UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

6272872874

CO-ORDINATED SCIENCES **0654/05**

Paper 5 Practical Test **October/November 2009**

2 hours

Candidates answer on the Question Paper.

Additional Materials: As listed in Instructions to Supervisors

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use a pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
Chemistry practical notes for this paper are printed on page 12.

At the end of the examination, fasten all your work including ray diagrams in Question 2 securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

For Examiner's Use	
1	
2	
3	
Total	

This document consists of **11** printed pages and **1** blank page.

UNIVERSITY of CAMBRIDGE International Examinations

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For Examiner's Use

1 You are supplied with tubes **A**, **B** and **C** set up as shown in Fig.1.1. The experiment is used to study the conditions needed for photosynthesis.

A plant was left in the dark for 48 hours to remove starch. Three leaves were removed and placed in the tubes **A**, **B** and **C**. The tubes were left in daylight for 24 hours.

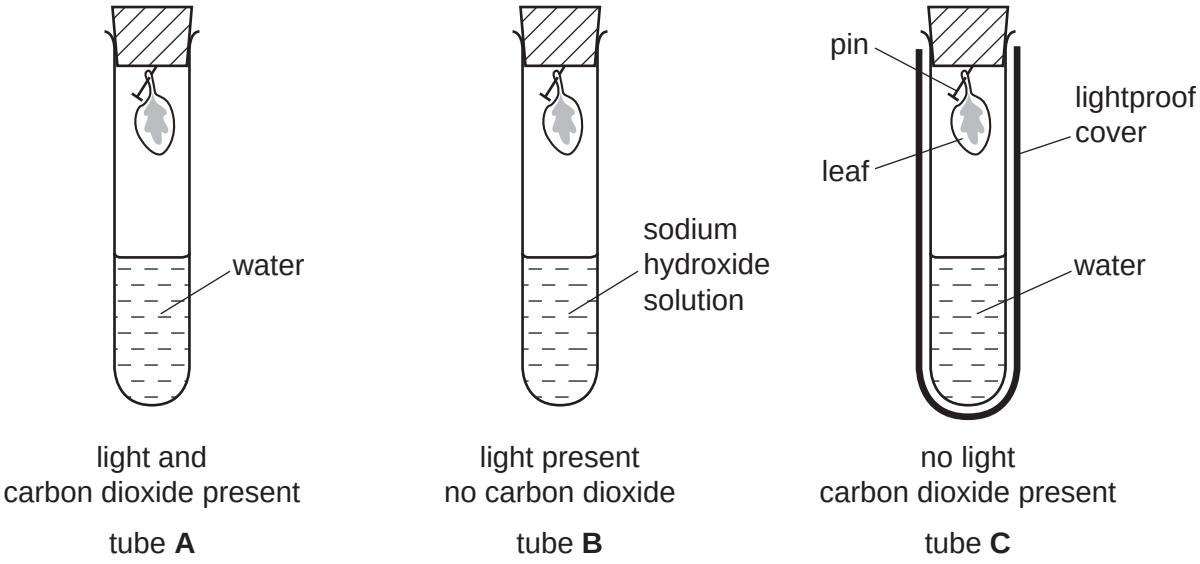

Fig. 1.1

(a) Carefully remove the bungs from each tube and put the leaves on a white tile. In Fig. 1.2 draw the leaves to show the patterns of chlorophyll. Label the **chlorophyll** in **one** of the diagrams.

leaf **A**	leaf **B**	leaf **C**

Fig.1.2

[2]

(b) You are going to do a starch test on the three leaves to find where photosynthesis has taken place.
Follow the procedure below. If you wish, you may test all three leaves at the same time. Throughout the experiment remember which leaf is which.

- Half fill a beaker with water and bring it to the boil. (You may have a water bath instead).
- Using tweezers put the leaf from tube **A** into the boiling water for one minute.
- Take the leaf out of the water.

Turn off your Bunsen burner or other naked flame if you have used one. This is important for safety.

