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 2010**

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	
9	
Total	

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

1 A student was given 5 marbles and a 30 cm rule. She was asked to determine the diameter of each marble. She arranged the marbles in a row as shown in Fig. 1.1.

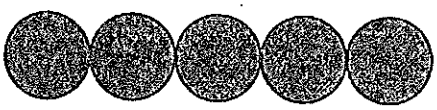


Fig. 1.1

(a) Measure and record the length of the row of marbles in Fig. 1.1.

.....[1]

(b) Calculate the diameter of each marble.

.....[2]

(c) The volume of the marbles was measured by using the displacement method as shown in Fig. 1.2.

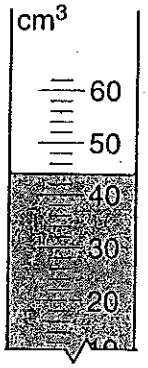


Fig. 1.2(a)

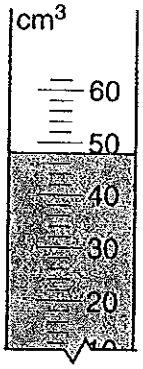


Fig. 1.2(b)

The reading in Fig. 1.2(a) was recorded before putting the marbles into the measuring cylinder.
The reading in Fig. 1.2(b) was recorded after putting the marbles into the measuring cylinder.

(i) State the accuracy with which you could measure a volume of liquid using this measuring cylinder.

.....[1]

(ii) Find the volume of the 5 marbles.

.....[2]

2 A stopwatch was used to measure the period of a simple pendulum. At the start of the experiment the bob is displaced at the angle shown in Fig. 2.1.

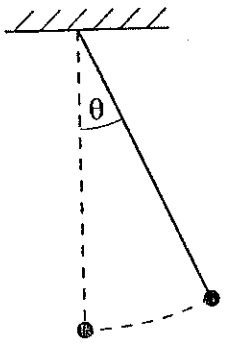


Fig. 2.1

(a) Measure and record θ, the angle at which the bob is displaced.

.....[1]

(b) The student used a stopwatch to measure the time for 20 oscillations.
Fig. 2.2 shows the reading on the stopwatch.

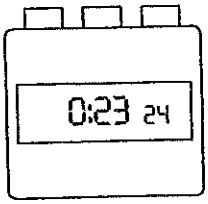


Fig. 2.2

Write down the time shown in Fig. 2.2.

.....[1]

(c) The experiment was repeated without resetting the stopwatch after obtaining the time in Fig. 2.2.
Fig. 2.3 shows the time on the stopwatch at the end of this experiment.

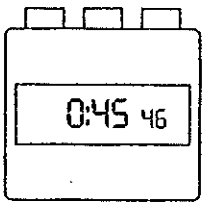


Fig. 2.3

(i) What was the actual time for the second 20 oscillations?

.....[1]

(ii) Find the average time for 20 oscillations.

.....[1]

(iii) Determine **T**, the period of the pendulum.

.....[1]

(d) The length of the pendulum can be determined using the relation;

$$l = 0.25 \times T^2$$

Determine l, the length of the pendulum.

.....[2]

3 Fig. 3.1 shows a circuit used to compare the conductivities of different metals. Wires made of different metals were connected across **XY** in separate experiments.

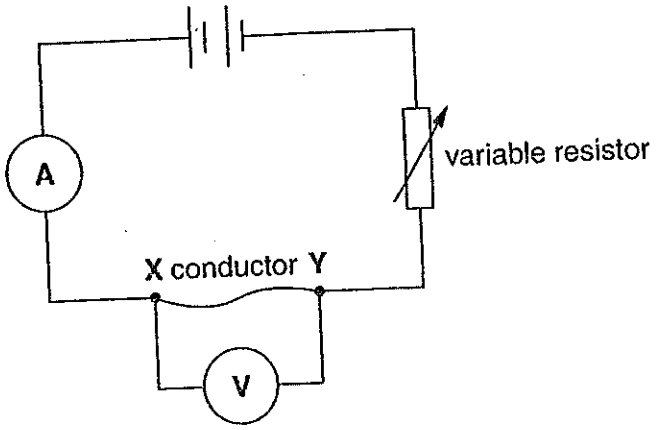


Fig. 3.1

(a) State two variables that must be kept the same when using wires made of different metals in this experiment.

