UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME	
CENTRE NUMBER	
CANDIDATE NUMBER	

2379524993

PHYSICAL SCIENCE **0652/51**

Paper 5 Practical Test **October/November 2012**

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 12.

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

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1	
2	
Total	

This document consists of **10** printed pages and **2** blank pages.

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1 **(a)** You are going to find the mass of a metre rule. Refer to Fig. 1.1 as you follow these instructions.

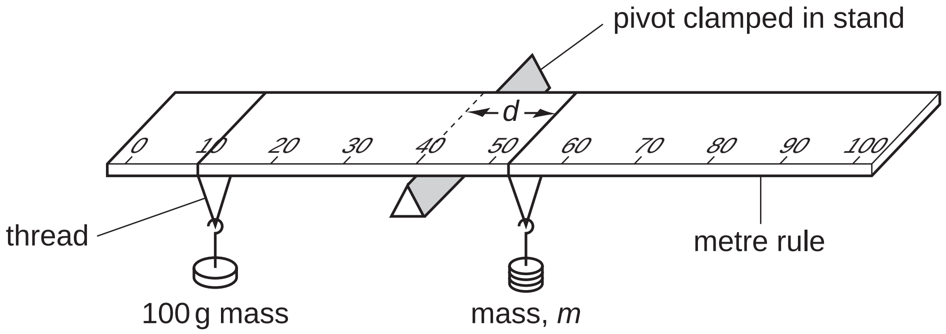

Fig. 1.1

(i)
- Clamp a knife edge or triangular piece of wood in a clamp on a stand; this will act as a pivot on which to balance the rule.
- Place the metre rule horizontally on the pivot at the 40 cm mark on the rule.
- Hang the 100 g mass provided from the 10 cm mark on the rule, using half of the thread.
- Now hang a second mass, *m*, of 50 g, using the other half of the thread, from the rule on the other side of the pivot from the 100 g mass.
- Adjust the distance, *d*, from the pivot to the 50 g mass by moving the 50 g mass to make the rule balance.
- Measure the distance, *d*, from the pivot to the 50 g mass.

Record this value in Table 1.1 on page 4. [1]

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Table 1.1

mass, *m* / g	**distance, *d* / cm**	$\frac{1}{\text{mass, } m} / \frac{1}{\text{g}}$	**mass, *m* × distance, *d* / g cm**
50		0.020	
60			
70			
80			
90		0.011	

(ii) Repeat **(i)** using a 60 g mass instead of the 50 g mass to balance the rule, ensuring that the pivot is still at the 40 cm mark and the 100 g mass is still at the 10 cm mark.

Record the new value of distance, *d*, in Table 1.1.

(iii) Repeat **(i)** using 70 g, 80 g and 90 g masses to balance the rule, ensuring that the pivot is still at the 40 cm mark and the 100 g mass is still at the 10 cm mark.

Record the values of distance, *d*, in Table 1.1. [3]

(b) **(i)** Calculate $\frac{1}{\text{mass, } m}$ for the three remaining values of mass, *m*, and record your answers in Table 1.1. [1]

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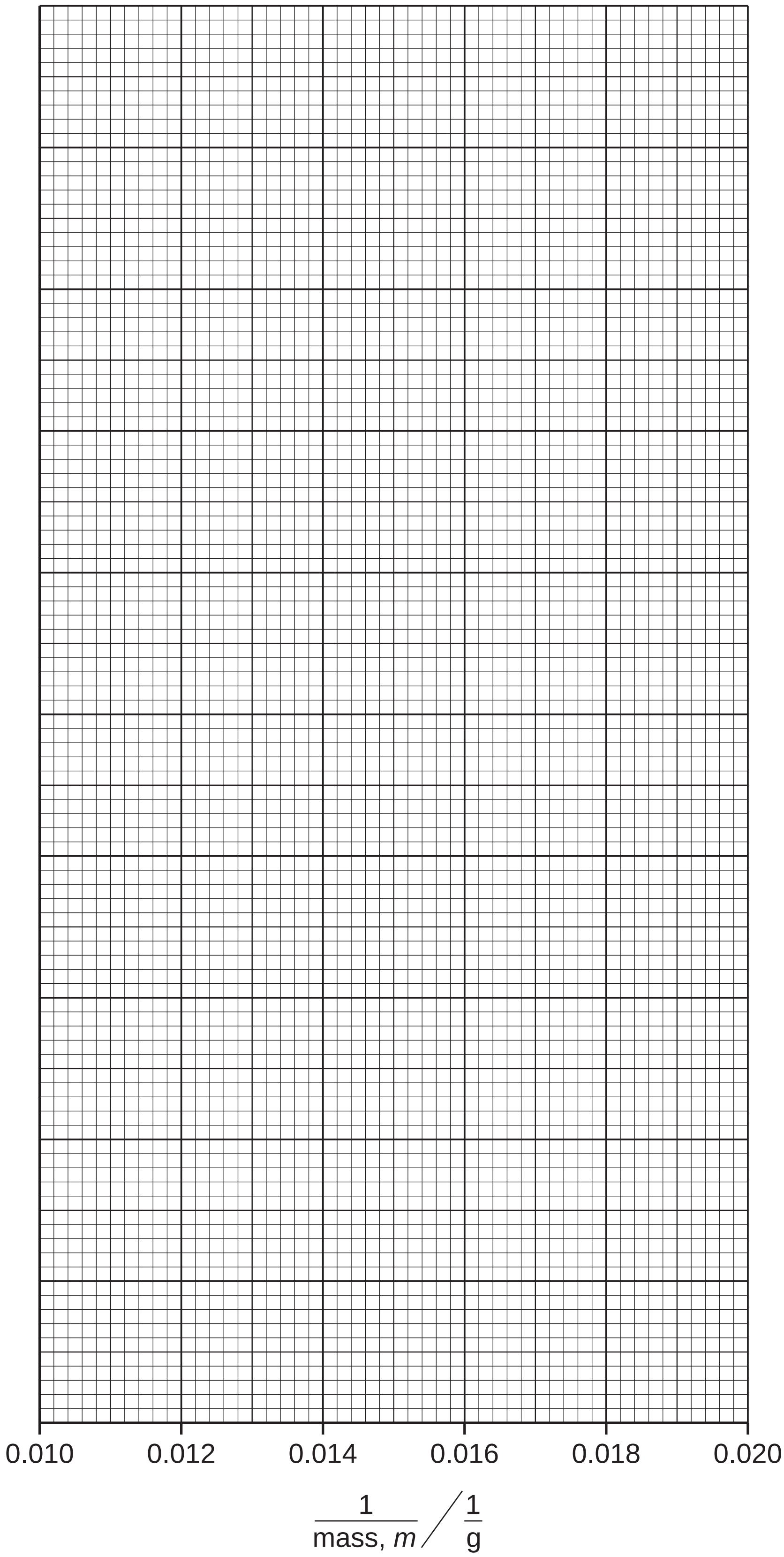
(ii) Complete the vertical scale and plot a graph of distance, d, against $\frac{1}{\text{mass, } m}$ on the grid provided.

