BOTSWANA EXAMINATIONS COUNCIL
in collaboration with
UNIVERSITY OF CAMBRIDGE LOCAL EXAMINATIONS SYNDICATE
Botswana General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

SCIENCE : DOUBLE AWARD **0569/04**

Paper 4 **October/November 2011**

1 hour 30 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name 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.

For Examiner's Use	
1	
2	
3	
4	
5	
6	
7	
8	
Total	

This document consists of **15** printed pages and **1** blank page.

1 Fig. 1.1 shows a set-up used by a student to investigate the effect of current on the number of iron nails an electromagnet can lift.

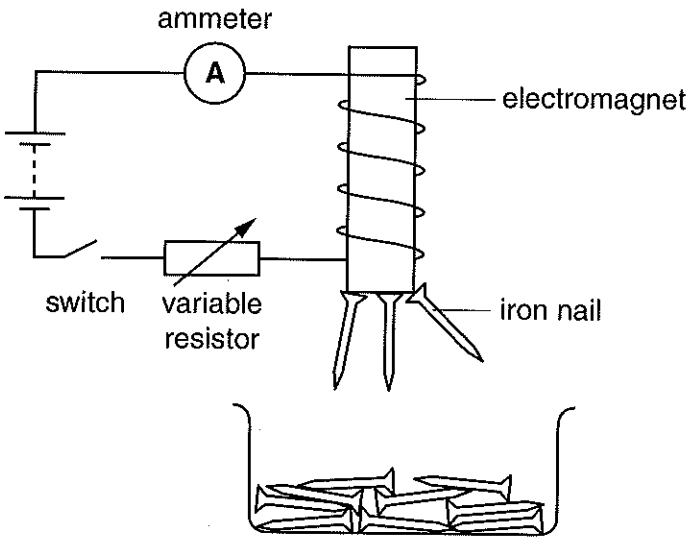


Fig. 1.1

(a) Fig. 1.2(a) and Fig. 1.2(b) show some of the ammeter readings obtained during the experiment.

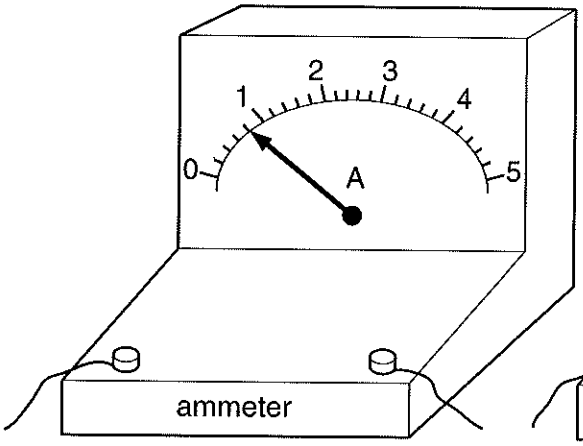


Fig. 1.2(a)

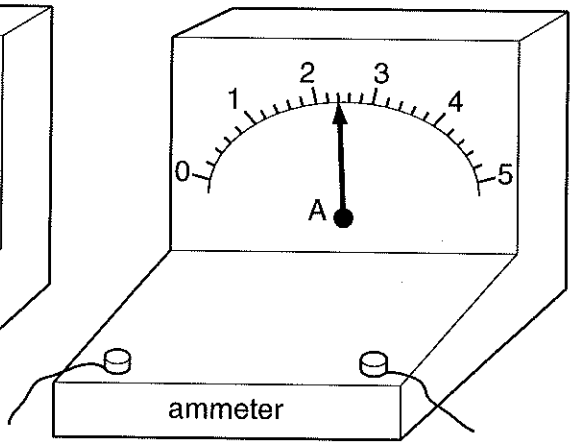


Fig. 1.2(b)

Record the readings shown in Fig. 1.2(a) and Fig. 1.2(b).

reading in Fig. 1.2(a) = ...

reading in Fig. 1.2(b) = ... [3]

(b) Another student performed the experiment with a similar set-up.

