BOTSWANA EXAMINATIONS COUNCIL
Botswana General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

SCIENCE: DOUBLE AWARD **0569/04**

Paper 4 **October/November 2018**

1 hour 30 minutes

Candidates answer on the Question Paper.
Additional Materials: 300 mm ruler.

337

READ THESE INSTRUCTIONS FIRST

Write your candidate name, Centre number and candidate number in the spaces provided 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 staples, paper clips, highlighters, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
Write your answers in the spaces provided on the Question Paper.
The number of marks is given in brackets [ ] at the end of each question or part question.
You may use a calculator.

A copy of the Periodic Table is printed on page 16.

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For Examiner's Use	
1	
2	
3	
4	
5	
6	
Total	

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1 Fig. 1.1 shows a set-up used to determine the mass m of a uniform metre rule.
A pivot is placed at the 40 cm mark of the rule.

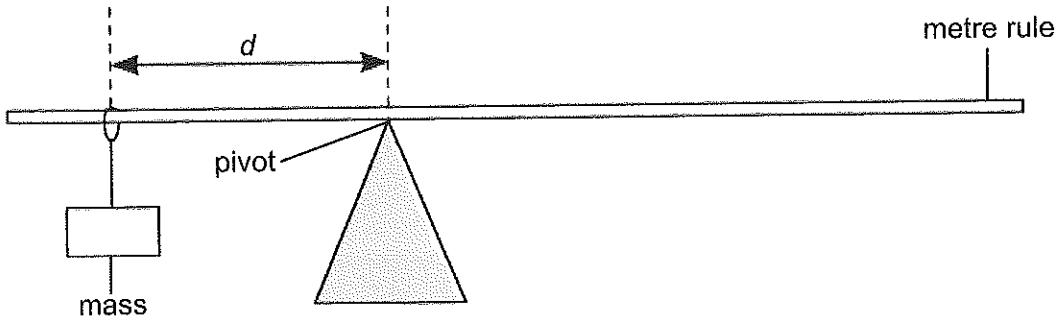


Fig. 1.1

Different masses are used to balance the rule with the pivot still at the 40 cm mark.

(a) Fig. 1.2 shows the set-up when a mass of 80 g is used.

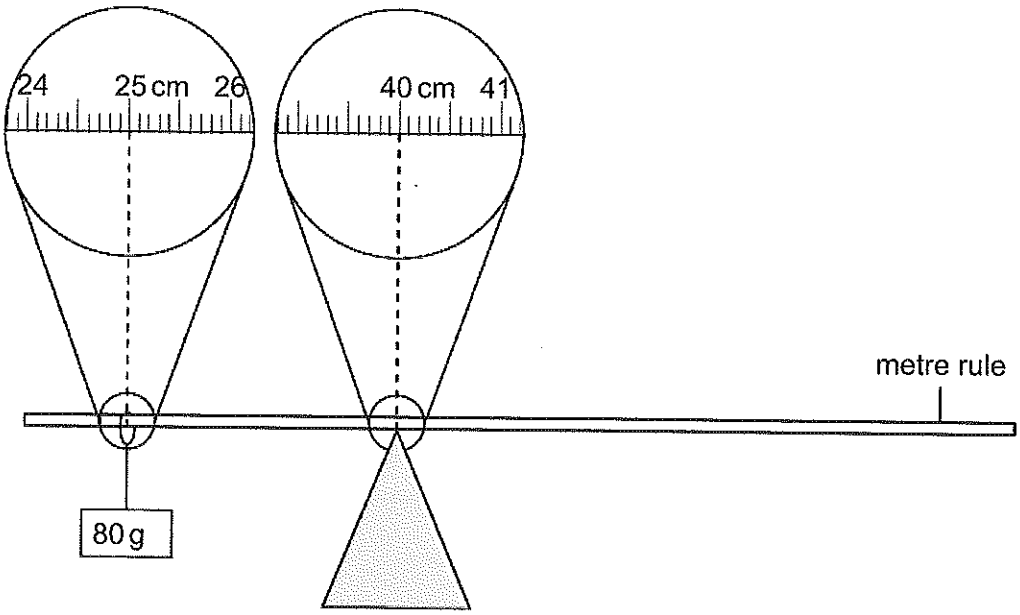


Fig. 1.2

Table 1.1 shows some of the results of the experiment.

