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Cambridge Assessment International Education

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8453680305

BIOLOGY **9700/36**

Paper 3 Advanced Practical Skills 2 **October/November 2024**

2 hours

You must answer on the question paper.

You will need: The materials and apparatus listed in the confidential instructions

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- You should show all your working and use appropriate units.

INFORMATION

- The total mark for this paper is 40.
- The number of marks for each question or part question is shown in brackets [ ].

For Examiner's use	
1	
2	
Total	

This document has **16** pages. Any blank pages are indicated.

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1 Blood plasma contains soluble proteins such as albumin.

Albumin can be separated from blood plasma and used in medical treatments.

When the pH changes, soluble proteins become insoluble and form large clumps. This is known as precipitation.

You will investigate the effect of different concentrations of hydrochloric acid on the precipitation of proteins.

You are provided with the materials shown in Table 1.1.

Table 1.1

labelled	contents	hazard	volume / cm^3
H	2.0 mol dm^{-3} hydrochloric acid	irritant	30
P	protein solution	none	15
W	distilled water	none	30

If any solution comes into contact with your skin, wash off immediately with cold water.

It is recommended that you wear suitable eye protection.

You will need to:

- prepare different concentrations of hydrochloric acid
- observe the effect of the different concentrations of hydrochloric acid on the precipitation of a protein solution at 0, 5 and 10 minutes.

You will need to use **proportional** dilution to make five different concentrations of hydrochloric acid.

You will need to prepare 5 cm^3 of each concentration, using **H** and **W**.

Table 1.2 shows two of the concentrations of hydrochloric acid you will use and how to prepare **one** of the concentrations.

Decide which **three** other concentrations of hydrochloric acid you will use.

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(a) (i) Complete Table 1.2 to show how you will prepare the concentrations of hydrochloric acid you will use.

Table 1.2

concentration of hydrochloric acid / mol dm^{-3}	volume of H / cm^3	volume of W / cm^3
2.0	5.0	0.0
0.4		

[3]

Carry out step 1 to step 8.

step 1 Label five test-tubes with the concentrations of hydrochloric acid solution decided in **(a)(i)**.

step 2 Prepare the concentrations of hydrochloric acid as shown in Table 1.2, in the appropriately labelled test-tubes. Mix well.

You will be adding **P** to the different concentrations of hydrochloric acid to form a white precipitate.

The solution becomes cloudier as more proteins precipitate, as shown in Fig. 1.1.

clear ⟶ cloudy

soluble proteins precipitated proteins

Fig. 1.1

You will need to record how cloudy each solution appears.

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(ii) Decide on a key you will use to record your observations.

Complete Table 1.3 to show the key you will use.

Table 1.3

appearance	key
most cloudy	
clear	

[1]

You will be observing the appearance of the solutions in the test-tubes. You may use a piece of black card behind the test-tubes to help you to decide on the amount of precipitation of the solutions.

You may observe the same amount of precipitation in more than one test-tube.

step 3 Put 1 cm^3 of **P** into each of the test-tubes. Shake gently to mix.

step 4 Observe the appearance of the solutions in the test-tubes.

step 5 Record in **(a)(iii)** your observations using the key decided in **(a)(ii)**. This is your observation at 0 minutes.

step 6 Start timing.

step 7 Record in **(a)(iii)** your observations after 5 minutes.

step 8 Record in (**a)(iii)** your observations after 10 minutes.

(iii) Record your results in an appropriate table.

[5]

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(iv) State the trend in your results at 0 minutes.

.....

..... [1]

(v) With reference to your observations at 0, 5 and 10 minutes, describe the effect of concentration of hydrochloric acid on the **rate** of protein precipitation.

.....

.....

.....

.....

..... [2]

(vi) A possible source of error when adding **P** in step 3 is shown in Table 1.4.

Complete Table 1.4 by stating the type of error (systematic or random) **and** by stating the effect on the trend seen in the results at 0 minutes.

Table 1.4

source of error	systematic error or random error	effect on the trend
the 1.0 cm^3 mark on the syringe actually measured 1.05 cm^3		

[1]

(vii) Identify **one** source of error in the investigation other than the error stated in Table 1.4.

Suggest **one** modification to the procedure to reduce the effect of this error.

error .....

.....

modification .....

.....

.....

[2]

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(b) A scientist identified the proteins present in a sample of blood plasma.

The quantity of each protein as a percentage of the total protein in the blood plasma is shown in Table 1.5.

