Centre Number	Candidate Number	Candidate Name

NAMIBIA SENIOR SECONDARY CERTIFICATE

PHYSICAL SCIENCE ORDINARY LEVEL

4323/3

PAPER 3

1 hour 30 minutes

Marks 60

2018

Additional Materials: Non-programmable calculator
Ruler

INSTRUCTIONS AND INFORMATION TO CANDIDATES

- Candidates answer on the Question Paper in the spaces provided.
- Write your Centre Number, Candidate Number and Name in the spaces at the top of this page.
- Write in dark blue or black pen.
- You may use a soft pencil for any diagrams, graphs or rough working.
- Do not use correction fluid.
- Do not write in the margin *For Examiner's Use*.

- Answer **all** questions.

- The number of marks is given in brackets [ ] at the end of each question or part question.
- You may use a non-programmable calculator.

- Take the weight of 1 kg to be 10 N (i.e. acceleration of free fall g = 10 m/s^2).
- The Periodic Table is printed on page 15.
- Chemistry practical notes are printed on page 16.

For Examiner's Use	
1	
2	
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6	
TOTAL	
Marker	
Checker	

This document consists of **16** printed pages.

Republic of Namibia

MINISTRY OF EDUCATION, ARTS AND CULTURE

1 A Grade 12 student is investigating the stretching of a spring.

Fig. 1.1 shows the experimental set up.

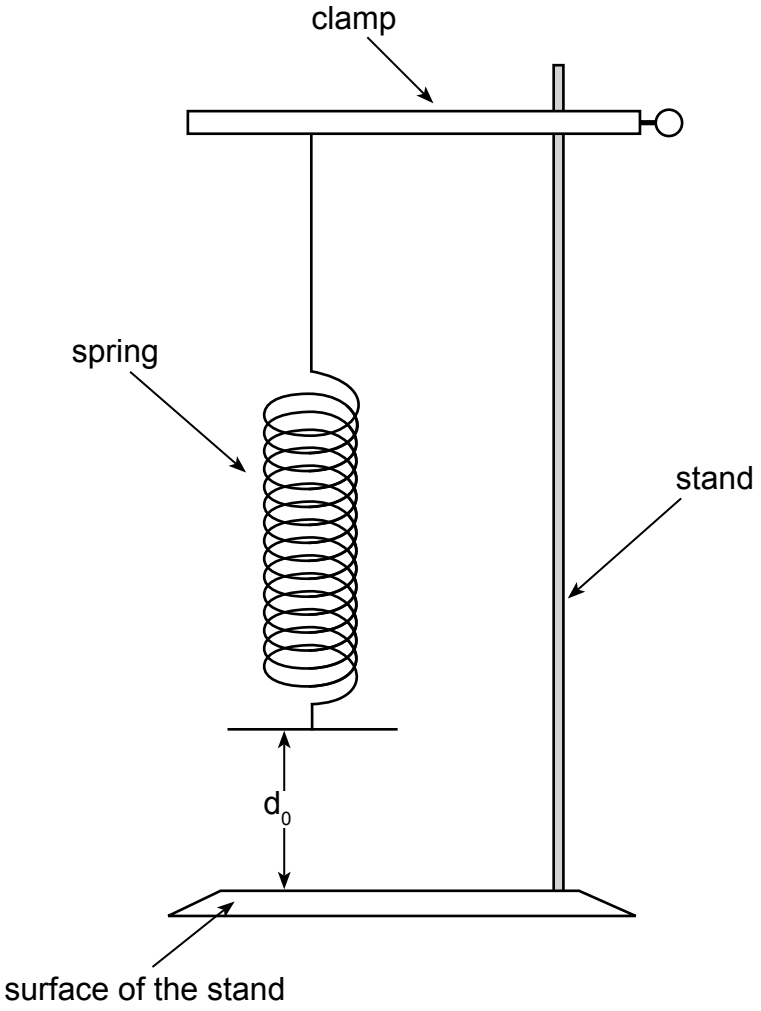


Fig. 1.1

(a) On Fig. 1.1, use your ruler to measure the vertical distance d_0, in mm, between the bottom of the spring and the surface of the stand.

d_0 = ... mm [1]

(b) The diagram is drawn 1/10th of the actual size.
Calculate the actual distance D_0, in mm, between the bottom of the spring and the surface of the stand.