Use Fig. 1.2 to determine the value of d when the mass is 80 g.
Record the value in Table 1.1. [1]

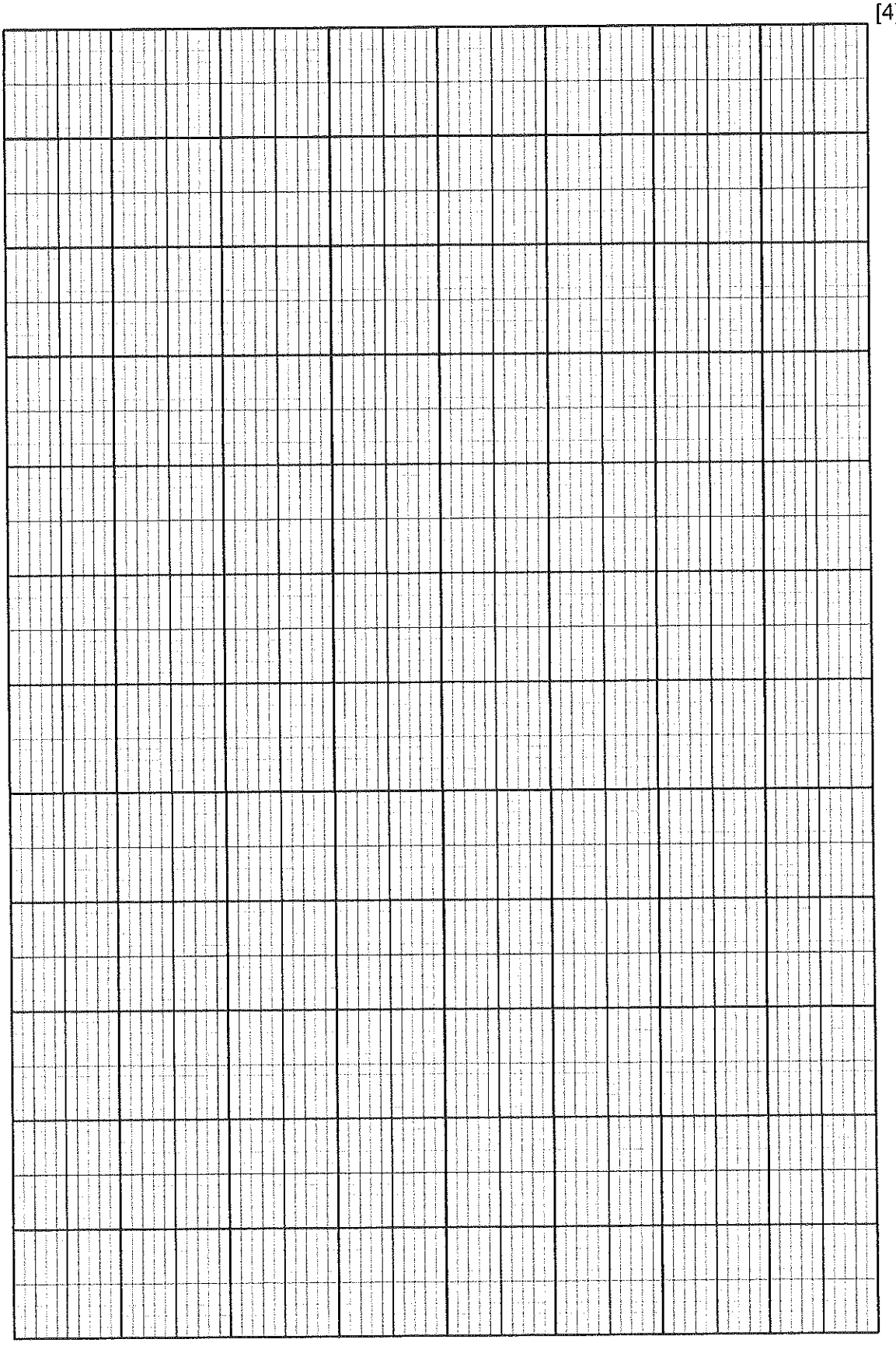
Table 1.1

mass / g	d / cm	$\frac{1}{d}$ / $\frac{1}{\text{cm}}$
40	30.0	0.03
60	19.8	
80		
100	12.1	
120	10.0	0.10

