UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

5404222517

COMBINED SCIENCE **0653/51**

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.

For Examiner's Use	
1	
2	
3	
Total	

This document consists of **12** printed pages.

For Examiner's Use

1 You are going to investigate some of the conditions needed for the germination of pea seeds. You are provided with petri dishes **A**, **B**, **C** and **D** that have been set up as shown in Fig. 1.1.

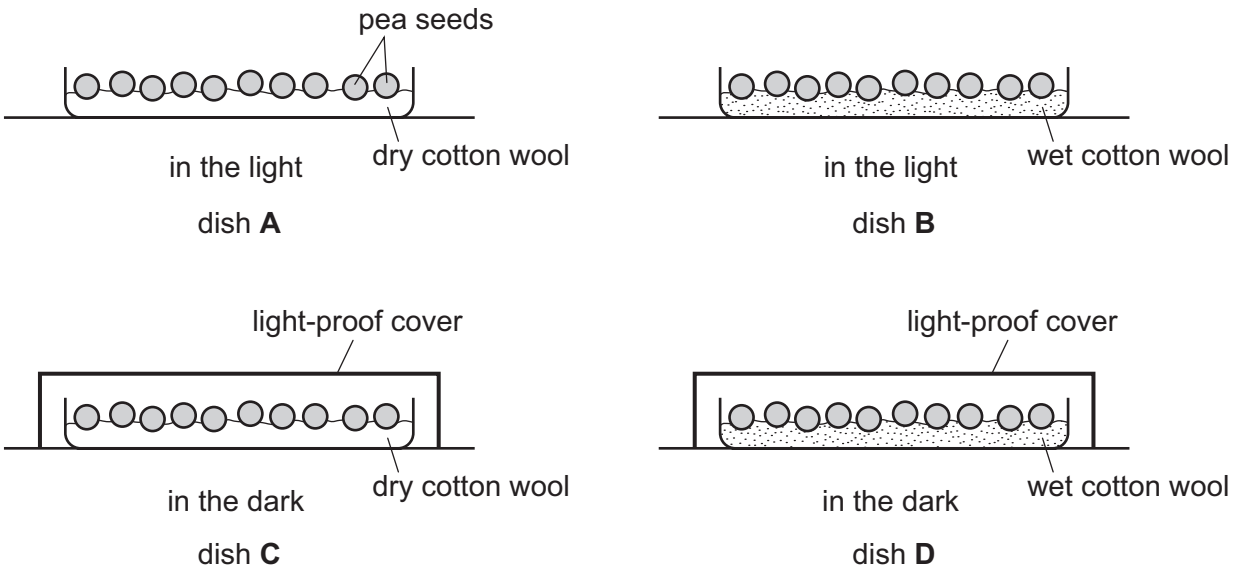

Fig. 1.1

Each petri dish contains some pea seeds. The seeds were soaked in water for 24 hours before being placed in the dishes.

- Dish **A** was left in the light, with the seeds on dry cotton wool.
- Dish **B** was left in the light, with the seeds on wet cotton wool.
- Dish **C** was left in the dark, with the seeds on dry cotton wool.
- Dish **D** was left in the dark, with the seeds on wet cotton wool.

The dishes were then left for 7 days.

(a) Examine the four dishes. Make a note of

(i) the total number of seeds in each dish,

(ii) the number of seeds that have begun to germinate. Germination is indicated by the clear emergence of a radicle (young root) from any seed.

Record your results in Table 1.1.

Table 1.1

petri dish	A	B	C	D
total number of seeds in the dish				
number of germinating seeds in the dish				

[2]

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(b) Use your results to write conclusions about whether light and water are needed for the germination of pea seeds.

light .....

.....

water .....

..... [2]

(c) You are going to test the germinating seeds and their radicles (roots) for the presence of starch and reducing sugar.

Obtain your samples as follows -

- Remove all the seeds from one of the petri dishes where there is clear evidence of germination.
- Cut off the radicles from all of these seeds, and place the radicles in a mortar. Keep two of the seeds for later.
- Add about 10-15 cm^3 water to the radicles.
- Use a pestle to crush the radicles and mix them thoroughly with the water.
- Divide this mixture evenly between two test-tubes.
- Label the test-tubes **R1** and **R2**, and stand them in the test-tube rack for testing later.
- Wash the mortar and pestle before using it again.
- Take the two seeds which you kept, and place them in the clean mortar.
- Crush them with water as before.
- Divide this mixture between two fresh test-tubes. Label these tubes **S1** and **S2**, and stand them in the test-tube rack for testing later.

Now test your samples as follows -

- Add five drops of Benedict's solution to each of test-tubes **R1** and **S1**.
- Place both tubes **R1** and **S1** into the hot water bath provided, and leave them for five minutes.
- Record your observations in Table 1.2.
- Add five drops of iodine solution to test-tubes **R2** and **S2**.
- Record your results in Table 1.2 on page 4.

Table 1.2

test-tube	R1	S1	R2	S2
colour obtained with Benedict's test				
colour obtained with iodine test				

[4]

For Examiner's Use

(d) Which parts of the germinating seeds contained starch, and which contained reducing sugar?

starch .....

.....

reducing sugar .....

..... [2]

2 **(a)** You are going to find the mass of a metre rule. Refer to Fig. 2.1 as you follow these instructions.

