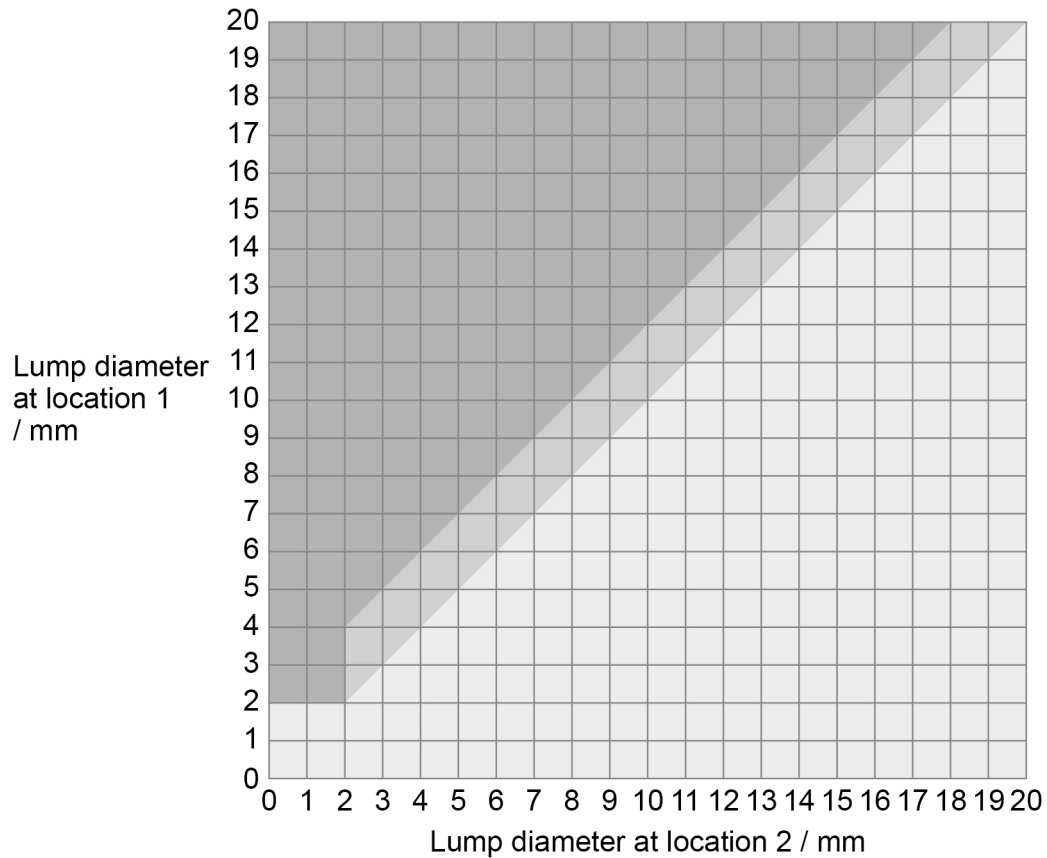
- Location 1 – with antigens from *M. bovis* and from harmless species of *Mycobacterium*.
- Location 2 – with antigens **only** from harmless species of *Mycobacterium*.

Lumps form under the skin if there is a secondary immune response to the injected antigens. The diameter of each lump is measured.

Figure 2 is used to determine the results of the skin tests.



Figure 2



TB **negative** deer have a secondary immune response at location 2.

Explain why.

[2 marks]

Question 4 continues on the next page

Turn over ►



0 4 . 3 A scientist used the skin test on five deer taken from a deer herd.

Table 4 shows some of her results.

Table 4

Deer number	Lump diameter on skin / mm		
	Location 1	Location 2	Location 1 : Location 2 ratio
1	6		0.55 : 1.00
2			1.17 : 1.00
3	9	8	1.13 : 1.00
4	8	7	1.14 : 1.00
5	17	20	0.85 : 1.00

The lump diameter at location **2** on deer **2** was one and a half times larger than the lump diameter at location **2** on deer **3**.

Complete **Table 4** for deer **1** and deer **2**.

Give answers to the nearest whole number.

[2 marks]



0 4 . 4

The scientist concluded the deer herd did **not** have TB.

Evaluate the scientist's conclusion.

In your answer use **only** the values of lump diameter in **Table 4** for deer **3**, **4** and **5**, and information in **Figure 2** (on page 9).

[3 marks]

9

Turn over for the next question

Turn over ►



0 5 . 1 Describe how phospholipids form a bilayer.