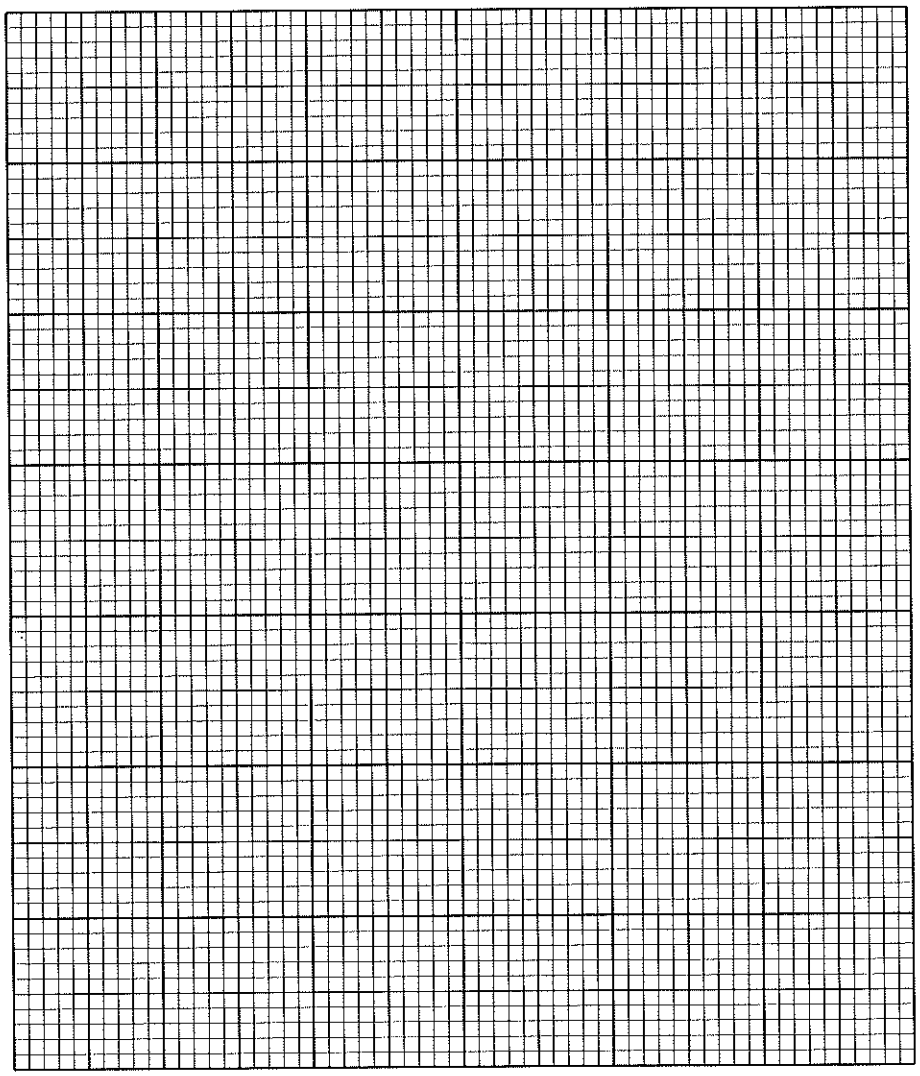
Complete Table 1.1 by filling in the missing number of the nails lifted by the electromagnet.

Table 1.1

current / A	number of nails lifted
0.0	0
0.2	3
0.4	
0.6	9
0.8	12
1.0	
1.2	18

[2]

(c) Plot a graph of the number of nails lifted against current / A. [4]



For Examiner's Use

(d) Use your graph to determine the current needed to lift one nail.

current = ... [1]

2 Leru performed an experiment to determine the refractive index, n, of a parallel sided glass block.

Fig. 2.1 shows the diagram that she obtained after performing the experiment.

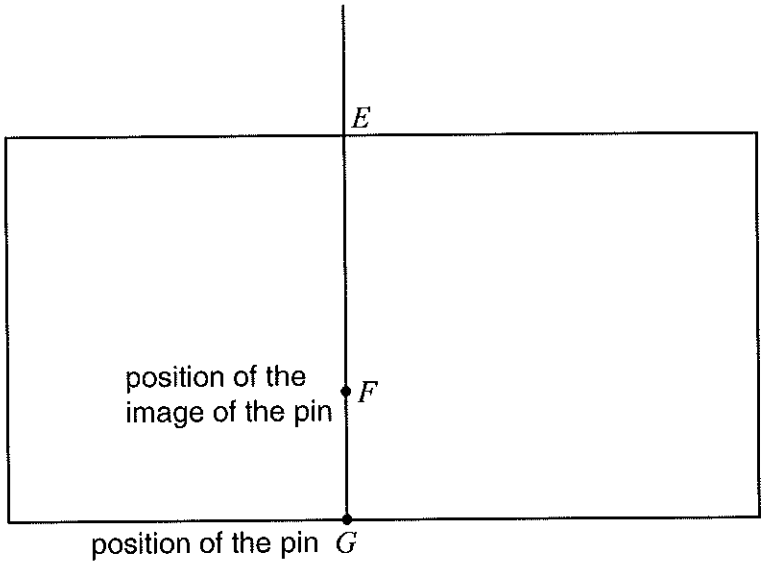


Fig. 2.1

(a) Measure and record the lengths of EG and EF.

length of EG = ...

length of EF = ... [3]

(b) Use the equation, $n = \frac{EG}{EF}$ to find the refractive index of the glass block.

n = ... [2]

3 A student performed an experiment to find the time taken by a marble to roll down on a smooth plank. Fig. 3.1 shows the set-up that he used. The plank was divided into 20 equal divisions.