(b) Complete Table 1.1 by calculating the values of $\frac{1}{d}$. [2]

(c) Plot a graph of mass / g against $\frac{1}{d} / \frac{1}{\text{cm}}$.

[4]



(d) Determine the gradient G of the graph.

G = ... [2]

(e) Calculate the mass m of the metre rule using the equation

$m = \frac{G}{k}$, where $k = 10\,\text{cm}$.

m = ... [1]

(f) Suggest **one** way of improving the reliability of the results.

.....

..... [1]

For Examiner's Use

2 An experiment is performed to find out which material, cotton wool or sheep wool, is a better thermal insulator. There is a supply of hot water and two identical containers.

(a) Name **two** other pieces of apparatus which are needed to perform this experiment.

1.....

2 .....
[2]

(b) Describe the experiment that should be performed to determine which material is a better insulator. You may draw a diagram to help you.

.....

.....

.....

.....

.....

.....

.....

..... [5]

(c) State **one** source of inaccuracy when carrying out this experiment.

.....

..... [1]

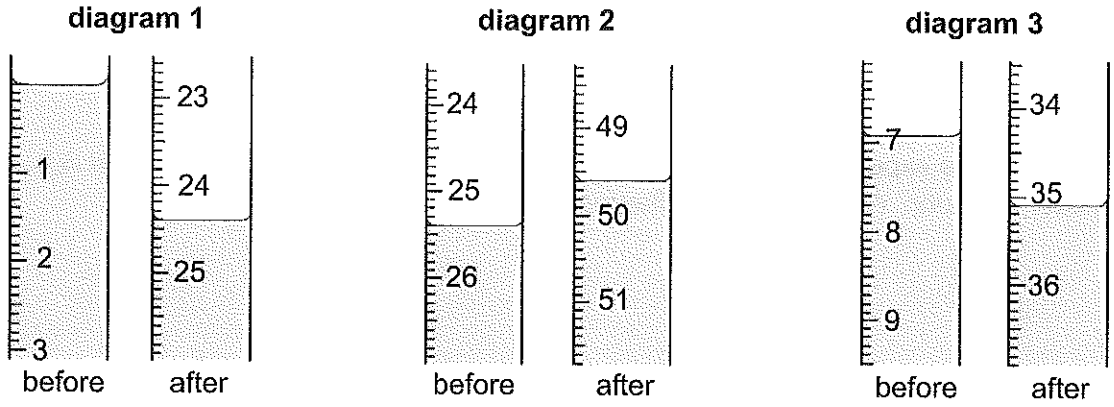
(d) Suggest **one** possible way in which this experiment can be improved.

.....

..... [1]

3 A student determines the concentration of dilute hydrochloric acid (HC*l*) by titrating the acid against 25.0 cm^3 of 0.010 mol / dm^3 sodium hydroxide (NaOH) solution.

(a) The diagrams show parts of the burette with the acid levels before and after each titration.



(i) Use the burette readings of the three titrations to complete the table.

titration number	1	2	3
final burette reading / cm^3			
initial burette reading / cm^3			
volume of acid used / cm^3			
tick the best results			

[6]

(ii) Calculate the average volume of hydrochloric acid from the ticked values.

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

(b) The number of moles of sodium hydroxide is 0.00025 moles.
The number of moles of the acid is equal to the number of moles of sodium hydroxide.

