Candidate Name _____

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

SCIENCE : DOUBLE AWARD   **0569/4**

PAPER 4 Alternative to Practical

OCTOBER/NOVEMBER SESSION 2002

1 hour 30 minutes

Candidates answer on the question paper.
Additional materials:
    Electronic calculator
    300 mm ruler

TIME   1 hour 30 minutes

INSTRUCTIONS TO CANDIDATES

Write your name, Centre number and candidate number in the spaces at the top of this page.
Answer **all** questions.
Write your answers in the spaces provided on the question paper.
Please show your working for any calculations.

INFORMATION FOR CANDIDATES

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 12.

FOR EXAMINER'S USE	
1	
2	
3	
4	
5	
6	
7	
8	
9	
TOTAL	

This question paper consists of 11 printed pages and 1 blank page.

SPA (NF/JB) S18568/3
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[Turn over

1 A student performs an experiment to determine the refractive index of glass. He shines a ray of light on a parallel sided glass block.

incident ray
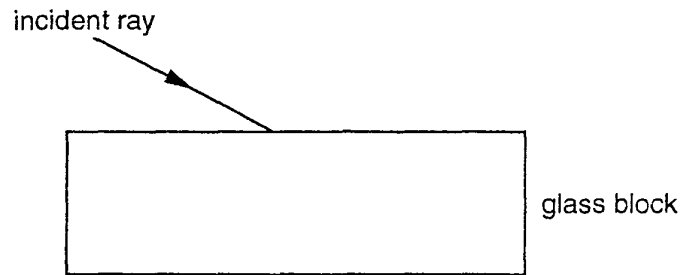
glass block

(a) Draw lines on the diagram to show the path of the ray through the glass block. Label angles *i* and *r*.

(b) He measures five different values of the angle of incidence (*i*) and their corresponding angles of refraction (*r*), and obtains the following results.

i/°	*r*/°	sin *i*	sin *r*
20	13	0.34	0.22
30	19	0.50	0.33
40	25	0.64	0.42
50	31	0.77	0.52
60	35	0.87	0.57

[3]

(i) Plot a graph of sin *i* (y-axis) against sin *r* (x-axis).
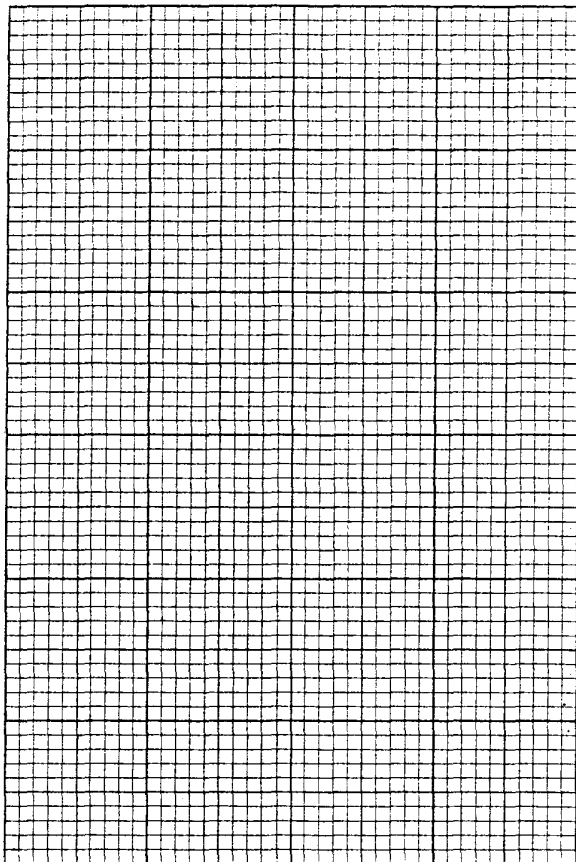
[3]

(ii) Calculate the gradient of the graph, G.
G = Refractive index (n) of glass.