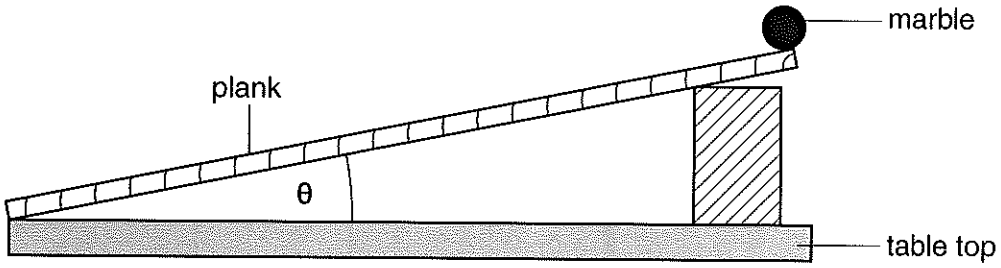


Fig. 3.1

(a) Measure and record the value of θ, the angle between the table top and the plank.

θ = ... [1]

(b) The actual length of one division in the plank is shown in Fig. 3.2.

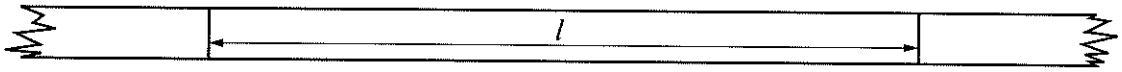


Fig. 3.2

(i) Measure and record the length of the division, l.

l = ... [1]

(ii) Determine the length of the plank.

length = ... [2]

(c) Fig. 3.3 shows the reading obtained on the stop watch for the marble to roll down the plank.

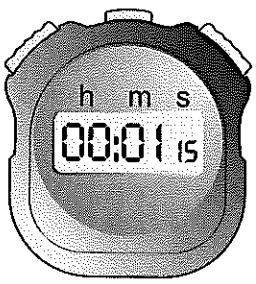


Fig. 3.3

Write down the time in seconds shown in Fig. 3.3.

time = ... [1]

For Examiner's Use

4 Tests were carried out on a substance, **S**. Table 4.1 shows the tests, observations and conclusions made. Complete the table.

Table 4.1

test	observation	conclusion
(a) **S** was dissolved in dilute sulphuric acid.	.....	**S** is a compound of a transition metal.
	..... [1]	
A gas was produced and passed through limewater.	.....	**S** contains CO_3^{2-} ions.
	..... [1]	
The resulting solution was divided into two portions for tests **(b)** and **(c)**.		
(b) **(i)** To the first portion aqueous sodium hydroxide solution was added until a change was seen.	.....	**S** probably contains Cu^{2+} ions
	.....	
	..... [2]	
(ii) An excess of sodium hydroxide was added to the mixture from **(b)(i)**.	.....	
	..... [1]	
(c) To the second portion, a few drops of aqueous ammonia were added until no further change was observed.	.....	The presence of Cu^{2+} ions is confirmed.
	.....	
	.....	
	.....	
	.....	
	..... [3]	

(d) What is the name and the formula of **S**?

name .....

formula ..... [2]

5 Zinc nitrate crystals are made by following the steps given below.

step 1 Pour 30 cm^3 of dilute nitric acid into a beaker.

step 2 Add a small amount of zinc oxide.

step 3 Warm and stir the mixture.

step 4 Add more zinc oxide until all the acid is used up.

step 5 Remove excess zinc oxide.

step 6 Obtain zinc nitrate crystals from the solution.

(a) (i) Name the apparatus used to measure the acid.

..... [1]

(ii) Name the apparatus used to transfer the small amount of zinc oxide in **step 2**.

..... [1]

(iii) Why is the mixture warmed in **step 3**?

..... [1]

(b) How could you show that all of the acid is used up in **step 4**?

.....

..... [2]

(c) Name the method that can be used in **step 5**.

..... [1]

(d) Describe how zinc nitrate crystals are obtained in **step 6**.

.....

.....

.....

..... [3]

(e) Zinc metal is used instead of zinc oxide. Zinc metal is more reactive than zinc oxide. Suggest **one** way how the rate of reaction could be slowed down.

..... [1]

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6 **(a)** Thabo prepared a glucose solution by stirring some glucose in water.
Fig. 6.1 shows the readings on the balance, that were obtained when measuring the mass of the glucose.