Use the formula given to calculate the concentration of the acid.

$$\text{concentration of acid} = \frac{\text{number of moles}}{\text{volume}}$$

concentration of acid = ... [1]

4 Some tests are conducted on solid X.
Table 4.1 shows the tests, observations and conclusions.

Table 4.1

tests	observations	conclusions
(a) Solid X is dissolved in water and the solution is divided into **two** portions.	.... [1]	X is not a compound of a transition metal.
(b) To the first portion .... is added and the mixture is warmed gently. [1]	.... [2]	.... gas produced. [1] NH_4^+ ions present.
(c) To the second portion acidified lead(II) nitrate solution is added.	yellow precipitate formed	X contains .... ions. [1]

(d) The formula of solid X is ..... [1]

(e) A yellow precipitate is formed from the test in **(c)**.
Describe how a pure sample of the solid could be obtained.

(i) List the apparatus required.

.....

.....

..... [2]

(ii) Describe how the experiment should be performed.
You may draw a diagram to help you.

.....

.....

.....

.....

..... [3]

5 Fig. 5.1(a) shows a longitudinal section of a banana fruit and Fig 5.1(b) shows a longitudinal section of a cucumber fruit.

Fig. 5.1(a)

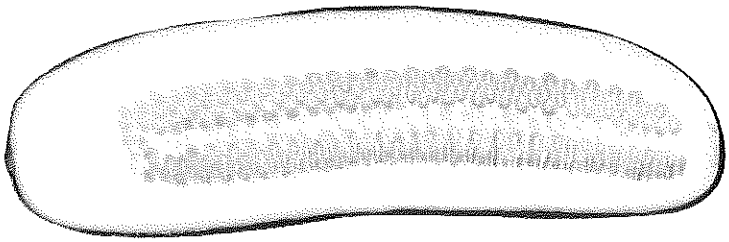


Fig. 5.1(b)

(a) Make a large drawing of the cucumber fruit in Fig. 5.1(b).

[4]

(b) (i) Measure and record the longest length of the photograph in Fig. 5.1(b).

length = ...

Measure and record the corresponding length in your drawing.

length = ...
[1]

(ii) Calculate the magnification, using the formula

$$\text{magnification} = \frac{\text{length of drawing}}{\text{length of photograph}}.$$

magnification = ... [2]

(c) State **two** visible differences between the banana in Fig. 5.1(a) and the cucumber in Fig. 5.1(b).

1.....

2 .....
[2]

(d) (i) Describe how a piece of the fruit in Fig. 5.1(a) can be tested for protein.

.....

.....

.....

..... [3]

(ii) State the result that shows that proteins are present.

.....

..... [1]

6 Fig. 6.1(a) and Fig. 6.1(b) show an experiment to investigate the action of an enzyme on egg white cubes at different temperatures.
The enzyme is mixed with the egg white cubes after 5 minutes.
The egg white cubes become transparent after some time when mixed with the enzyme.

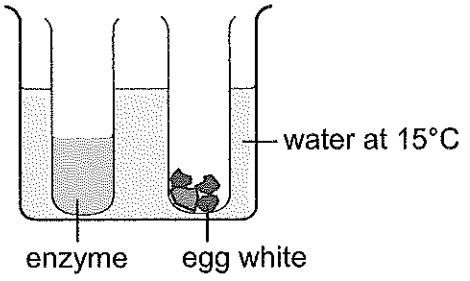


Fig. 6.1(a)

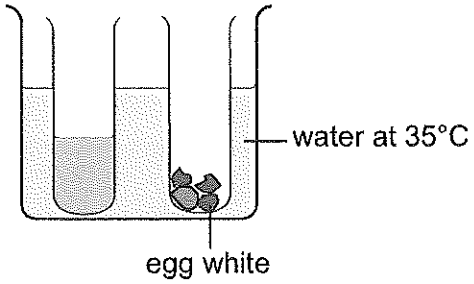


Fig. 6.1(b)

(a) State **two** variables that should be kept constant in this experiment.

1 .....

2 .....

[2]

(b) Suggest **one** improvement to the experiment.

.....

..... [1]

(c) Suggest why the test-tubes are left in the water baths for 5 minutes before mixing the enzyme with egg white.

.....

..... [1]

(d) Predict and explain how the result for the experiment shown in Fig. 6.1(a) would differ from that in Fig. 6.1(b).

prediction .....

.....

explanation .....

.....

[3]

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

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