EXAMINATIONS COUNCIL OF ESWATINI
Eswatini General Certificate of Secondary Education

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

PHYSICAL SCIENCE **6888/04**

Paper 4 Alternative to Practical **October/November 2025**

1 hour

Candidates answer on the Question Paper.

Additional materials: Calculator

READ THESE INSTRUCTIONS FIRST

Write your name, centre number and candidate number in the spaces provided.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams, graphs, tables or rough working.
Do **not** use staples, paper clips, highlighters, glue or correction fluid.
Do **not** write on the bar code.

Answer **all** questions.

You may lose marks if you do not show your working or if you do not use the appropriate units.

The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks is 40.
Chemistry practical notes for this paper are printed on page 13.

For Examiner's Use	
1	
2	
Total	

This document consists of **13** printed pages and **3** blank pages.

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[Turn over

1 A student investigates the reactivity of four metals and their reactions with dilute hydrochloric acid and aqueous silver nitrate by completing two experiments.

The student is provided with:

- 1 g each of copper powder, magnesium powder, zinc powder and iron filings
- 1 g each of copper turnings, magnesium ribbon, zinc granules and iron turnings
- 50 cm^3 of dilute hydrochloric acid in a beaker
- 40 cm^3 of aqueous silver nitrate.

(a) In this first experiment, the student investigates the reactivity of the metals, copper, magnesium, zinc, and iron with dilute hydrochloric acid.

The student:

1. • measures the temperature of the acid in the beaker using a thermometer. The thermometer reads 24 °C.
   • records this temperature as the initial temperature in Table 1.1.
2. • pours 10 cm^3 of the acid into each of four test-tubes labelled **A**, **B**, **C** and **D**, as shown in Fig. 1.1.

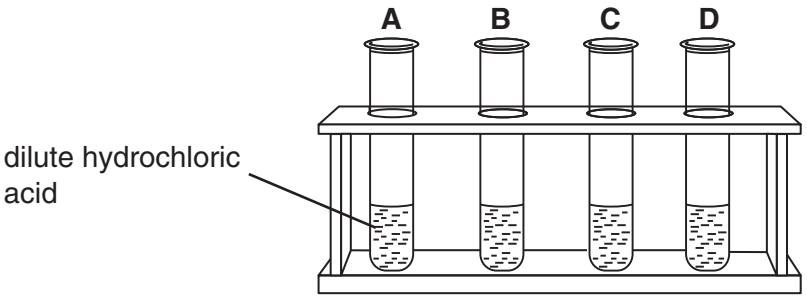


Fig. 1.1

3. The student
   • adds the iron filings into test-tube **A** and stirs with the thermometer for three minutes. The final temperature of the acid is shown in Fig. 1.2.

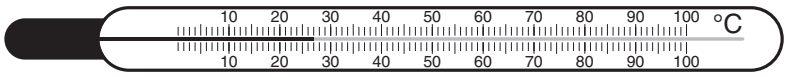


Fig. 1.2

(i) Read the final temperature shown in Fig. 1.2 and record it in Table 1.1. [1]

The student

4. repeats step **3** for test-tube **B** using zinc powder instead of iron filings.
5. repeats step **3** for test-tube **C** using copper powder instead of iron filings.
6. • adds the magnesium powder into test-tube **D** and stirs with the thermometer.
   • inserts a lighted splint into the test-tube to test the gas given off.
   • reads and records the final temperature Table 1.1.
   • records the observation made by the student Table 1.1.

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Fig. 1.3 shows the experiment

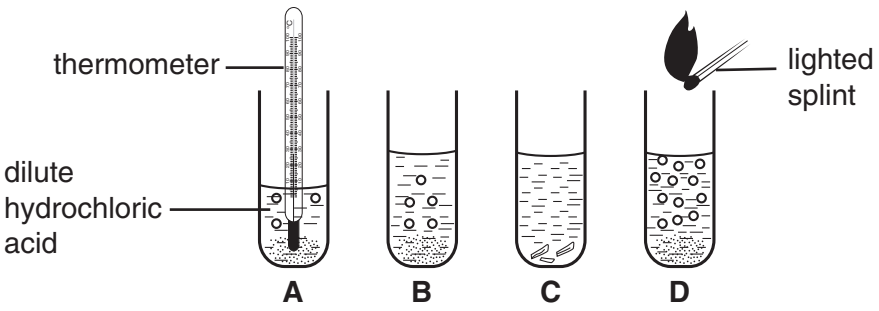


Fig. 1.3

(ii) Using Fig. 1.3, complete Table 1.1 by stating the observations the student makes in test-tube **B**, **C** and **D**.