Table 1.5

protein in blood plasma	percentage of total protein
albumin (A)	55.0
alpha globulin (AG)	12.5
beta globulin (BG)	16.5
gamma globulin (GG)	8.5
fibrinogen (F)	7.0

(i) Draw a bar chart of the data in Table 1.5 on the grid in Fig. 1.2.

Use a sharp pencil.

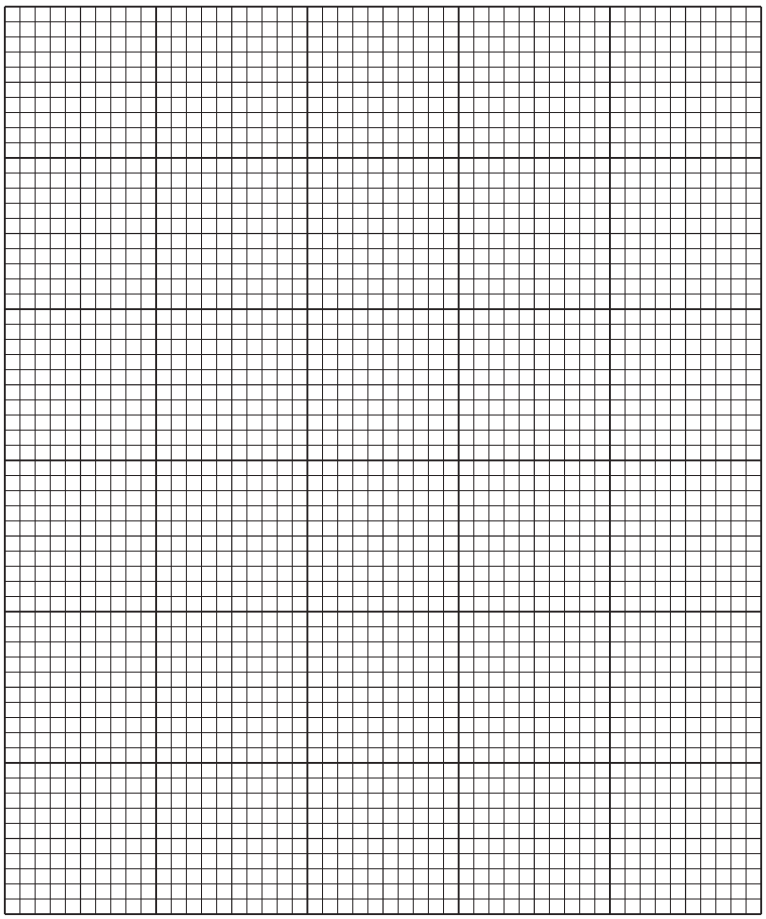


Fig. 1.2

[4]

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(ii) The total protein concentration in the blood plasma is 70 mg cm^{-3}.

Calculate the concentration of globulin proteins in the blood plasma.

Show your working and give your answer to the appropriate number of significant figures.

concentration of globulin proteins = ...mg cm^{-3} [2]

[Total: 21]

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2 Starch grains are present in plant cells. The starch grains have different sizes and shapes depending on the type of plant.

As the starch grains get larger, patterns form on the surface of the starch grains. These patterns can be observed using a microscope.

You are provided with samples from two different plants, **C** and **D**.

You will need to:

- prepare a microscope slide of starch grains from **C** and **D**
- observe the starch grains present on each microscope slide
- draw **two** starch grains from each sample.

Carry out step 1 to step 13.

step 1 Label one clean and dry microscope slide, **C**. Put the slide onto a paper towel.

step 2 Put sample **C** onto a white tile.

step 3 Cut a thin slice (approximately 1 mm) from the end of sample **C**.

step 4 Cut this slice into smaller pieces.

step 5 Put two drops of distilled water onto these small pieces.

step 6 Use a teat pipette to transfer drops of the liquid from around the small pieces prepared in step 5 onto the slide labelled **C**.

step 7 Put a coverslip over the liquid on slide **C**.

step 8 Use the microscope to observe the starch grains on slide **C**.

You may need to reduce the amount of light entering the microscope and will need to adjust the fine focus to observe the surface of the starch grains clearly.

step 9 Select **two** starch grains on slide **C** that show distinct circular patterns on their surface.

step 10 Make a large drawing of these **two** starch grains in **(a)(i)**.

step 11 Repeat step 1 to step 8 to carry out the same procedure for sample **D**.

step 12 Select **two** starch grains on slide **D** that show patterns on their surface that are **different** from those observed on slide **C**.

step 13 Make a large drawing of these **two** starch grains in **(a)(i)**.