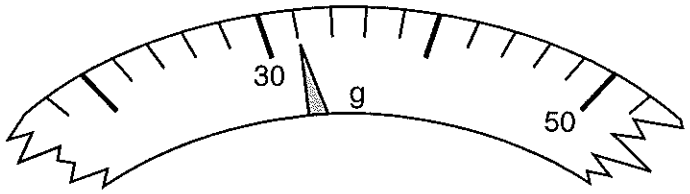


Fig. 6.1(a) mass of petri-dish alone

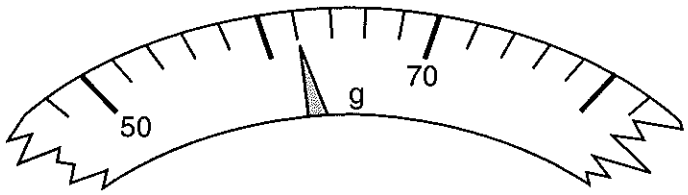


Fig. 6.1(b) mass of petri-dish with glucose

(i) Record the readings shown in Fig. 6.1(a) and Fig. 6.1(b).

reading in Fig. 6.1(a) = ...

reading in Fig. 6.1(b) = ... [1]

(ii) Determine the mass of the glucose used.

mass of glucose = ... [1]

(b) Fig. 6.2 shows the volume of water that was used by Thabo.

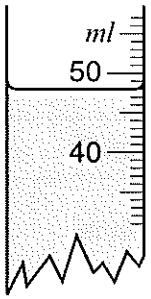


Fig. 6.2

Record the volume of water used.

volume = ... [1]

(c) Use the equation, $percentage = \frac{mass\ of\ glucose}{volume\ of\ water}$ to calculate the percentage of glucose in the solution.

percentage = ... [1]

7 Two solutions, **S** and **T**, were tested for glucose and starch.
Table 7.1 shows the results obtained.

Table 7.1

test	solution S	solution T
starch	blue black	brown
glucose	blue	orange

(a) Describe the procedure used when testing the solutions for glucose.

.....

.....

..... [2]

(b) The solutions were then separated by a selectively permeable membrane as shown in Fig. 7.1 and left to stand for 2 hours.

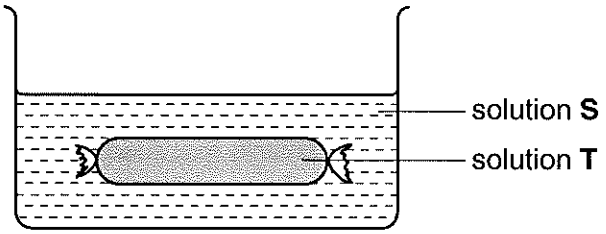


Fig. 7.1

(i) The solutions were removed and tested again for glucose and starch.

Complete Table 7.2 to show the expected results.

Table 7.2

test	solution S	solution T
starch	blue black	
glucose		orange

[2]

(ii) Explain the results in Table 7.2 for both the starch test and the glucose test.

starch test .....

.....

.....

.....

..... [2]

glucose test .....

.....

.....

.....

..... [2]

8 Fig. 8.1 shows a cross-section of a kiwifruit.

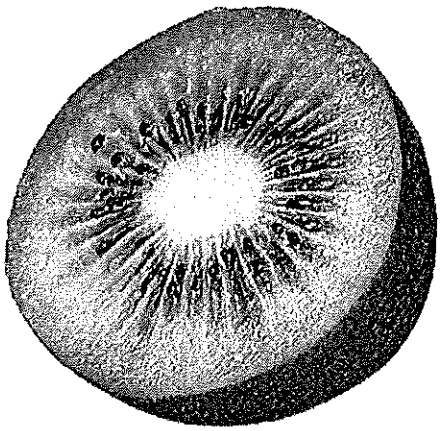


Fig. 8.1

(a) In the space provided, make a large drawing of Fig. 8.1.

[5]

(i) Measure and record the length of the longest part of your drawing.

length = ... [1]

(ii) Draw a straight line through the longest part of the kiwifruit **on Fig. 8.1**, which represents the same length that you measured in your drawing in **(i)**.

Measure the length of the kiwifruit along the line.

length = ... [1]

(iii) Calculate the magnification of your drawing.

$$magnification = \frac{image\ size}{object\ size}$$

magnification = ... [1]

(i) Measure and record the length of the longest part of your drawing.

length = ... [1]

(ii) Draw a straight line through the longest part of the kiwifruit **on Fig. 8.1**, which represents the same length that you measured in your drawing in **(i)**.

Measure the length of the kiwifruit along the line.

length = ... [1]

(iii) Calculate the magnification of your drawing.

$$magnification = \frac{image\ size}{object\ size}$$

magnification = ... [1]

0569/04/O/N/11

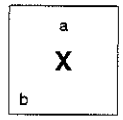
DATA SHEET
The Periodic Table of the Elements

Group I	Group II											Group III	Group IV	Group V	Group VI	Group VII	Group 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 = 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.).