Table 1.1

experiment in test-tube	temperature of acid / °C		observations
	initial	final	
A	24	.....	fewer bubbles given off.
B	24	29	.....
C	24	24	.....
D	24	35	result with lighted splint ..... other observation .....

[4]

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(iii) Name the gas that is produced in test-tube **D**.

..... [1]

(iv) Using the results in Table 1.1, identify the most reactive and least reactive metal.

most reactive .....

least reactive .....
[2]

(v) State **two** reasons for your answer to **(a)(iv)**.

1 .....

2 .....
[2]

(vi) Identify a variable that was controlled to ensure the experiment was a fair test.

..... [1]

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(b) In the second experiment, the student investigates the reactivity of the metals, copper, magnesium, zinc, and iron with aqueous silver nitrate.

The student:

1. pours 7 cm^3 aqueous silver nitrate into each of four test-tubes labelled **E**, **F**, **G** and **H** as shown in Fig. 1.4 and measures the temperature of the silver nitrate in each test-tube using a thermometer.
2. adds zinc granules to the test-tube **E**, iron turnings to the test-tube **F**, copper turnings to the test-tube **G** and magnesium ribbon to the test-tube **H** simultaneously.
3. leaves the test-tubes undisturbed for **three minutes**.
4. measures the temperature of the contents of the test-tubes using a thermometer.

Table 1.2 shows the temperature readings taken from each test-tube.

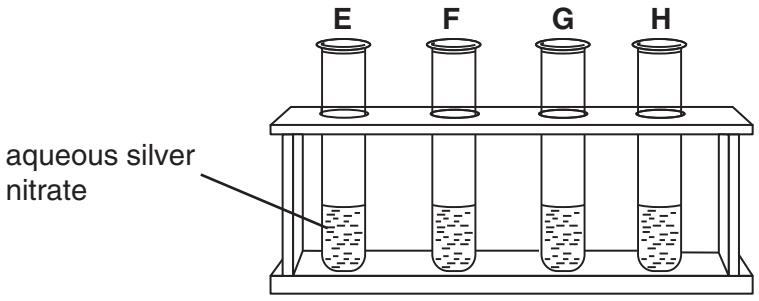


Fig. 1.4

(i) In Table 1.2, suggest and record **two** observations the student makes during the reaction of aqueous silver nitrate with the metals iron, copper, and magnesium.

The observation made with zinc has been done for you.

Table 1.2

metal	temperature / °C		observation
	initial	final	
zinc	21	28	grey precipitate formed slowly
iron	21	29	....
copper	21	26	....
magnesium	21	33	....

[3]

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(ii) Using the results in Table 1.2, state and explain the type of reaction that occurs.

.....

.....

..... [2]

(iii) Zinc nitrate is one of the substances formed when zinc granules react with aqueous silver nitrate.

Name the other substance formed in the reaction.

..... [1]

(iv) Using the results from Table 1.2, state which metal is the least reactive. Explain your answer.

least reactive metal .....

explanation .....

.....

[2]

(c) Using the results from **(a)** and **(b)**, arrange the four metals in order of reactivity, starting with the most reactive.

most reactive .....

.....

.....

least reactive .....

[1]

[Total:20]

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[Turn over

2 A student investigates the relationship between a load and the extension of a spring.

The student sets up the experiment shown in Fig. 2.1.