D_0 = ... mm [1]

(c) The student hangs a 1.0 N load on the spring. He measures and records the distance D between the bottom of the spring and the surface of the stand, and the value of the load L.

He repeats the procedure using loads of 2.0 N, 3.0 N, 4.0 N and 5.0 N. His readings are shown in the table in Fig. 1.2.

Calculate the extension, e, of the spring for each set of readings using the equation shown below.

$e = (D_0 - D)$

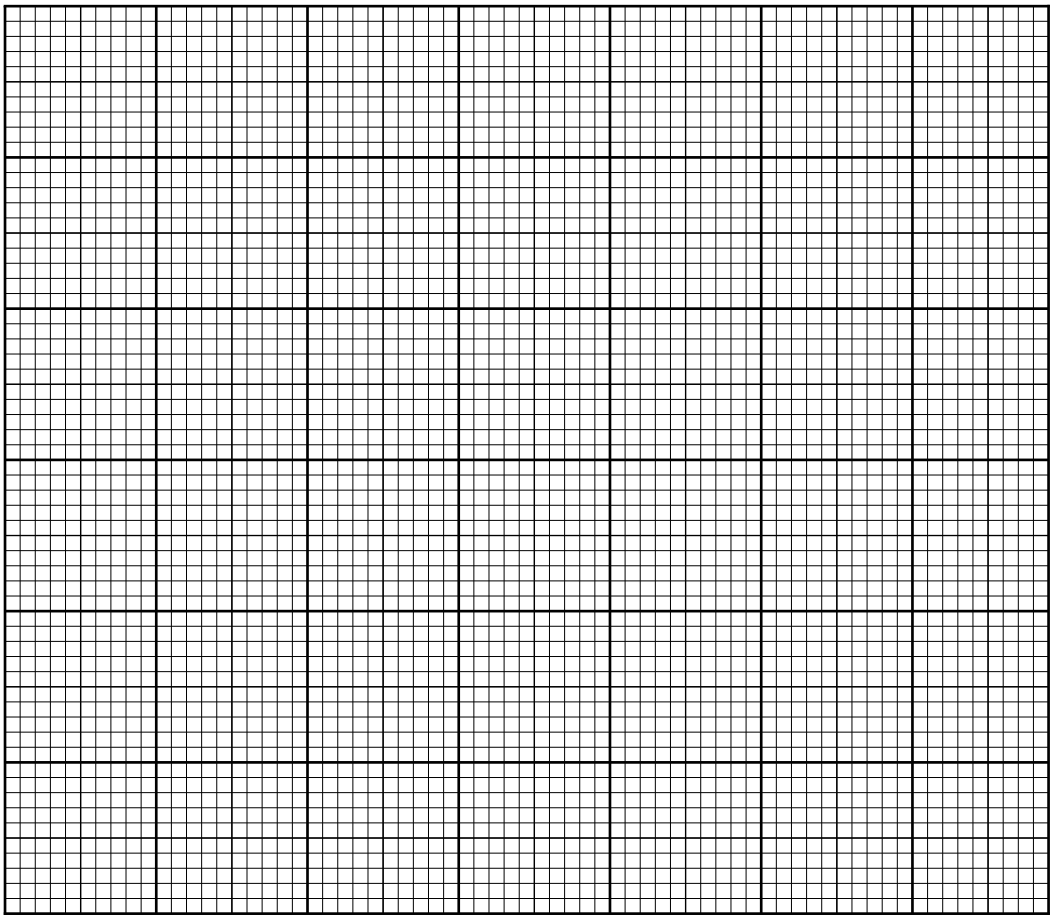
Record the values of e in the table in Fig. 1.2.