G = ... [2]

(iii) Use your value of G to calculate the angle of refraction corresponding to an angle of incidence of 25°.

angle of refraction = ... [2]

[Turn over

2 The diagram shows the face of a stopwatch.

> 0: 27: 08
> m   s
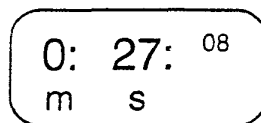
(a) Record the time shown on the watch.

time = ... s [1]

(b) The stopwatch shows a measurement made of the time taken for 10 swings of a pendulum. How can the accuracy of the measurement be improved?

....

.... [2]

3 Fig. 3.1 shows an experiment set up to investigate the effect of surface area on cooling. Equal volumes of hot water at an initial temperature of 70 °C were poured into two containers A and B.


A   B
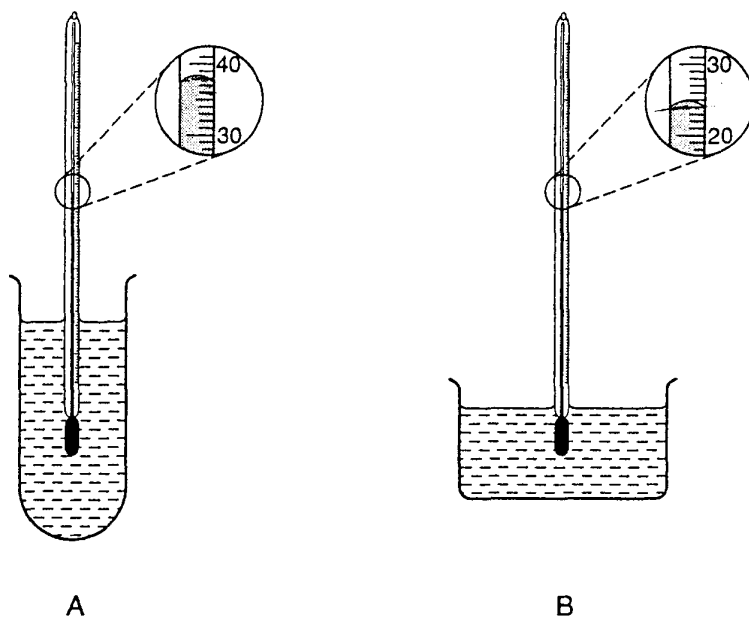
Fig. 3.1

The two thermometers show the temperature after 5 minutes.

(i) Record accurately the final readings on each thermometer scale.

A = ...

B = ...   [2]

(ii)   What conclusion can be drawn from these results?

....

....[1]

4   The circuit in Fig. 4.1 was used to investigate the maximum current that could pass in a fuse without melting the fuse wire.
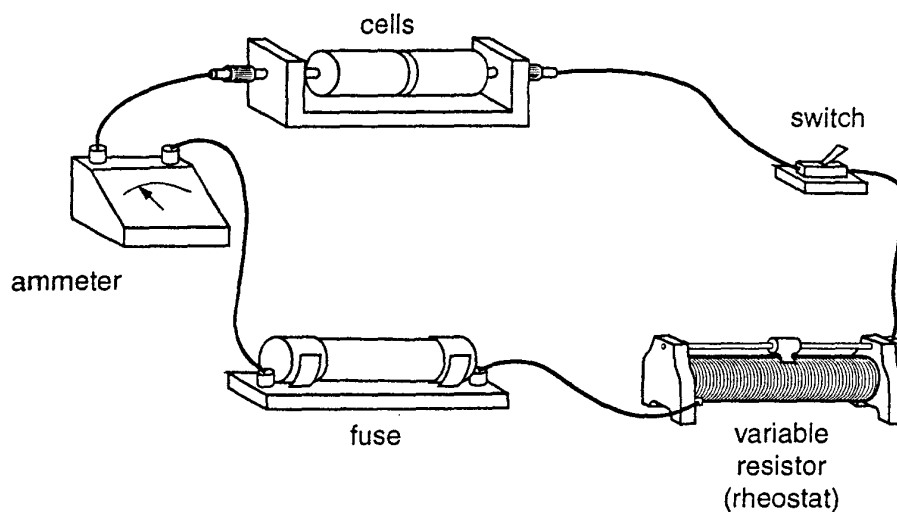

Fig. 4.1

Draw the circuit using symbols of the components in the circuit.