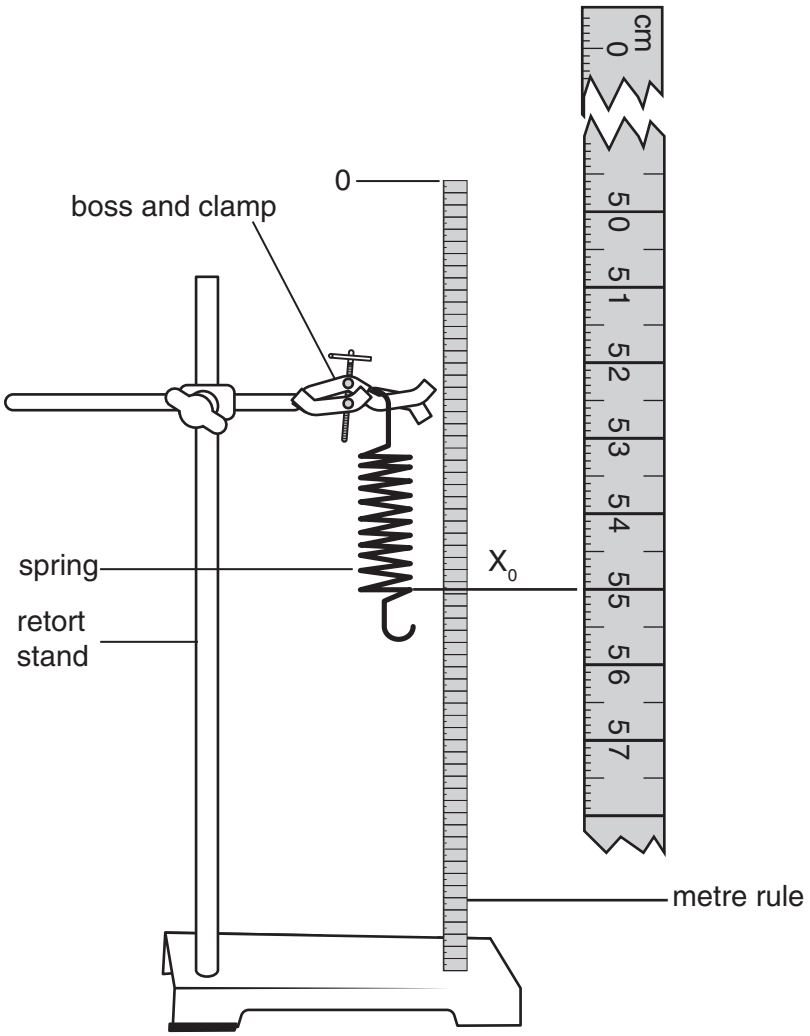


Fig. 2.1

(a) Read and record the position of the bottom of the spring, X_0, shown in Fig. 2.1.

[Write your answer in millimetres.]

..... [1]

(b) The student suspends a 100 g mass on the spring as shown in Fig. 2.2.

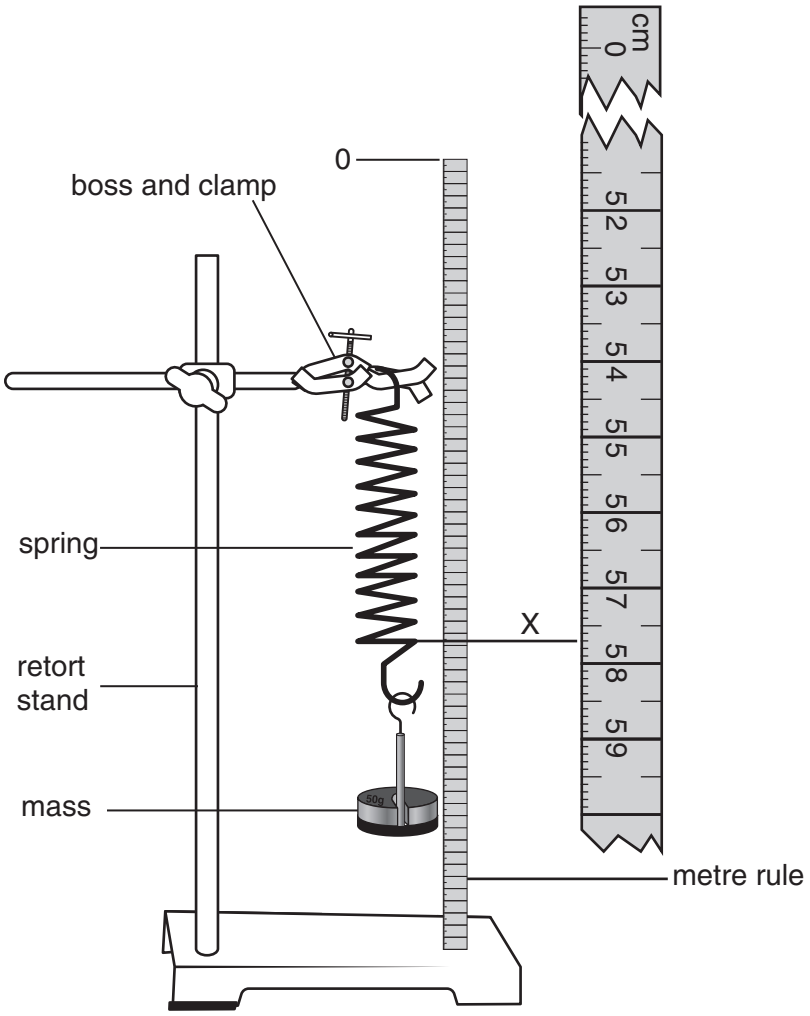


Fig. 2.2

Read and record the new position of the bottom of the spring, X, in Table 2.1.