L/N	D/mm	e/mm
1.0	199	
2.0	191	
3.0	179	
4.0	171	
5.0	160	

[4]

Fig. 1.2

(d) Plot a graph of e/mm (y-axis) against L/N (x-axis) on the grid in Fig. 1.3.



[5]

Fig. 1.3

For Examiner's Use

(e) Use the information from your graph to write a conclusion for the experiment.

.....

..... [1]

(f) When making measurements, the student is careful to avoid a line-of-sight error.

Suggest **one** other precaution that the student should take when measuring the distance, D, between the bottom of the spring and the surface of the stand.

.....

.....

..... [1]

[13]

2 Heat is given out when alcohol is burned.

Peter used the apparatus in Fig. 2.1 to find the amount of heat produced when four different alcohols: methanol, ethanol, propanol and butanol, were burned.

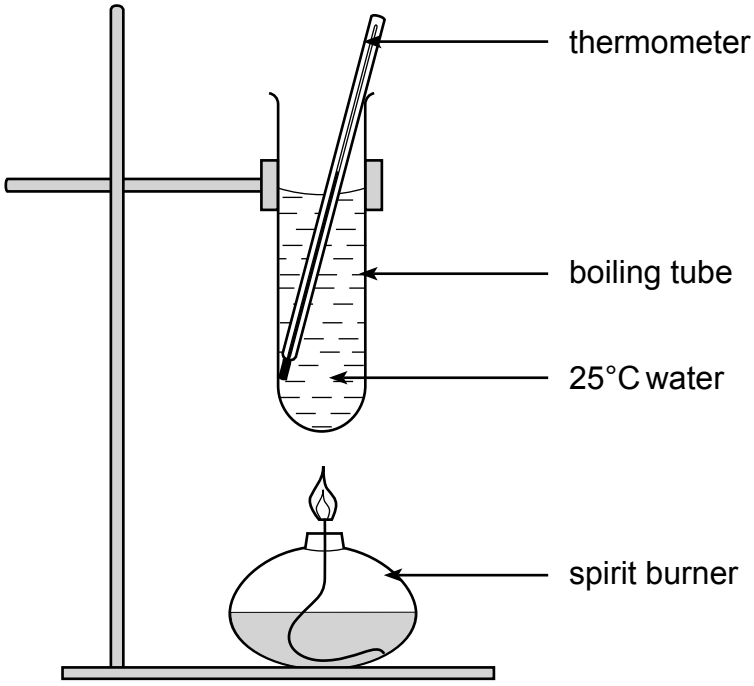
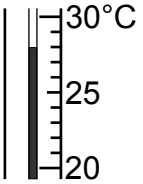
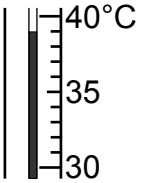
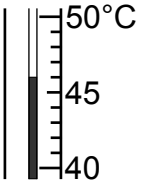
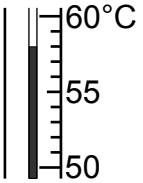


Fig. 2.1

- He puts some methanol into the spirit burner.
- He puts a certain volume of water at 25°C in the boiling tube.
- He lit the spirit burner, allowed it to burn and heat the water for one minute.
- He extinguished the flame and recorded the final temperature in the table in Fig. 2.2.
- The experiment was repeated with ethanol, propanol and butanol. The same volume of water at 25°C was used in each experiment.

(a) Use the thermometer diagrams to record the final temperatures in the table in Fig. 2.2.

Complete the table by calculating the temperature rise for ethanol, propanol and butanol.