- Place the leaf into a clean test-tube and add enough alcohol to cover the leaf. Place the tube into your beaker or water bath of hot water for five minutes. The alcohol may boil while it is dissolving the chlorophyll.
- Carefully remove the tube from the water, pour off the alcohol into the container provided, then rinse the leaf in cold water.
- Spread the leaf out on a white tile and cover it with iodine solution.
- Allow the colour to develop for a few minutes.
- Repeat this procedure for leaves **B** and **C**.

(c) After testing with iodine draw diagrams in Fig. 1.3 of the three leaves. Use a pencil to shade where starch is present. Add the label **starch**.

leaf **A**	leaf **B**	leaf **C**

[3]

Fig. 1.3

(d) Explain the results of the starch test in terms of the conditions needed for photosynthesis.

tube **A**

.....

.....

.....

tube **B**

.....

.....

.....

tube **C**

.....

.....

..... [4]

(e) Why was sodium hydroxide solution placed in tube **B**?

.....

..... [1]

(f) **(i)** Why did you boil the leaves at the start of the starch test?

.....

..... [1]

(ii) Why was water placed in tubes **A** and **C**?

.....

..... [1]

(g) Describe another experiment to show that light is necessary for starch production if the leaves remain on the plant. You may draw a diagram to help your answer.

.....

.....

.....

..... [3]

For Examiner's Use

2 Carry out the following experiment to plot the path of a ray of light through a rectangular block.

(a) Record the value provided of the refractive index of the block.

refractive index = ... [1]

(b) Place the block on a sheet of paper and draw a pencil line around it. Remove the block. Draw a normal to the top line, about a third of the way along from the left hand side. Using a protractor, draw a line at 30° to the block, making an angle of incidence, **i**, of 60°. Place two pins, $\mathbf{P_1}$ and $\mathbf{P_2}$, on this line as shown in Fig. 2.1.

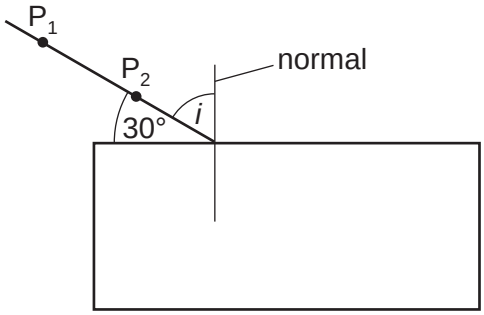

Fig. 2.1

Replace the block in its original position inside the pencil lines already drawn.

Look through the edge of the block from the other side so that images of these first two pins can be seen. Move your head until $\mathbf{P_2}$ is in line with $\mathbf{P_1}$. Place two more pins into the paper in line with the images. Label these positions $\mathbf{P_3}$ and $\mathbf{P_4}$. Remove the block and pins and complete the diagram as shown in Fig. 2.2.

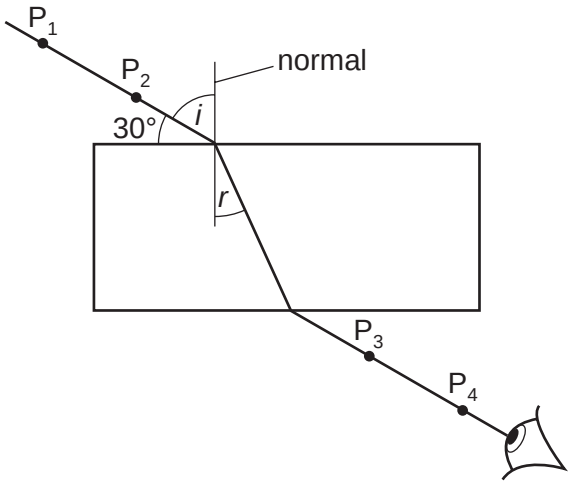

Fig. 2.2

Measure the angle of incidence, **i**, and the angle of refraction, **r**.
Record these in Fig. 2.3.

(c) Repeat using an angle of 35° to the block, making an angle of incidence, **i**, of 55°.
Measure and record the angles of incidence and refraction in Fig. 2.3. Use a fresh sheet of paper if necessary.

(d) Make three further sets of measurements using angles of 50°, 60° and 70° to the block, producing angles of incidence, **i**, 40°, 30° and 20°. Use a fresh sheet of paper if necessary. Measure and record the angles of incidence and refraction in Fig. 2.3.