Draw the best straight line.



[3]

(iii) Find the gradient of the line of your graph, showing clearly your working.

gradient = ... [2]

(iv) Use the value of the gradient from **(b)(iii)** and the formula shown to calculate the mass of the rule.

mass of rule = 300 – (0.1 × gradient)

mass of rule = ... g [1]

(c) It is possible to find the mass of the rule without plotting a graph.

(i) For each set of readings in Table 1.1, calculate mass, m × distance, d.

Enter the answers in column 4 of Table 1.1.

[1]

(ii) Calculate the average of your mass, m × distance, d values in Table 1.1.

average (mass, m × distance, d) = ... g cm [1]

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(iii) Use the value of the average from **(c)(ii)** and the formula to calculate the mass of the rule.

$$\text{mass of rule} = 300 - \left(\frac{\text{average (mass, } m \times \text{distance, } d\text{)}}{10}\right)$$

mass of rule = ... g [1]

(d) What is the advantage of plotting a graph and finding the gradient rather than using the average (mass, *m*, × distance, *d*) value to calculate the mass of the rule?

....

.... [1]

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2 You are going to investigate the acidity of a soil sample. The sample of soil has been shaken with purified water and filtered. You have been given the filtrate as soil washings, **S**.

You are going to find the concentration of acid in **S**.

(a) (i)
- Use a measuring cylinder to place 10 cm^3 of the alkali aqueous calcium hydroxide into a small beaker.
- Add 3 drops of indicator **P** to the alkali in the beaker.
- Place 10 cm^3 soil washings **S** in the rinsed 0-10 cm^3 measuring cylinder.
- **Slowly** add, drop by drop, soil washings **S** from the measuring cylinder to the beaker containing the alkali and the indicator **P** until the mixture just becomes colourless.

Record, in Table 2.1, the volume of unused soil washings, V_R, remaining in the measuring cylinder. [1]

Table 2.1

volume of aqueous calcium hydroxide, V_a / cm^3	volume of unused soil washings, V_R / cm^3	volume of soil washings used, V_s / cm^3
10.0		
10.0		
10.0		

(ii) Repeat **(a)(i)** twice more, recording the volume of unused soil washings, V_R, remaining in the measuring cylinder in Table 2.1. [3]

(iii) Calculate the volume of soil washings used, V_s, in each case and record the values in column three of Table 2.1. [1]

(iv) Calculate the average volume of soil washings used, V_{av}, using the data in Table 2.1.

V_{av} = ... cm^3 [1]

(v) Calculate the concentration, c_s, of the acid (H^+ ion) in the soil washings, **S**, using the following formula and data

$$c_s \times V_{av} = 2 \times c_a \times V_a$$

V_{av} = average value from **(a)(iv)**
c_a = concentration of alkali, 0.013 mol / dm^3
V_a = 10 cm^3

c_s = ... mol / dm^3 [3]

(b) (i) Place 5 cm^3 soil washings, **S**, in a test-tube and add four drops of Universal Indicator.

Record the colour and pH of the soil washings. Keep the mixture for **(b)(ii)**.

colour = ...

pH = ... [1]

(ii) Add a spatula load of solid calcium carbonate to the mixture from **(b)(i).** Stopper the test-tube and with your finger on the stopper shake well.

Record the colour and pH of the resulting mixture. Keep this mixture for **(b)(iii)**.

colour = ...

pH = ... [1]

(iii) To the mixture from **(b)(ii)** add a second spatula load of solid calcium carbonate, stopper and shake.

Once again record the colour and pH of the resulting mixture.

colour = ...

pH = ... [1]

(c) It is essential that you wear eye protection.

- Place 5 cm^3 soil washings, **S**, in a test-tube and add four drops of Universal Indicator.
- Add a spatula load of solid calcium hydroxide to the test-tube.
- Put a stopper in the test-tube and with your finger on the stopper, shake well.

Record the colour and pH of the resulting mixture.

colour = ...

pH = ... [1]

(d) Suggest which substance, calcium carbonate or calcium hydroxide, would require the smaller amount to spread on the soil to neutralise acidity in the soil.

Explain your answer using the results from **(b)** and **(c)**.

....

....

.... [2]

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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