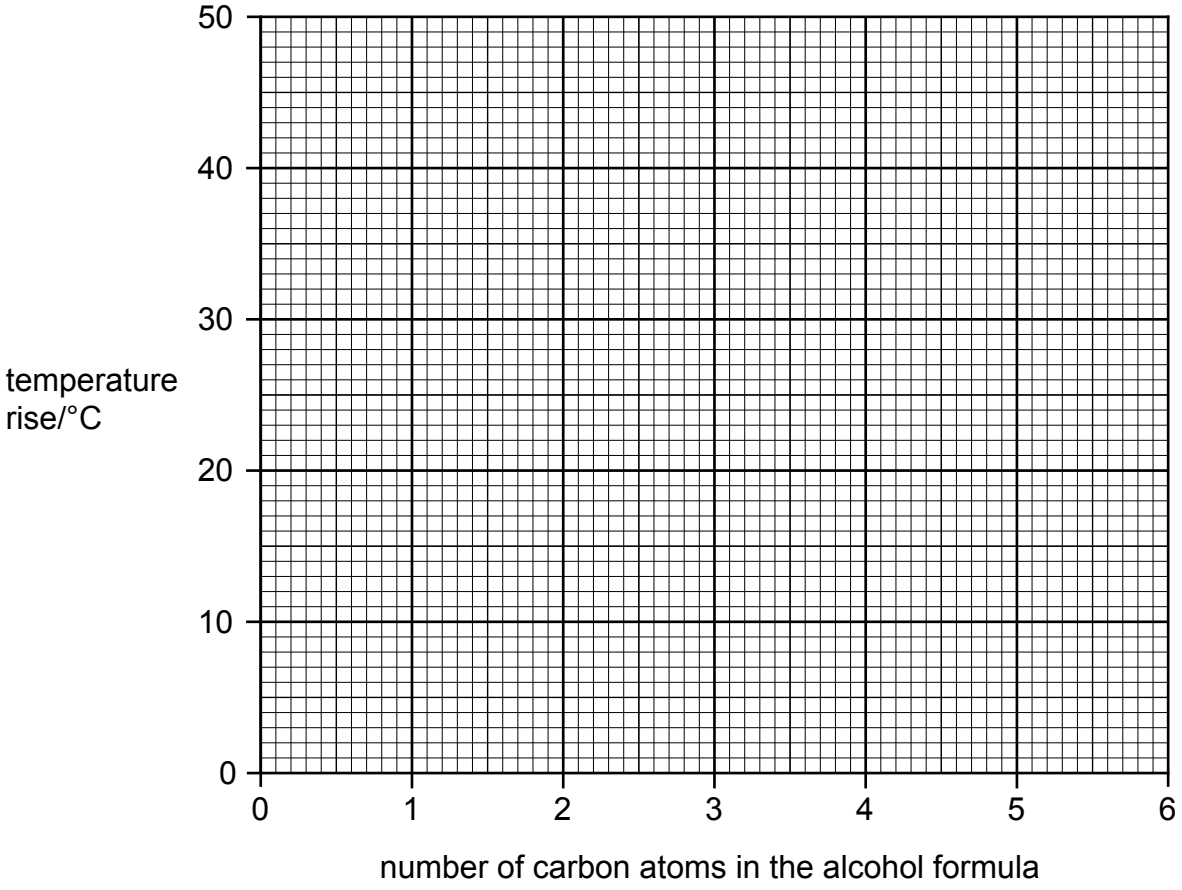
alcohol	formula	final		temperature rise/°C
		thermometer diagram	temperature/°C	
methanol	CH_3OH		28	3
ethanol	C_2H_5OH			
propanol	C_3H_7OH			
butanol	C_4H_9OH			

[4]

Fig. 2.2

For Examiner's Use

(b) Plot the results obtained on the grid in Fig. 2.3 and draw a line of best fit through the points.



[4]

Fig. 2.3

(c) From your graph, work out the temperature rise expected if the experiment was repeated using pentanol, $C_5H_{11}OH$.

Show clearly on the grid how you obtained your answer.

..... [3]

(d) State the importance of using the same volume of water for all experiments.

..... [1]

(e) Suggest the effect of using a steel tube to heat the water instead of a boiling tube. Explain your answer.

Effect .....

Explanation .....