1 .....

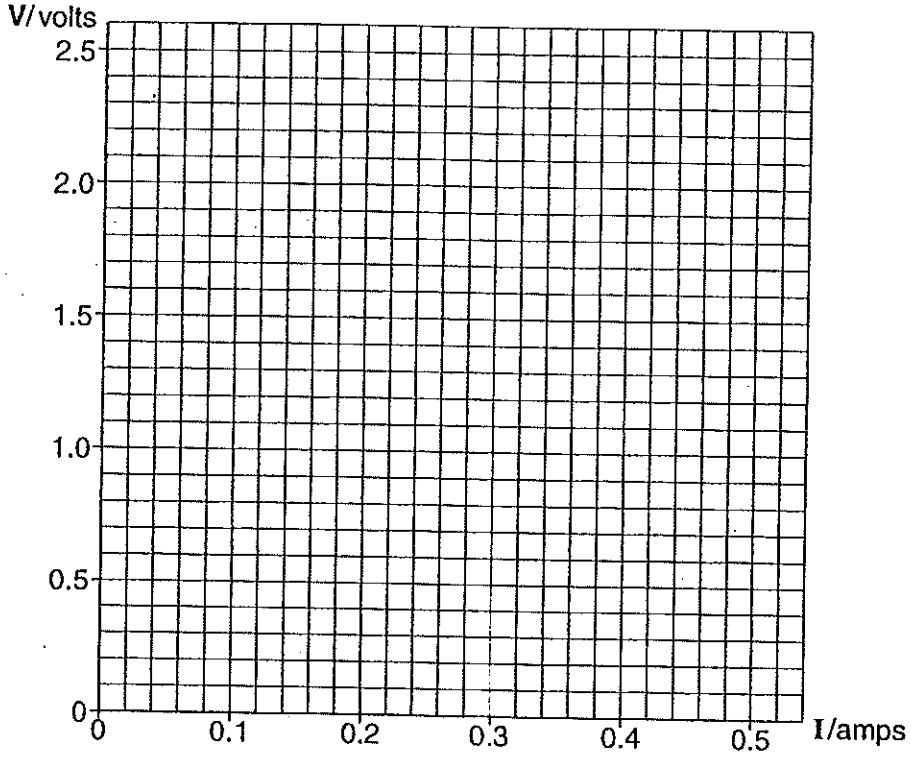
2 .....[2]

(b) The results obtained for two conductors **A** and **B**, were recorded in Table 3.1.

Table 3.1

Conductor A		Conductor B	
V/volts	I/amps	V/volts	I/amps
0.0	0.0	0.0	0.0
0.25	0.1	0.4	0.1
0.50	0.2	0.8	0.2
0.75	0.3	1.2	0.3
1.00	0.4	1.6	0.4

On the grid provided plot a graph of **V** against **I** for each conductor. [3]



(c) Use your graph to determine the conductor which has the lower resistance.

.....

.....

.....[2]

4 A Universal Indicator solution was added to 5 different solutions, **A**, **B**, **C**, **D** and **E**. The pH values of the solutions are shown in Table 4.1.

Table 4.1

solution	pH
A	1
B	7
C	12
D	5
E	9

(a) State the colour of the Universal Indicator in solutions **A**, **C** and **E**.

solution	**colour**
A	
C	
E	

[3]

(b) The solutions were known to be either ammonia solution, sodium chloride, potassium hydroxide, dilute sulphuric and/or vinegar.

Which solutions are likely to be **A**, **B** and **C**?

A .....

B .....

