OXFORD

INTERNATIONAL
AQA EXAMINATIONS

Please write clearly in block capitals.

Centre number | | | | | | Candidate number | | | | |

Surname _____

Forename(s) _____

Candidate signature _____
I declare this is my own work.

INTERNATIONAL A-LEVEL
BIOLOGY (9610)

Unit 5 Synoptic paper

Time allowed: 1 hour 30 minutes

Materials

For this paper you must have:
- a pencil
- a ruler with millimetre measurements
- a scientific calculator, which you are expected to use where appropriate.

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).
- All working must be shown.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 75.
- In Question 6, 2 marks will be awarded for the quality of your written communication. You will be marked on your ability to:
  – use good English
  – organise information clearly
  – use specialist vocabulary where appropriate.

For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
TOTAL	

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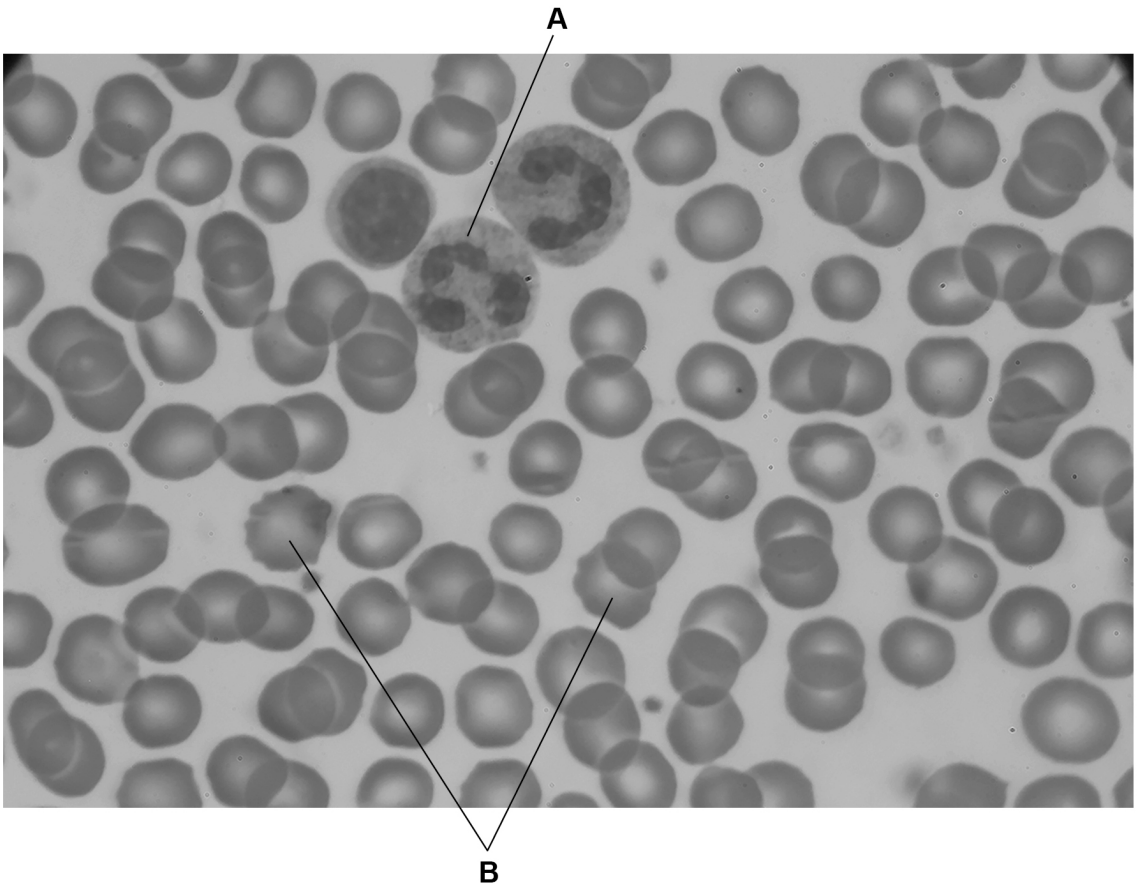
Answer **all** questions in the spaces provided.

0 1 **Figure 1** shows blood cells viewed under an optical microscope.

Figure 1



0 1 . 1 Draw cell **A**.

Label your drawing.

[3 marks]

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0 1 . 2 The actual diameter of cell **A** is 10.5 μm

Calculate the magnification of **Figure 1**.

Give your answer to 3 significant figures.

[3 marks]

Magnification = _____

0 1 . 3 Cell **A** is a phagocyte.

Describe how phagocytes help to protect the body from disease.

Include the role of lysosomes in your answer.