[4]

[Turn over

**5** Fig. 5.1 shows a syringe containing oxygen at room temperature and pressure.
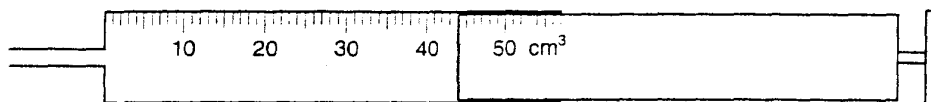
Fig. 5.1

(a) What is the volume of the oxygen in the syringe?

volume = ... cm^3 [1]

(b) State one observation made when the temperature of the gas is increased.

....[1]

6 A student measured the volume of an acid solution needed to neutralise 25.0 cm^3 of 0.10 mol/dm^3 sodium hydroxide using a burette. The experiment was repeated three times. The diagrams show the initial and final burette readings of the three experiments.

1		2		3	
initial reading	final reading	initial reading	final reading	initial reading	final reading
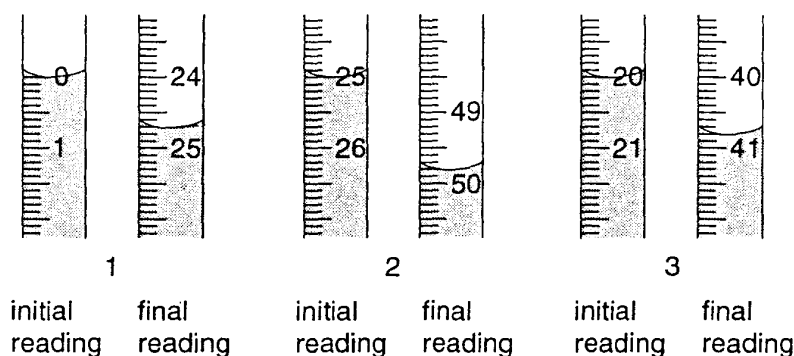
(a) Record the initial and final burette readings and calculate the volume of the acid used.

Experiment	1	2	3
Final burette reading/cm^3			
Initial burette reading/cm^3	O		
Volume of acid/cm^3			

[5]

(b) (i) Name a suitable piece of apparatus to measure 25.0 cm³ of the acid.

....

(ii) Which two experiments were correctly carried out?

....

(iii) State one precaution taken when carrying out this experiment.

....[3]

(c) (i) Calculate the average volume of the acid needed to neutralise 25.0 cm³ of sodium hydroxide solution.

volume = ... [1]

(ii) Calculate the number of moles of sodium hydroxide that reacted.

number of moles = ... [2]

(iii) Sodium hydroxide reacts with the acid in the ratio of 1:2. Calculate the concentration of the acid.

concentration = ... [1]

7 (a) Name a substance which would;

(i) dissolve copper(II) hydroxide precipitate into a deep blue solution.

....

(ii) react with acidified sodium chloride solution to produce a white precipitate.

....

(iii) react with aqueous hydroxide to form a dirty green precipitate.

....

[3]

[Turn over

(b) Name each of the three pieces of apparatus shown below.
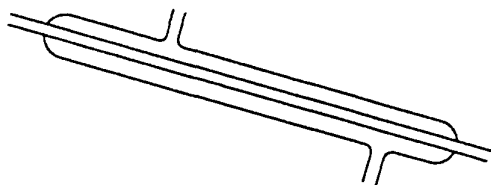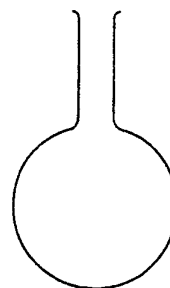
X   Y   Z

X: ....