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(a) (i) Make a large drawing of:

- **two** starch grains from slide **C**
- **two** starch grains from slide **D**.

Use a sharp pencil.

Slide **C**

Slide **D**

[5]

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(ii) State the reagent that is used to test for starch and the colour that is produced if starch is present.

reagent .....

colour .....

[1]

(iii) Suggest why the starch grains get smaller as plants germinate.

.....

.....

..... [1]

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(b) (i) **N1** is a slide of a stained transverse section through a leaf.

Draw a large plan diagram of the region of the leaf on **N1** indicated by the shaded area in Fig. 2.1. This region must include **two** vascular bundles.

Use a sharp pencil.

Use **one** ruled label line and a label to identify **one** vascular bundle.

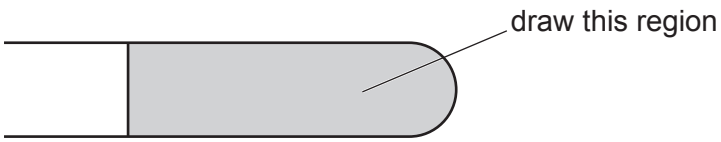


Fig. 2.1

[5]

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(ii) Fig. 2.2 is a photomicrograph of part of a stained transverse section of a different leaf from **N1**.

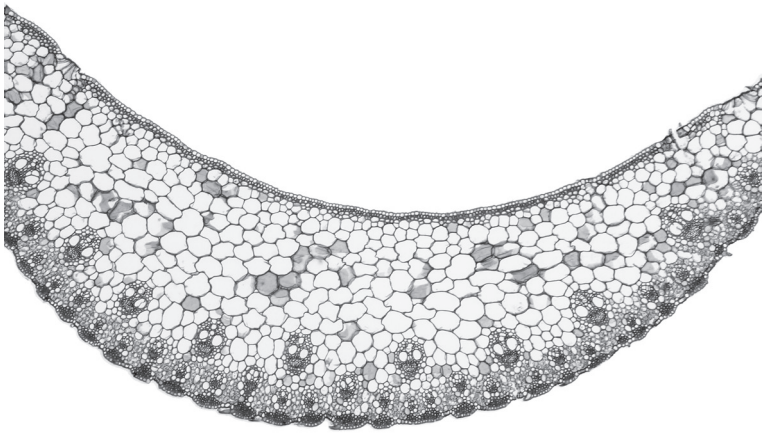


Fig. 2.2

Identify **three** observable differences, other than colour, between the section on **N1** and the section in Fig. 2.2.

Record these **three** observable differences in Table 2.1.

Table 2.1

feature	N1	Fig. 2.2

[4]

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(iii) Fig. 2.3 is the same photomicrograph as that shown in Fig. 2.2.

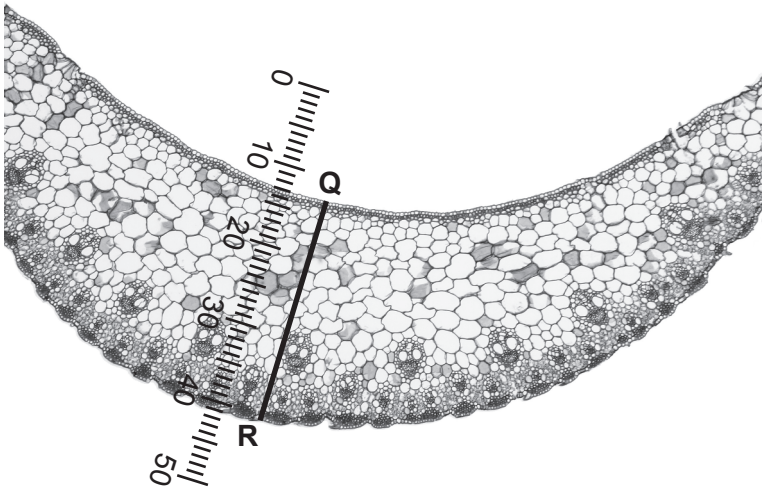


Fig. 2.3

An eyepiece graticule scale is shown on Fig. 2.3.

The calibration of the eyepiece graticule scale is:

1 eyepiece graticule division = 34 μm

Use the calibration of the eyepiece graticule to calculate the actual width of the section in Fig. 2.3 shown by the line **Q–R**.

Show your working.

actual width of leaf ..... [3]

[Total: 19]

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