[1 mark]

A scientist isolated a pure sample of a biological molecule (**W**) from crushed soybean seeds. She made mixtures **A**, **B** and **C**.

- A** lipid + lipase + **W**
B lipid + lipase + **W** + protease
C lipid + lipase

At intervals over 3 minutes, she recorded:

- the mass of **W** and
- the acidity of the mixture.

0 5 . 2 The scientist did **not** use an emulsion test to measure lipase activity.

Use your knowledge of practical procedures to explain why.

[2 marks]



0 5 . 3

The scientist determined lipase activity from increases in the acidity of each solution.

Explain why an increase in the acidity of a solution is a measure of lipase activity.

[2 marks]

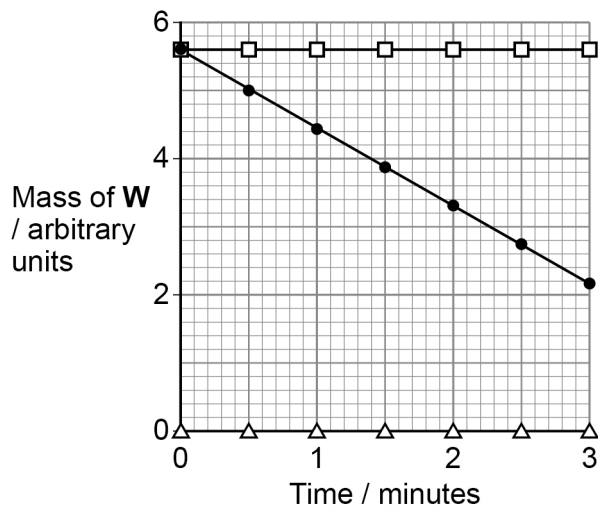
Question 5 continues on the next page

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The scientist's results are shown in **Figures 3** and **4**.

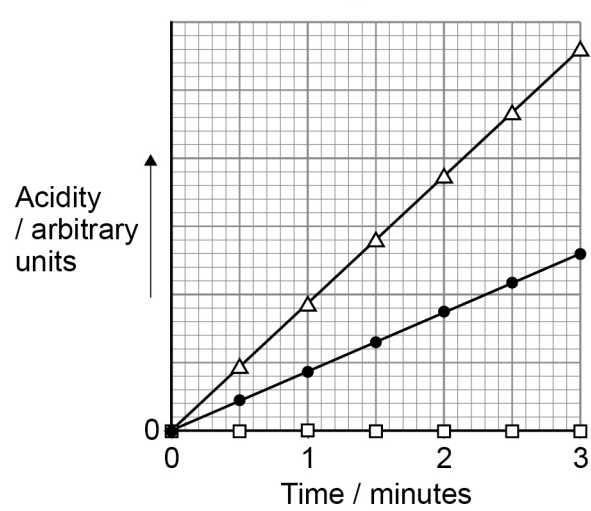
Figure 3



Key

- A lipid + lipase + W
- B lipid + lipase + W + protease
- △—△ C lipid + lipase

Figure 4



What can you conclude from information in **Figure 3** and **Figure 4**:

- [5 marks]**

[illegible]

10

Turn over for the next question

Turn over ►



0 6 . 1

Explain how **two** features of the alveolar epithelium create an ideal surface for gas exchange.

[2 marks]

1 _____

2 _____

Cigarette smoking is a cause of lung disease.

TTFC is defined as the length of time between waking up and smoking the first cigarette of the day.

Scientists investigated the link between TTFC and two measures of lung function.

- FVC, the maximum volume of air exhaled in one breath. This measures lung capacity.
- FEV₁, the maximum volume of air exhaled in 1 second. The FEV₁ value of healthy lungs is high.

They measured the FVC and FEV₁ in many smokers whose TTFC was less than 5 minutes and compared their results with the lung function of non-smokers.

They used a statistical test to test the following null hypothesis.

TTFC of less than 5 minutes makes no significant difference to lung function.

Table 5 shows their results.

Table 5

Lung function	Mean percentage difference between smokers and non-smokers	Outcome of the statistical test on the null hypothesis
FVC	-2	Accepted
FEV ₁	-6	Rejected



0 6 . 2

Using information in **Table 5**, what can you conclude about the link between TTFC of less than 5 minutes and lung function?

Explain your conclusions.

[2 marks]

0 6 . 3

Suggest **two** aspects of smoking behaviour that the scientists controlled in this investigation.