[Write your answer in millimetres.] [1]

(c) The student:

- repeats procedure **(b)** by adding 50 g masses, one at a time, on the suspended mass
- records the new positions of the bottom of the spring, X, in Table 2.1 for each 50 g mass added.

Table 2.1

mass / kg	0.10	0.15	0.20	0.25	0.30
load / N					
new position 'X' / mm		595	615	635	655
extension …….....					

Complete Table 2.1 by:

(i) filling in the unit for extension [1]

(ii) calculating the load, W, for each mass using the formula:

$W = mg$

[Take $g = 10\,N / kg$]

[2]

(iii) calculating the extension, e, caused by each mass using the formula:

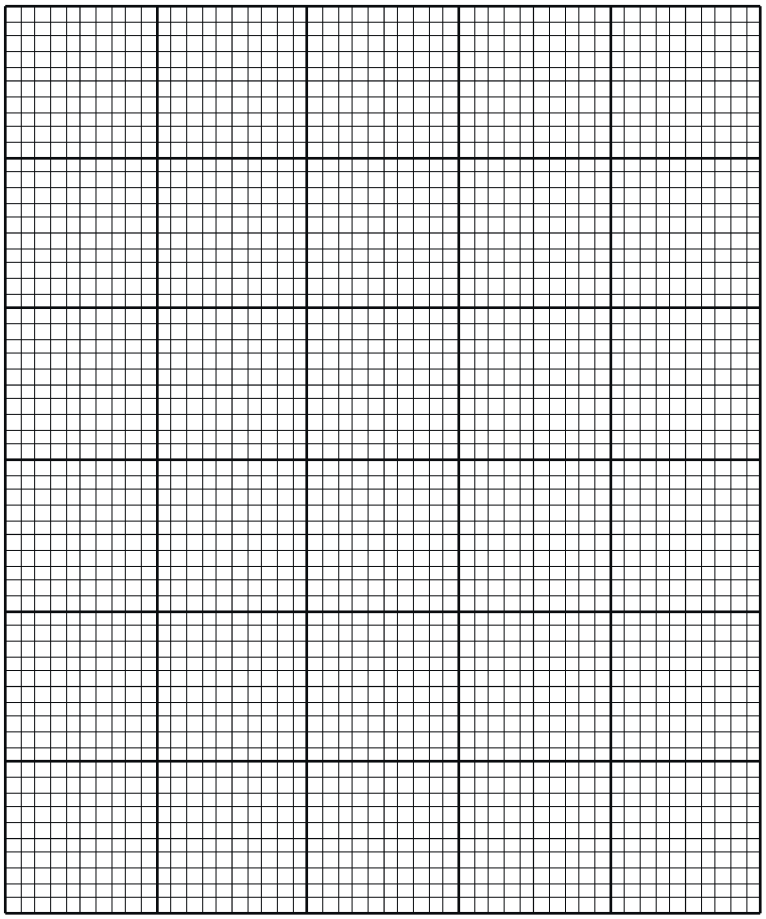
$e = X - X_0$.

[2]

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(d) Using the results in Table 2.1, plot a graph of extension against load.

extension / .....



load / N

[3]

(e) (i) Using the graph, determine the load when the extension is 50 mm.

..... N [2]

(ii) Using your value in **(e)(i)** and the extension of 50 mm, calculate the spring constant, k.

Use the formula:

$W = ke$

Where: W = load

k = spring constant

e = extension

..... N / m [2]

(f) State the relationship between the load and the extension of the spring.

.....

..... [1]

(g) (i) State **one** source of error when carrying out the experiment.

..... [1]

(ii) Suggest a precaution to remove this error.

..... [1]

(h) Suggest how the method described in **(b)** and **(c)** can be changed to investigate the limit of proportionality.

.....

.....

.....

.....

..... [3]

[Total: 20]

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CHEMISTRY PRACTICAL NOTES

Tests 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.
iodide(I^-) [in solution]	acidify with dilute nitric acid, and then add aqueous lead(II) nitrate/ aqueous silver nitrate	yellow ppt.
nitrate (NO_3^-) [in solution]	add aqueous sodium hydroxide then aluminium foil; warm carefully	ammonia produced
sulfate (SO_4^{2-}) [in solution]	acidify with dilute nitric acid, then add aqueous barium nitrate	white ppt.

Tests for aqueous cations

Cation	*Effect of aqueous sodium hydroxide*	*Effect of aqueous ammonia*
ammonium (NH_4^+)	ammonia produced on warming	no reaction
calcium (Ca^{2+})	white ppt, insoluble in excess	no ppt or very slightly white ppt.
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

Tests for gases

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

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