[3 marks]

_____

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Question 1 continues on the next page

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Different red blood cells have slightly different water potentials.
Most red blood cells have a water potential between –400 kPa and –300 kPa

0 1 . 4 The two red blood cells labelled **B** are a different shape from most of the other red blood cells in **Figure 1** (on page 2).

When preparing the microscope slide, the cells are mounted in a solution of sodium chloride.

The sodium chloride solution has a water potential of –400 kPa

Explain what causes the cells labelled **B** to have a different shape from the other red blood cells.

[3 marks]

0 1 . 5 Suggest why most of the red blood cells in **Figure 1** (on page 2) are **not** the same shape as the cells labelled **B**.

[2 marks]

14

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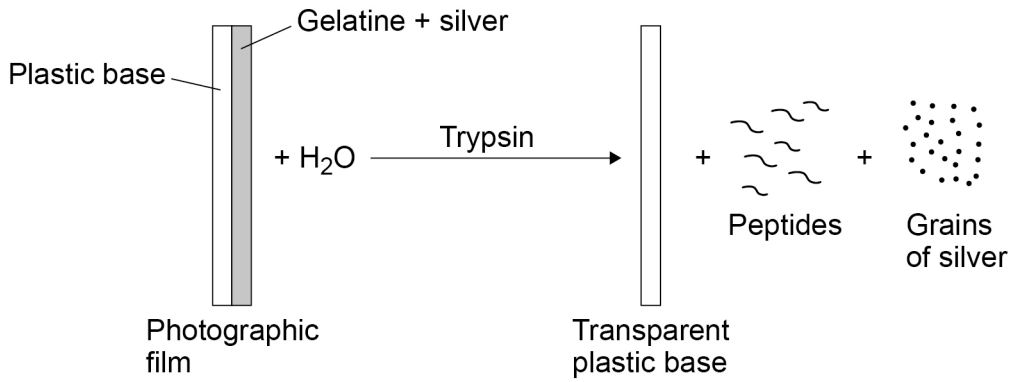
0 2 Trypsin is a protease enzyme made by the pancreas. Gelatine is a protein.

Some cameras use a photographic film to record an image. The image on the photographic film is made of grains of silver in a layer of gelatine stuck to a plastic base. Gelatine is hydrolysed by trypsin. Hydrolysis releases the grains of silver and the film becomes uniformly transparent, as shown in **Figure 2**.

Figure 2



Students investigate the effect of pH on the activity of trypsin.

The students:

- put 9 cm^3 of buffer solution of different pH into 5 different test tubes
- add 1 cm^3 of trypsin solution to each tube
- fix a piece of a photographic film into each of 5 small spheres of plasticine (modelling clay) as shown in **Figure 3**
- put 1 sphere with its piece of photographic film into each of the 5 test tubes as shown in **Figure 3**
- measure the time taken for the photographic film to become transparent
- repeat the investigation 6 times.

Figure 3

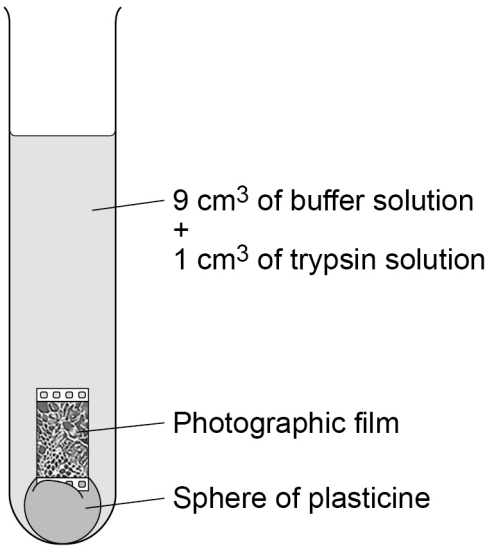


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Table 1 shows the students' results.

Table 1

pH	Mean time taken / min	Rate of reaction $= \frac{1}{\text{Time taken}}$ / min^{-1}	Standard deviation of rate
2	No reaction	0.000	0.000
4	20		0.025
6	8		0.055
8	3		0.020
10	8		0.070

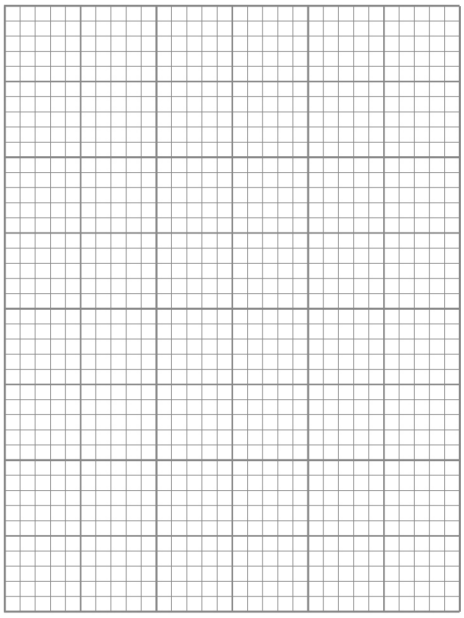
0 2 . 1 Calculate the rate of reaction for each pH.