..... [2]

[14]

3 In an experiment a student is using the apparatus shown in Fig. 3.1 to find the mass of a metre rule.

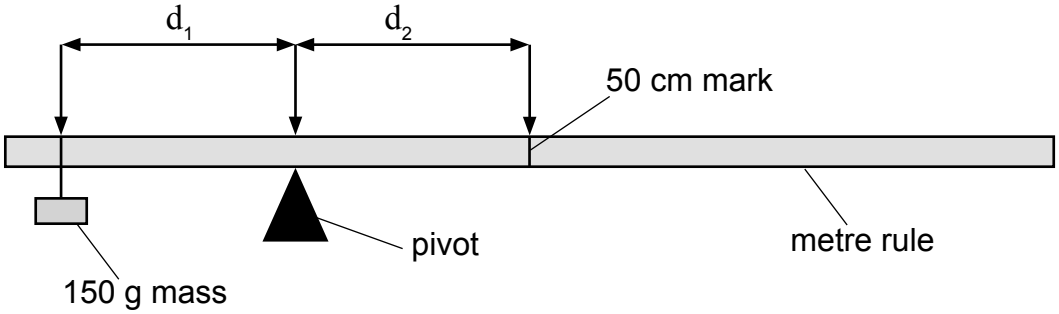


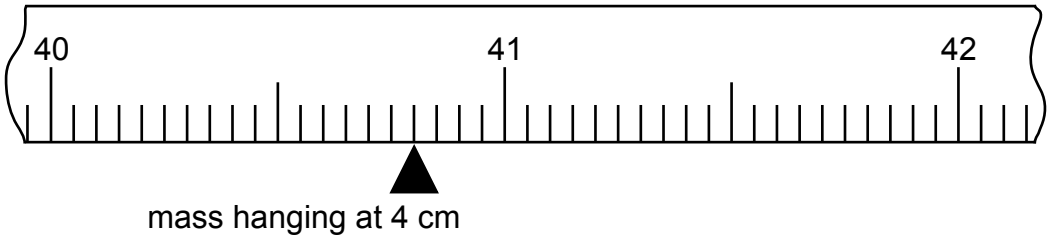
Fig. 3.1

She hangs a 150 g mass from the 2 cm mark of the metre rule. She changes the position of the pivot until the rule is balanced. She does this four more times with the mass hanging at 4, 6, 8 and 10 cm marks. She recorded the positions of the pivot for the mass hanging at the 2, 6 and 10 cm marks in the table in Fig. 3.2.

Position of mass/cm	Position of pivot/cm
2	40.4
4	
6	41.2
8	
10	42.0

Fig. 3.2

(a) The readings for the mass hanging at 4 and 8 cm are shown on Fig. 3.3. Record these readings in the table in Fig. 3.2.



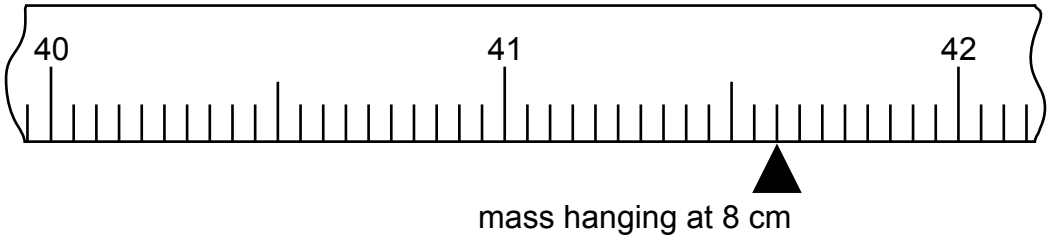


Fig. 3.3

[2]

For Examiner's Use

(b) She calculated the mass of the metre rule using the formula below.

mass x d_2 = 150 x d_1

d_1 = (position of the pivot – position of mass)

d_2 = (50 – position of the pivot)

(i) Using the data from the table in Fig. 3.2, calculate d_1 and d_2 when the position of the mass is 10 cm.

d_1 = ...cm

d_2 = ...cm [2]

(ii) Using the values of d_1 and d_2 from **(b) (i)**, calculate the mass of the metre rule.