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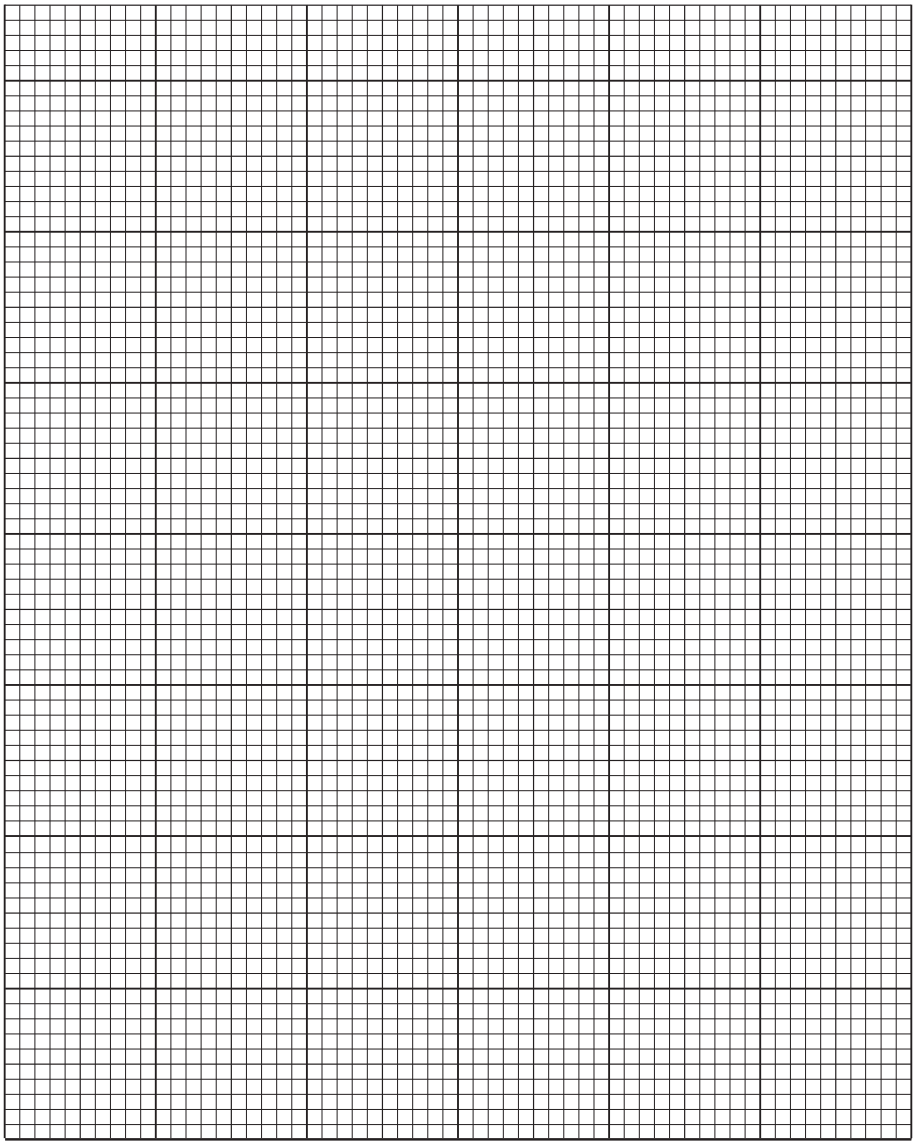
angle of incidence ***i***	angle of refraction ***r***

Fig. 2.3

[5]

Attach your ray diagrams to your paper at the end of the examination.

(e) Plot a graph of angle of incidence (vertical axis), against angle of refraction (horizontal axis). Draw a smooth curve through your points.



[3]

(f) Read off the angle of incidence for an angle of refraction of 25°.
Record this in the space below.

angle of incidence = ... [1]

(g) The refractive index of the glass is given by

$$\frac{\text{sine (angle of incidence)}}{\text{sine (angle of refraction)}}$$

Use the table of sines of angles, Fig. 2.4 to find this ratio for the angles in **(f)**.
If necessary, estimate the value of sine **i** from Fig. 2.4.

sine of angle of incidence recorded in **(f)** = ...

sine of angle of refraction 25° = ...

