UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

*7515429499*

**PHYSICAL SCIENCE** **0652/05**

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

**1 hour 30 minutes**

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 8.

At the end of the examination, fasten all your work, including ray diagrams in Question 1, 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 | |
| Total | |

This document consists of **8** printed pages.

**1** Carry out the following experiment to plot the path of a ray of light through a recta
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. 1.1.

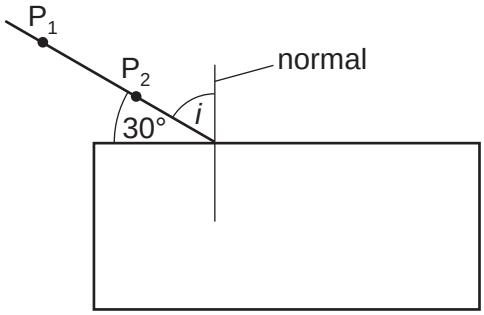



**Fig. 1.1**

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. 1.2.

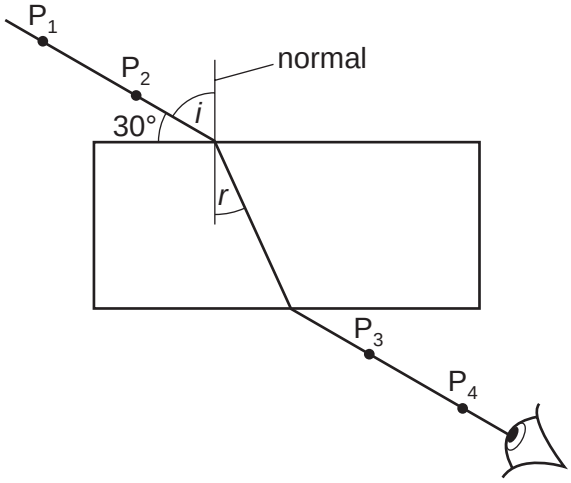



**Fig. 1.2**

Measure the angle of incidence, **i**, and the angle of refraction, **r**.
Record these in Fig. 1.3.

**(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. 1.3. Use a fresh sheet of paper if necessary.

**(d)** Make three further sets of measurements using angles of 50°, 60° and 70° to the ... producing angles of incidence, **i**, 40°, 30° and 20°. Use a fresh sheet of paper if necess... Measure and record the angles of incidence and refraction in Fig. 1.3.

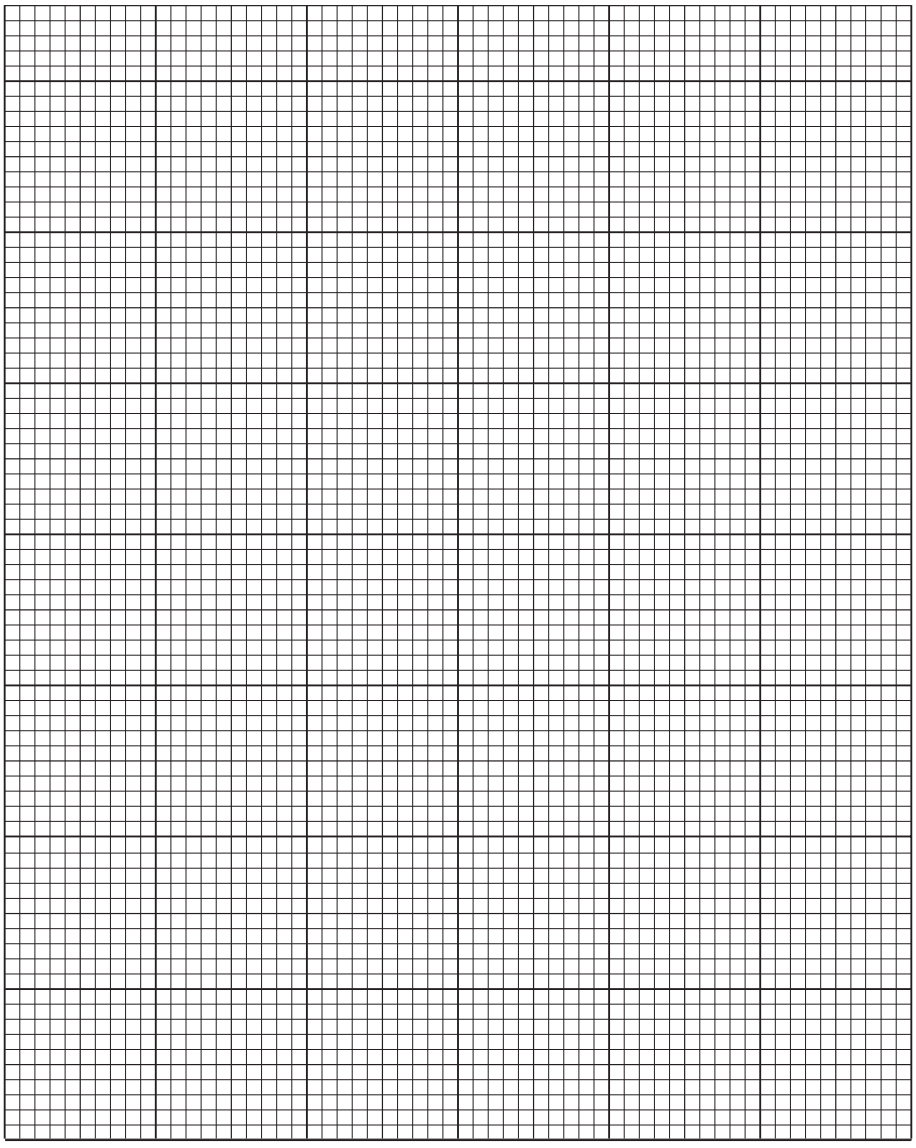
| angle of incidence **i** | angle of refraction **r** |
|---|---|
| | |
| | |
| | |
| | |
| | |

**Fig. 1.3**

[5]

Attach your ray diagrams to your question 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. 1.4 to find this ratio for the angles in **(f)**.
If necessary, estimate the value of sine **i** from Fig. 1.4.

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. 1.4**

**(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. 1.3, differ for a block of d
refractive index?

Explain your answer.

.....

.....

..... [2]

**2** You are provided with three solutions, **A**, **B** and **C**, of potassium manganate(VII) ea a different concentration. You will use solution **X** to determine the most concenth 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 |