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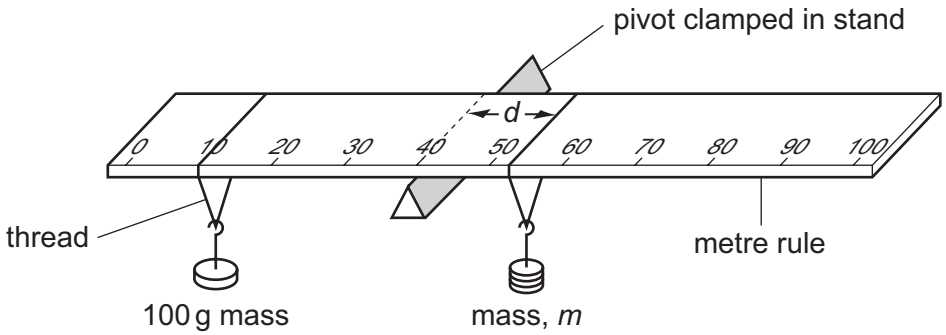

Fig. 2.1

(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 2.1 on page 6. [1]

For Examiner's Use

Table 2.1

mass, m / g	distance, d / cm	$\frac{1}{\text{mass}, m} \Big/ \frac{1}{\text{g}}$
50		0.020
60		
70		
80		0.0125

(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 2.1.

(iii) Repeat **(i)** using 70 g and 80 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 2.1. [2]

(b) (i) Calculate $\frac{1}{\text{mass}, m}$ for the two remaining values of mass, *m*, and record your answers in Table 2.1. [1]

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

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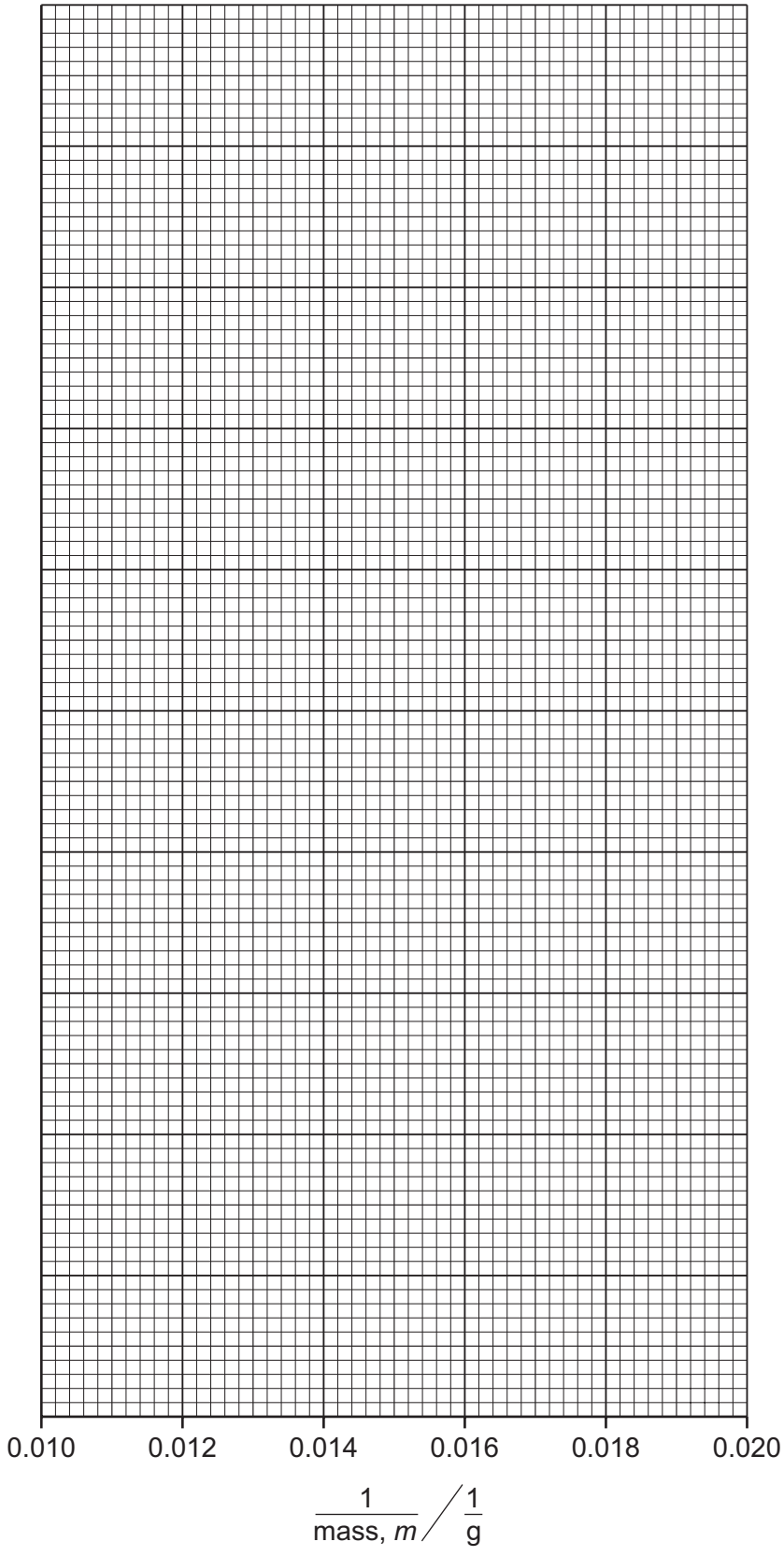
Draw the best straight line.



[3]

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

For Examiner's Use

gradient = ... [2]

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

$$\text{mass of rule} = 300 - (0.1 \times \text{gradient})$$

mass of rule = ... g [1]

Please turn over for Question 3.

For Examiner's Use

3 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 3.1, the volume of unused soil washings, V_R, remaining in the measuring cylinder. [1]

Table 3.1

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 3.1. [3]

(iii) Calculate the volume of soil washings used, V_s, in each case and record the values in column three of Table 3.1.

[1]

(iv) Calculate the average volume of soil washings used, V_{av}, using the data in Table 3.1.

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

For Examiner's Use

(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) 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.

colour = ...

pH = ... [1]

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