Mass of metre rule = ... [2]

(c) Explain the importance of using all five values to determine the mass of the metre rule.

.....

..... [1]

(d) Describe how the same apparatus can be used to find the mass of a small stone.

.....

.....

.....

.....

.....

..... [3]

[10]

4 A student prepared a sample of copper(II) sulfate, a blue crystalline salt. He followed the following procedures.

- Using a measuring cylinder, he measures the volume of sulfuric acid of a known concentration and added it to a beaker.
- He carefully heated the contents in the beaker until nearly boiling.
- He added copper(II) oxide to the beaker until it is in excess.
- He stirred the mixture and heated it further for 1 or 2 minutes.

(a) Fig. 4.1 shows a measuring cylinder with the amount of sulfuric acid added.

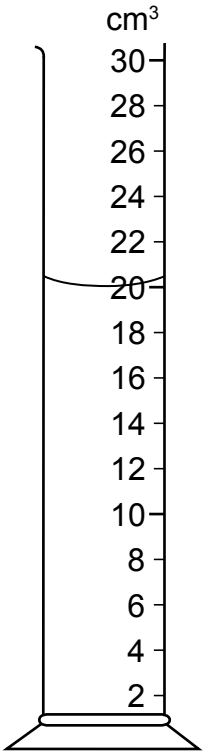


Fig. 4.1

Record the volume of sulfuric acid added.

..... [1]

(b) Write the word equation for the reaction.

..... [2]

(c) Suggest a simple test that the student could do to make sure that all the acid has been reacted.

Test .....

.....

Result ..... [2]

(d) Fig. 4.2 shows the setup of apparatus used to separate unreacted copper(II) oxide from the solution of copper(II) sulfate.

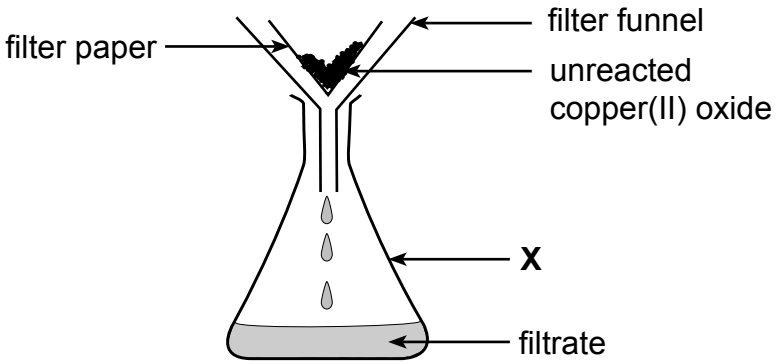


Fig. 4.2

(i) Give the name of the apparatus labelled **X**.

..... [1]

(ii) Describe the process followed to obtain copper(II) sulfate crystals from the filtrate.

.....

.....

.....

.....

.....

.....

.....

..... [4]

[10]

5 A Grade 12 student carried out a timing experiment using a simple pendulum. She plotted a graph of T^2/s^2 against l/m. T is the time for one swing of the pendulum and l is the length of the pendulum.

The graph is shown in Fig. 5.1.