[2 marks]

1

2

Question 6 continues on the next page

Turn over ►



0 6 . 4

Explain why people with a low FEV_1 will become tired faster when doing exercise than people with a higher FEV_1 .

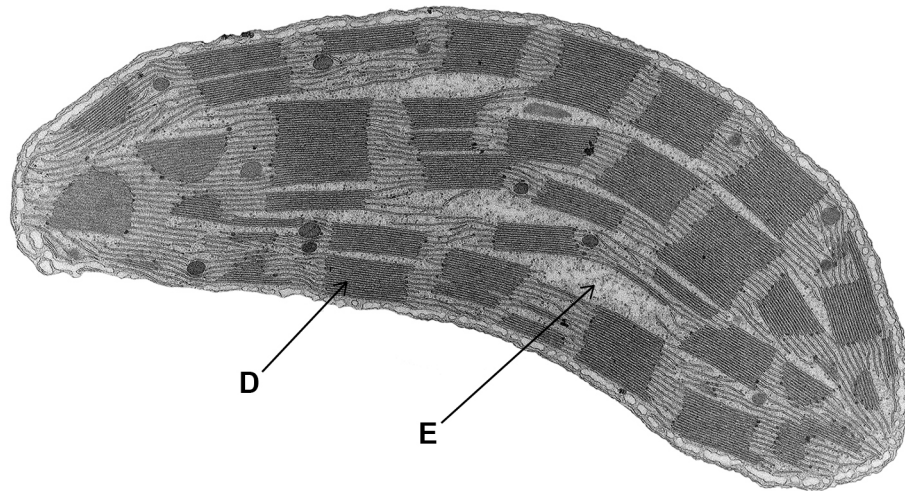
[3 marks]

9

07.1

Figure 5 shows an organelle seen using a transmission electron microscope.

Figure 5



Identify **D** and **E**.

[1 mark]

D _____

E _____

Question 7 continues on the next page

Turn over ►



Banana peel changes colour from green, through shades of green-yellow, to yellow as bananas ripen.

A student investigated the ripening of one banana. She put four squares of green peel into each of two plastic bags. She:

- added water to one bag
- added glucose solution to the other bag.

After one week, she compared the colour of each square of peel using the scale on the colour chart shown in **Figure 6**.

Figure 6

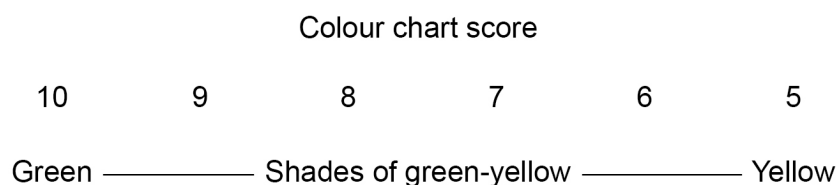


Figure 7 shows her results.

Figure 7

Bag contents	Colour chart score			
Water	5	6	5	5
Glucose solution	9	10	8	9

The student controlled all variables in her investigation.

0 7 . 2

Give **three** relevant control variables **not** mentioned in the procedure.

[3 marks]

- 1 _____
- 2 _____
- 3 _____



A scientist also investigated ripening in a single banana.

She covered one set of peel in water and one set of peel in glucose solution. After one week, she measured the chlorophyll content of both sets of peel.

Table 6 shows her results.

Table 6

Liquid covering peel	Mean chlorophyll content in peel / $\mu\text{g g}^{-1}$
Water	9
Glucose solution	27

0 7 . 3

What is represented by $\mu\text{g g}^{-1}$ in the column heading in **Table 6**?

[1 mark]

0 7 . 4

Use information in **Figure 6**, **Figure 7** and **Table 6** to explain whether the student's findings support the scientist's results.

[1 mark]

Question 7 continues on the next page

Turn over ►



When bananas ripen:

- the cell-surface membranes of the cells in banana peel become more permeable to glucose
- a chlorophyllase enzyme, responsible for chlorophyll breakdown, is inhibited by glucose.

Use this information to suggest an explanation for the colour change of peel when bananas ripen.

[4 marks]

[illegible]

10



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0 8 . 1

Describe and explain how hydrostatic pressure is created in phloem tissue to cause the mass flow of substances in the phloem.

[3 marks]

0 8 . 2

Scientists removed a ring of phloem tissue from a sunflower stem. They did not damage the xylem tissue.