Y: ....

Z: ....

[3]

8 Fig. 8.1 and Fig. 8.2 show photographs of a dicot leaf and a monocot leaf respectively, both magnified ×2.
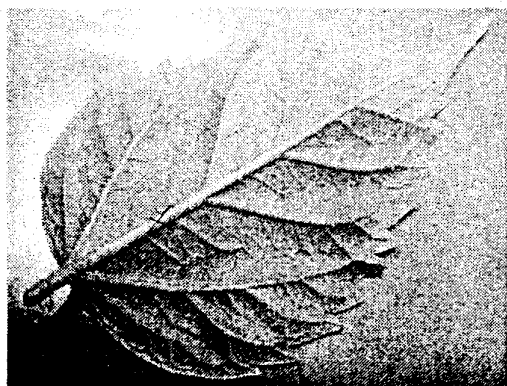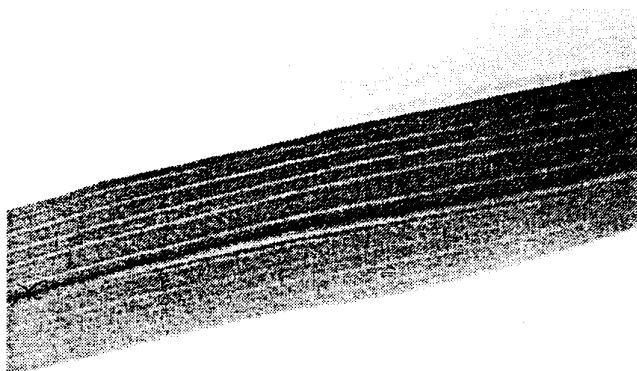
Fig. 8.1   Fig. 8.2

(a) State two visible similarities between the leaves Fig. 8.1 and Fig. 8.2.

1. ....

....

2. ....

....

[2]

(b) State **two** visible differences between the leaves Fig. 8.1 and Fig. 8.2.

Fig. 8.1	Fig. 8.2
1.	
2.	

[2]

(c) Draw a large diagram of the leaf in Fig. 8.1 (labels not required).

[2]

(d) Calculate the magnification of your drawing.

magnification = ... [4]

[Turn over

9 Fig. 9.1 shows a variegated leaf, which was used to investigate the necessity of a certain condition for photosynthesis.
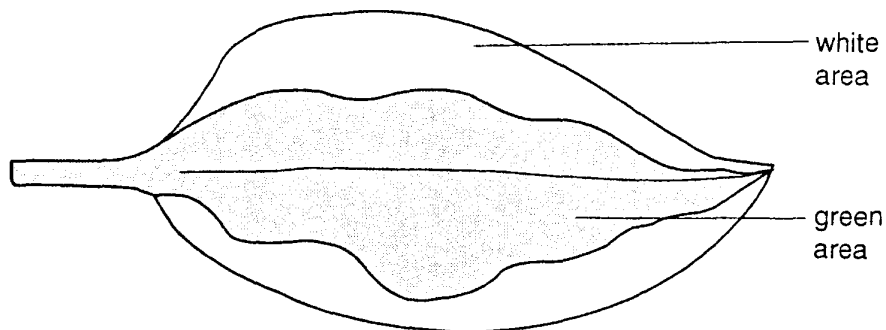
Fig. 9.1

(a) Name the condition that was under investigation.

.... [1]

(b) A student tested a leaf to find out which parts had been photosynthesising. Describe the four steps he would take, and give reasons for each step.

step	reason
1.	
2.	
3.	
4.	

[8]

(c) State the expected observation.

.... [1]

DATA SHEET
The Periodic Table of the Elements

Group

I	**II**											**III**	**IV**	**V**	**VI**	**VII**	**0**	

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.).