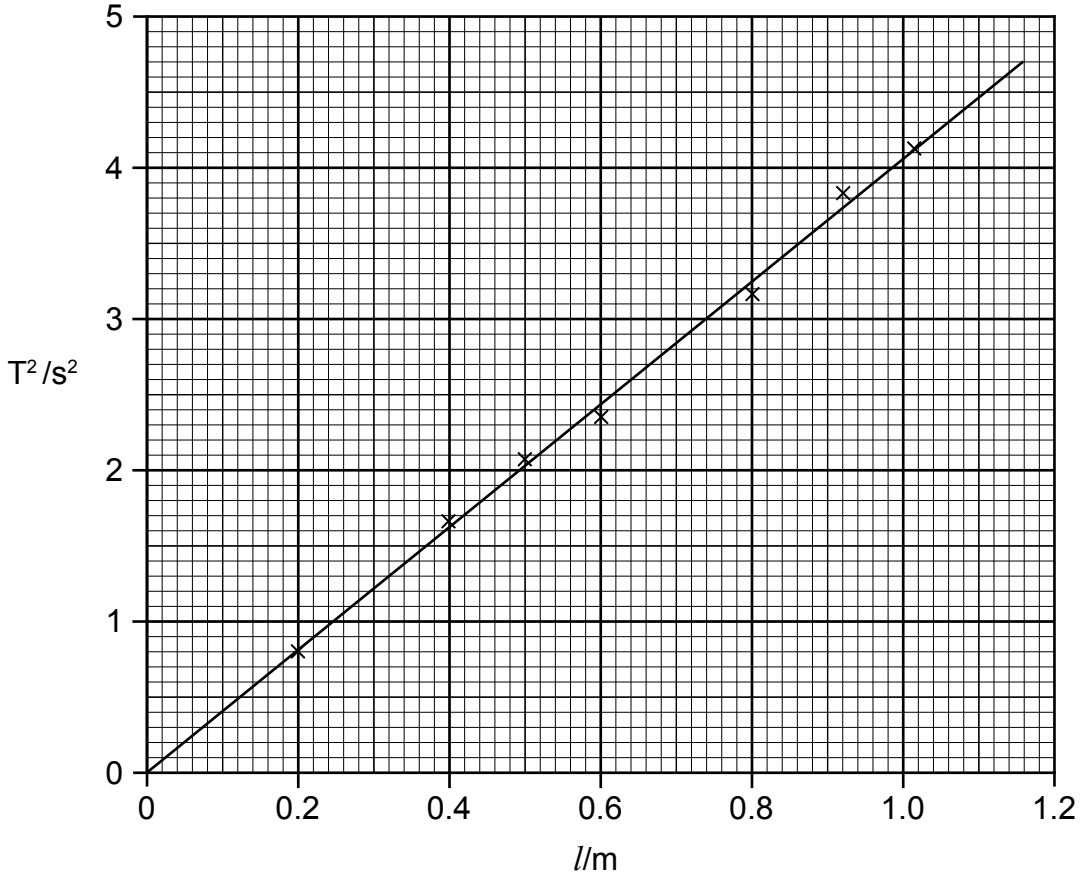


Fig. 5.1

(a) (i) Determine the gradient of the graph. Show clearly on the graph how you obtained the necessary information.

Gradient =..... [2]

(ii) Calculate the acceleration, g, of free fall using the equation shown below.

$$g = \frac{4\pi^2}{\text{gradient}}$$

g =..... m/s² [2]

(b) The student also studies the relationship between the mass, m, of the pendulum and the time, T, for one swing. The readings are shown in the table in Fig. 5.2.

m/g	T/s
50	1.58
100	1.60
150	1.61
200	1.57
250	1.59

Fig. 5.2

(i) Suggest **two** variables that must be kept constant to make the experiment fair.

1 .....

2 ..... [2]

(ii) Suggest the conclusion that the student could make.

.....

..... [1]

[7]

6 Two aqueous solutions, P and Q, were analysed. Q was a solution of sodium hydroxide.

The tests on the solutions and some of the observations are in the table below.

Complete the observations in the table.

Tests	Observations
(a) Appearance of the solutions. solution P solution Q	 colourless liquid colourless liquid
(b) Universal Indicator paper was used to test the pH of each solution. solution P solution Q	 pH 11 pH ……..... [1]
(c) Tests on solution P **(i)** Drops of solution P were added to copper(II) sulfate solution in a test-tube. Excess of solution P was then added to the test-tube. **(ii)** Experiment **(c) (i)** was repeated using aqueous aluminium sulfate instead of aqueous copper sulfate. **(iii)** A few drops of nitric acid and silver nitrate solution were added to solution P.	 pale blue precipitate formed deep blue solution formed white precipitate formed insoluble in excess no visible reaction
(d) Tests on solution Q **(i)** Experiment **(c) (i)** was repeated using solution Q. **(ii)** Experiment **(c) (ii)** was repeated using solution Q.	 ..... [1] .... [2]

(a) What conclusions can be made about solution P?