Calculate the refractive index of the block.

refractive index = ... [2]

angle / °	sine of angle
25	0.423
30	0.500
35	0.574
40	0.643
45	0.707
50	0.766
55	0.819

Fig. 2.4

(h) Does your result for the refractive index agree with that given and recorded in **(a)**?
Comment on your answer.

.....

..... [1]

(i) How would the angles of refraction, recorded in Fig. 2.3, differ for a block of different refractive index?

Explain your answer.

.....

.....

..... [2]

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3 You are provided with three solutions, **A**, **B** and **C**, of potassium manganate(VII) each with a different concentration. You will use solution **X** to determine the most concentrated solution, **A**, **B** or **C**.

(a) Using the dropping pipette and no other apparatus, produce drops of water and estimate the volume of one drop.

estimated volume of one drop = ... cm^3 [1]

(b) Using the small measuring cylinder, place 3 cm^3 of solution **A** into a test-tube. Add a few drops of dilute sulfuric acid. Using the dropping pipette, add solution **X** a drop at a time, counting the drops until the solution turns colourless.
Record the number of drops in the table below.

(c) **(i)** Repeat test **(b)** using solution **B**.

(ii) Repeat again using solution **C**. This time, keep the colourless solution for use in **(e).**

solution	number of drops
A	
B	
C	

[4]

(d) Which is the most concentrated solution, **A**, **B** or **C**? Explain your answer.

most concentrated solution is .....

explanation .....

..... [2]

(e) To the colourless solution from test **(c)(ii)**, add sodium hydroxide solution until no further change occurs.

Record your observation below.

observation = ... [1]

(f) Carry out the following tests on solution **X**.

Record your observations.

(i) Place about 2 cm^3 of solution **X** in a test-tube. Add a few drops of hydrochloric acid followed by drops of barium chloride solution.

observation = ... [1]

(ii) Place about 2 cm^3 of solution **X** in a test-tube. Add a few drops of nitric acid followed by drops of silver nitrate solution.

observation = ... [1]

(iii) Place about 2 cm^3 of solution **X** in a test-tube. Add sodium hydroxide solution until no further change occurs.

observation = ... [1]

(g) Name solution **X**. ..... [2]

(h) In test **(a)** you estimated the volume of a drop from the dropping pipette.
Describe how you could more accurately find the volume of one drop.

.....

.....

..... [2]

CHEMISTRY PRACTICAL NOTES

Test for anions

anion	*test*	*test result*
carbonate (CO_3^{2-})	add dilute acid	effervescence, carbon dioxide produced
chloride (Cl^-) [in solution]	acidify with dilute nitric acid, then add aqueous silver nitrate	white ppt.
nitrate (NO_3^-) [in solution]	add aqueous sodium hydroxide then aluminium foil; warm carefully	ammonia produced
sulfate (SO_4^{2-}) [in solution]	acidify then add aqueous barium chloride *or* aqueous barium nitrate	white ppt.

Test for aqueous cations

cation	*effect of aqueous sodium hydroxide*	*effect of aqueous ammonia*
ammonium (NH_4^+)	ammonia produced on warming	-
copper(II) (Cu^{2+})	light blue ppt., insoluble in excess	light blue ppt., soluble in excess giving a dark blue solution
iron(II) (Fe^{2+})	green ppt., insoluble in excess	green ppt., insoluble in excess
iron(III) (Fe^{3+})	red-brown ppt., insoluble in excess	red-brown ppt., insoluble in excess
zinc (Zn^{2+})	white ppt., soluble in excess giving a colourless solution	white ppt., soluble in excess giving a colourless solution

Test for gases

gas	*test and test results*
ammonia (NH_3)	turns damp red litmus paper blue
carbon dioxide (CO_2)	turns limewater milky
chlorine (Cl_2)	bleaches damp litmus paper
hydrogen (H_2)	“pops” with a lighted splint
oxygen (O_2)	relights a glowing splint