At intervals over the next 2 hours, they measured:

- the concentration of sucrose in shoot-tip cells above the ring
- the concentration of sucrose in root cells
- the rate of potassium ion uptake by the roots.

Table 7 shows their results.

Table 7

Time after phloem tissue removed / hours	Concentration of sucrose in shoot-tip cells / $\mu\text{mol g}^{-1}$	Concentration of sucrose in root cells / $\mu\text{mol g}^{-1}$	Rate of potassium ion uptake by roots / $\mu\text{mol g}^{-1} \text{ hour}^{-1}$
0	2.5	2.4	5.0
1	2.7	1.2	0.5
2	2.8	0.8	0.4



Suggest how the scientists' results:

- provide evidence of sucrose transport in the phloem
- show that potassium ion uptake by roots is an active process.

Use your own knowledge and the information in **Table 7**.

Explain your answer.

[3 marks]

6

Turn over for the next question

Turn over ►



0 9

Protein **X** is found on some types of tumour cells. PD-1 is a receptor molecule located on the surface of cytotoxic T cells (T_C cells). When the PD-1 receptor binds to **X**, the T_C cell does **not** destroy the tumour cell.

Scientists have produced a new monoclonal antibody drug, anti-PD-1. This monoclonal antibody targets PD-1 receptors on T_C cells.

0 9 . 1

Explain how anti-PD-1 monoclonal antibody could be used as a treatment for patients with tumour cells that have protein **X**.

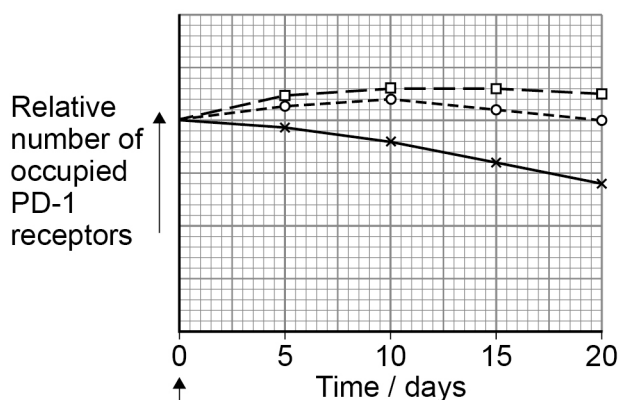
[2 marks]

Scientists have investigated the effects of this anti-PD-1 drug on:

- the relative number of PD-1 receptors on human T_C cells occupied with anti-PD-1
- mean tumour volume.

Their results are shown in **Figure 8** and **Figure 9**.

Figure 8

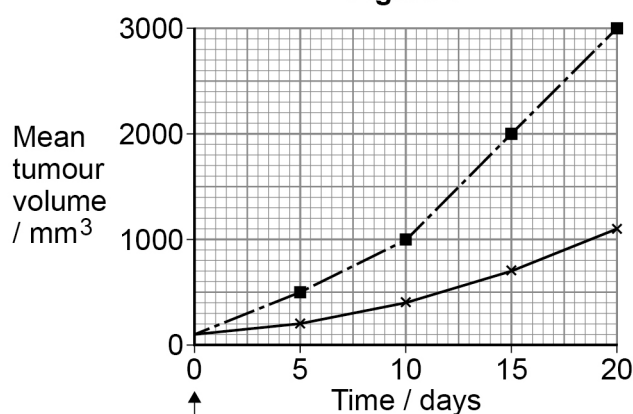


Patients given
anti-PD-1

Key

- 400 mg anti-PD-1
- 200 mg anti-PD-1
- 60 mg anti-PD-1

Figure 9



Patients given
60 mg anti PD-1

Key

- Not treated
- Treated with 60 mg anti-PD-1



09.2 Recommend the dose of anti-PD-1 to use as a treatment for patients with tumours.

Explain your answer.

[2 marks]

Recommended dose _____

Explanation

Use information in **Figure 8** and **Figure 9**.

Explain your answer.

[4 marks]

[illegible]

8

Turn over ►



Explain how the **left** ventricle and associated heart valves create a one-way flow of blood through the heart.

[illegible]

A student has dissected a sheep's lung and is asked to produce a biological drawing from a slice of the lung tissue.

Assume the student uses a sharp pencil.

[4 marks]

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Question 10 continues on the next page

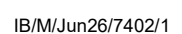
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[6 marks]

[illegible]

15



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Question number	
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