C .....[3]

5 Fig. 5.1 shows a set-up used to prepare and collect hydrogen gas.

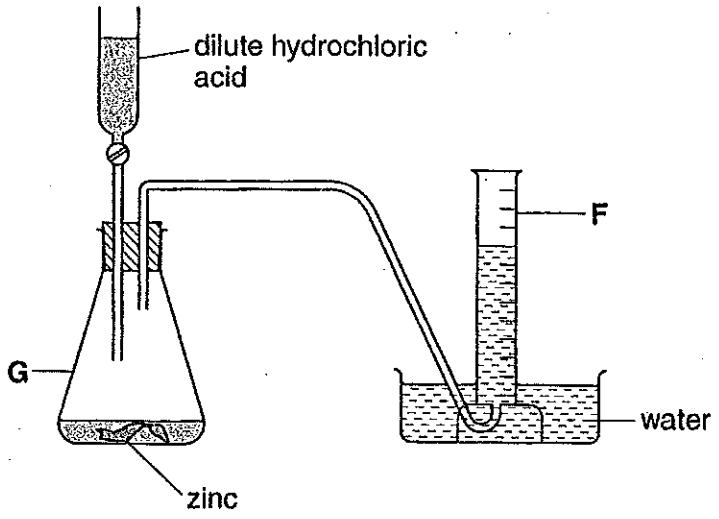


Fig. 5.1

(a) Name the apparatus labelled **F** and **G**.

F .....[1]

G .....[1]

(b) Describe the test for hydrogen gas and state the expected result.

Test .....

Result .....[2]

(c) Which property of hydrogen enables it to be collected over water?

.....[1]

6 Fig. 6.1 shows a set-up used to prepare ethanol by fermentation.

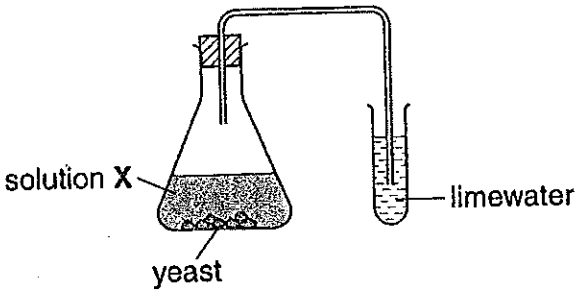


Fig. 6.1

(a) (i) Name solution **X**.

.....[1]

(ii) The reaction produces carbon dioxide gas. What change will be seen in the limewater after a few minutes?

.....

.....[1]

(iii) Suggest a suitable temperature for this experiment.

.....[1]

(b) Ethanol is a reducing agent. What colour change is observed when acidified potassium dichromate(VI) is added to ethanol?

.....

.....[2]

7 Excess iron fillings were added to aqueous copper(II) sulphate solution. The equation for the reaction is

$$Fe_{(s)} + CuSO_{4(aq)} \longrightarrow FeSO_{4(aq)} + Cu_{(s)}$$

(a) State **two** observations that would be made.

.....

.....

.....[2]

(b) Sodium hydroxide solution was added to the iron(II) sulphate produced.
What observation would be made?

.....

.....

.....[2]

8 Fig. 8.1 shows photographs of cross sections through two fruits.
Fig. 8.1(a) is a peach while Fig. 8.1(b) is a pear.

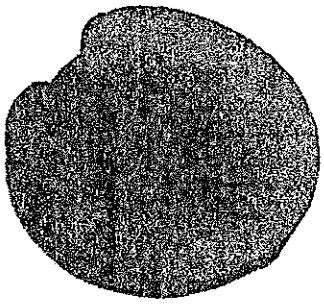


Fig. 8.1(a)

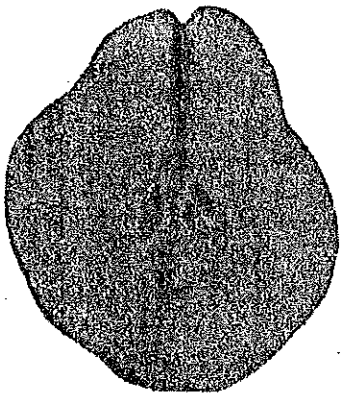


Fig. 8.1(b)

(a) Make a large labelled drawing of the section through the peach fruit in Fig. 8.1(a).

[4]

(b) **(i)** Measure the longest part of your diagram. Draw a line in your drawing to indicate where the measurement was taken.

Longest length = ...mm [1]

(ii) Measure the longest length on Fig. 8.1(a) that is equivalent to the length you measured on your drawing.

Length = ...mm [1]

(iii) Calculate the magnification of your drawing.

magnification = ...[2]

(c) State **one** observable difference between the fruits in Fig. 8.1(a) and Fig. 8.1(b).

.....