Write your answers in **Table 1**.

[2 marks]

0 2 . 2 Draw a graph to show how the rate of reaction varies with pH.

[4 marks]



0 2 . 3 Draw error bars on your graph to show ± standard deviation for each value.

Use the values given in **Table 1**.

[2 marks]

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0 2 . 4 The students state there is no significant difference in rate between pH 4 and pH 6.

Give evidence for this statement from your graph.

[1 mark]

0 2 . 5 The students conclude that the optimum pH for the action of trypsin is pH 8.

Suggest improvements the students could make to their method to find a more accurate value of the optimum pH for the action of trypsin.

[3 marks]

12

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0 3 Caffeine is a stimulant drug found in coffee.

0 3 . 1 Design an investigation to find the effect of caffeine on human heart rate.

You should include:
- how you would change the independent variable
- how you would make sure any other variables are kept constant
- how you would measure the dependent variable
- a suitable control.

[6 marks]

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You could use a graph and a statistical test to analyse your results.

0 3 . 2 Describe how you would show your results in a graph. Give a reason for your choice.

[4 marks]

0 3 . 3 Give a statistical test you would use to compare experimental and control results from your investigation. Give a reason for your choice.

[2 marks]

Statistical test

Reason

12

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0 4 Many neurones have a fatty myelin sheath around the axon.

0 4 . 1 Describe the function of this myelin sheath in nerve impulse conduction.

You should refer to the movement of sodium ions and potassium ions in your answer.

[3 marks]

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Tay–Sachs disease is a human inherited condition. Tay–Sachs disease is common in some groups of people with a tradition of marrying within their own community.

Tay–Sachs disease is caused by a recessive mutation. The mutation interferes with fat metabolism in neurones in the brain. Children with Tay–Sachs disease usually die before they are 4 years old.

Scientists in Brazil estimated that, in one community, 1 in every 29 people would be a carrier of Tay–Sachs disease. The scientists were able to make this estimate by knowing the frequency of babies born with Tay–Sachs disease in this community.

0 4 . 2 A student suggested that the scientists made their estimate using the Hardy–Weinberg equation.

Explain how the Hardy–Weinberg equation could be used for estimating the frequency of carriers of Tay–Sachs disease in this community.

[3 marks]

0 4 . 3 Give **one** reason why the estimate made using the Hardy–Weinberg equation may **not** be accurate.

[1 mark]

7

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0 5 2,4-dichlorophenoxyacetic acid (2,4-D) is a selective herbicide.
Farmers can spray 2,4-D on cereal crops to kill broad-leaved weeds growing among the crop.

Scientists are concerned that 2,4-D might cause cancer in humans.
In the USA, scientists found that farm workers who used large amounts of pesticides, including 2,4-D, had a higher occurrence of cancer than in the rest of the population.
However, studies in Australia and New Zealand did not show similar results.

0 5 . 1 Use this information to suggest why the scientists cannot be sure that 2,4-D causes cancer.

[2 marks]

Scientists tested the effect of 2,4-D on the rate of multiplication of cancer cells taken from a human male's prostate gland. The scientists compared the effect of 2,4-D with the effect of the male hormone dihydrotestosterone (DHT).

The scientists:

- put samples of prostate cancer cells into 19 separate flasks of tissue fluid
- add different concentrations of 2,4-D to flasks 1–9
- add different concentrations of DHT to flasks 10–18
- set up flask 19 as a control
- measure the number of cells in each flask after 4 days.

0 5 . 2 Suggest how the control flask should be set up.

[2 marks]