.....

..... [2]

[6]

DATA SHEET
The Periodic Table of the Elements

Group																	
I	II											III	IV	V	VI	VII	0
						1 H Hydrogen 1											4 He Helium 2
7 Li Lithium 3	9 Be Beryllium 4											11 B Boron 5	12 C Carbon 6	14 N Nitrogen 7	16 O Oxygen 8	19 F Fluorine 9	20 Ne Neon 10
23 Na Sodium 11	24 Mg Magnesium 12											27 Al Aluminium 13	28 Si Silicon 14	31 P Phosphorus 15	32 S Sulfur 16	35,5 Cl Chlorine 17	40 Ar Argon 18
39 K Potassium 19	40 Ca Calcium 20	45 Sc Scandium 21	48 Ti Titanium 22	51 V Vanadium 23	52 Cr Chromium 24	55 Mn Manganese 25	56 Fe Iron 26	59 Co Cobalt 27	59 Ni Nickel 28	64 Cu Copper 29	65 Zn Zinc 30	70 Ga Gallium 31	73 Ge Germanium 32	75 As Arsenic 33	79 Se Selenium 34	80 Br Bromine 35	84 Kr Krypton 36
85 Rb Rubidium 37	88 Sr Strontium 38	89 Y Yttrium 39	91 Zr Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42	Tc Technetium 43	101 Ru Ruthenium 44	103 Rh Rhodium 45	106 Pd Palladium 46	108 Ag Silver 47	112 Cd Cadmium 48	115 In Indium 49	119 Sn Tin 50	122 Sb Antimony 51	128 Te Tellurium 52	127 I Iodine 53	131 Xe Xenon 54
133 Cs Caesium 55	137 Ba Barium 56	139 La Lanthanum 57 *	178 Hf Hafnium 72	181 Ta Tantalum 73	184 W Tungsten 74	186 Re Rhenium 75	190 Os Osmium 76	192 Ir Iridium 77	195 Pt Platinum 78	197 Au Gold 79	201 Hg Mercury 80	204 Tl Thallium 81	207 Pb Lead 82	209 Bi Bismuth 83	Po Polonium 84	At Astatine 85	Rn Radon 86
Fr Francium 87	226 Ra Radium 88	227 Ac Actinium 89 †															

140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60	Pm Promethium 61	150 Sm Samarium 62	152 Eu Europium 63	157 Gd Gadolinium 64	159 Tb Terbium 65	162 Dy Dysprosium 66	165 Ho Holmium 67	167 Er Erbium 68	169 Tm Thulium 69	173 Yb Ytterbium 70	175 Lu Lutetium 71
232 Th Thorium 90	Pa Protactinium 91	238 U Uranium 92	Np Neptunium 93	Pu Plutonium 94	Am Americium 95	Cm Curium 96	Bk Berkelium 97	Cf Californium 98	Es Einsteinium 99	Fm Fermium 100	Md Mendelevium 101	No Nobelium 102	Lr Lawrencium 103

***58 - 71 Lanthanoid series**
†90 - 103 Actinoid series

Key

a	a = relative atomic mass
X	X = atomic symbol
b	b = proton (atomic) number

The volume of one mole of any gas is 24 dm^3 at room temperature and pressure (r.t.p.).

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.
iodide (I^-) [in solution]	acidify with dilute nitric acid, then add aqueous lead (II) 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*
aluminium (Al^{3+})	white ppt., soluble in excess, giving a colourless solution	white ppt., insoluble in excess
ammonium (NH_4^+)	ammonia produced on warming	–
calcium (Ca^{2+})	white ppt., insoluble in excess	no ppt., or very slight 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

Test for gases

gas	*test and test result*
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