.....[1]

(d) Describe how a piece of the pear fruit can be tested for protein.

.....

.....

.....

.....[3]

9 Fig. 9.1 shows a potometer used to investigate factors affecting the rate of transpiration at room temperature.

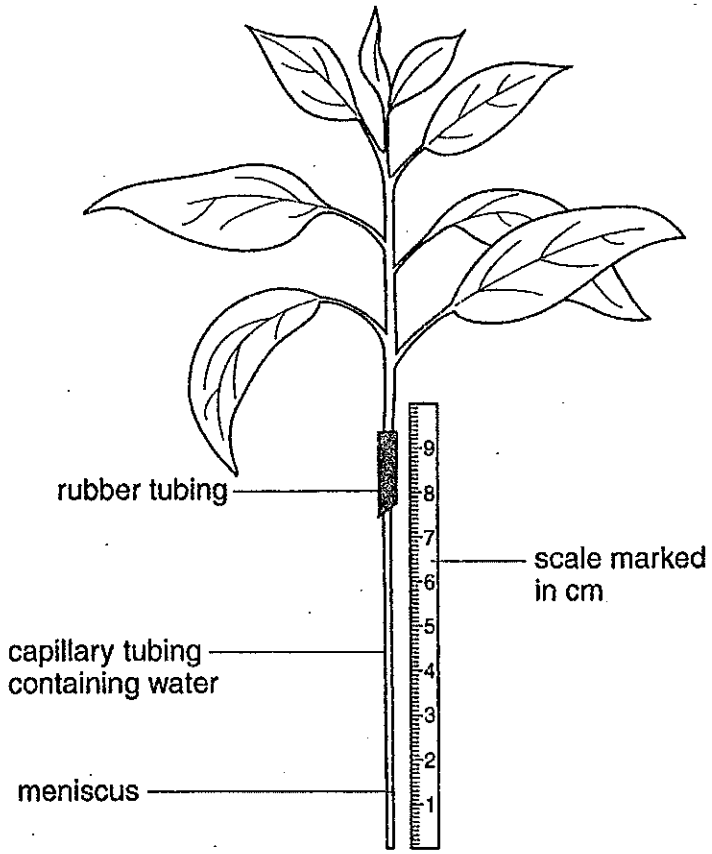


Fig. 9.1

The plant was exposed to different sets of conditions. Each time, it was left for 3 minutes before readings were taken.

(a) Explain why it is necessary to wait for 3 minutes before taking readings.

.....

.....[1]

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(b) In each set of conditions, the position of the meniscus was reset to 0 before measurements began. Fig. 9.2 shows the position of the meniscus after 10 minutes under three different conditions.

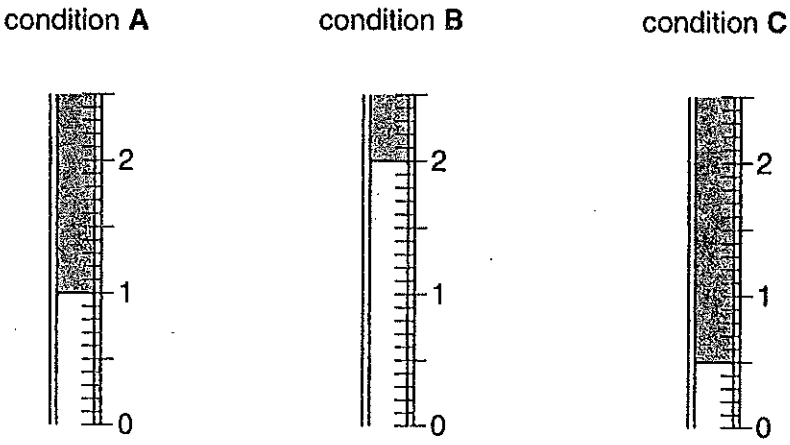

Fig. 9.2

Complete the table by writing the reading of each potometer next to the condition the plant was exposed to.

condition	reading / cm
closed laboratory	
leaves smeared with petroleum jelly	
placed near a running electric fan	

[3]

(c) Calculate the speed of the meniscus in the potometer placed near a running fan.

speed = ... cm / min [2]

(ii) Suggest how the reliability of the investigation can be improved.

.....

.....

.....[2]

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.).