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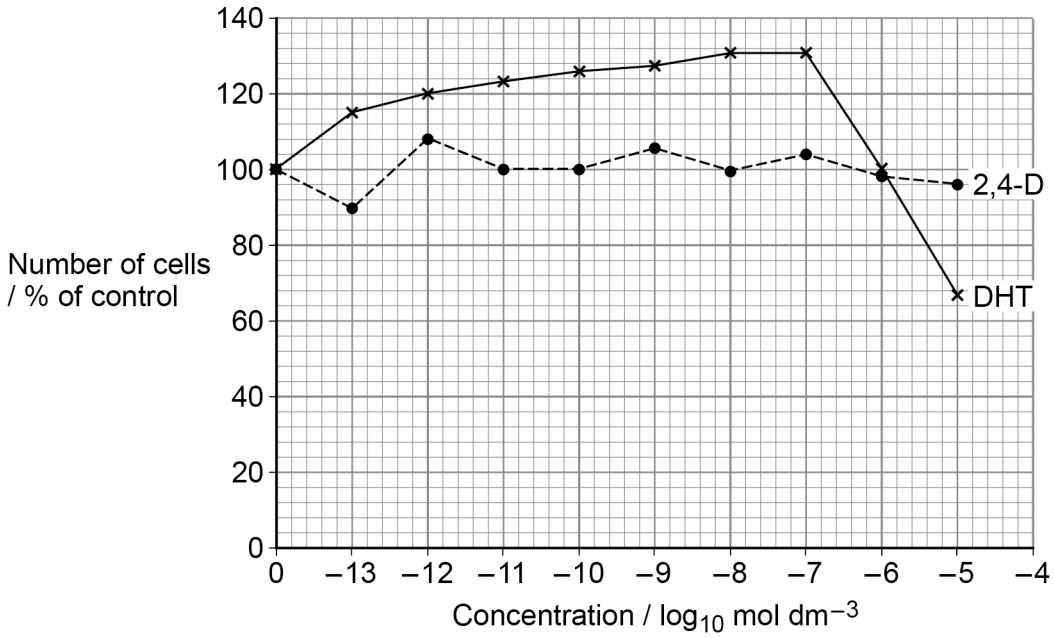
Figure 4 shows the scientists' results.

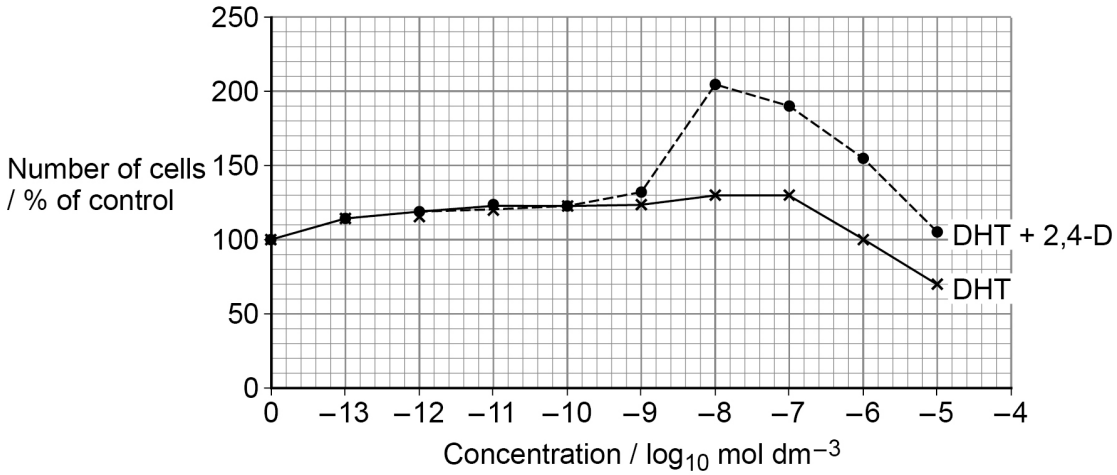
Figure 4



The scientists then added different concentrations of 2,4-D to 10^{-8} mol dm^{-3} DHT and measured the effect of this combined treatment on the cancer cells.

Figure 5 shows the results compared to treatment with DHT on its own.

Figure 5



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0 5 . 3 In **Figure 4** and **Figure 5**, the scientists use a logarithmic scale on the x-axis.

Suggest why.

[1 mark]

0 5 . 4 The scientists concluded:

- 2,4-D on its own has no effect on the multiplication of prostate cancer cells
- 2,4-D increases the effect of DHT on the multiplication of prostate cancer cells.

Give evidence to support this conclusion.

Use data from **Figure 4** and **Figure 5**.

[3 marks]

Question 5 continues on the next page

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0 5 . 5 Suggest **two** reasons why it is difficult to determine if 2,4-D causes prostate cancer in humans.

[2 marks]

1 _____

_____

_____

2 _____

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10

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You are reminded that 2 marks will be awarded
for the quality of your written communication in Question 6.

0 6 Various abiotic factors affect the distribution of plants.

0 6 . 1 Describe why abiotic factors affect plant growth.

Include named abiotic factors in your answer.

[7 marks]

Question 6 continues on the next page

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Fatsia japonica and *Fatsia polycarpa* are two species of woody plant.
The two species grow on different islands off the coast of Southeast Asia.

F. japonica grows well in shady forests.
F. polycarpa grows well in brighter light in the mountains.

0 6 . 2 Describe an experiment to find out if the leaves of *F. polycarpa* need a higher light intensity for photosynthesis than the leaves of *F. japonica*.

[4 marks]

0 6 . 3 Scientists believe that *F. japonica* and *F. polycarpa* evolved from a common ancestor that lived about 600 000 years ago.

Explain how these two different species of plant could have evolved from a common ancestor.

[7 marks]

20

Quality of written communication [2 marks]

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