BOTSWANA EXAMINATIONS COUNCIL
Botswana General Certificate of Secondary Education

CANDIDATE NAME			
CENTRE NUMBER		CANDIDATE NUMBER	

SCIENCE: DOUBLE AWARD

0569/04

Paper 4

October/November 2017

1 hour 30 minutes

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

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 lose marks if you do not show your working or if you do not use appropriate units.
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	
Total	

For Examiner's Use

1 **(a)** A student has a transparent parallel-sided perspex block, a soft board, plain paper, a ruler, a protractor and some optical pins.

Describe an experiment the student can carry out to determine the refractive index of the perspex block, using the available materials.

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.....[4]

(b) Fig. 1.1 shows a set-up used by a student to determine the refractive index n of water. The student measured the real depth h_d and apparent depth h_a of a rule.

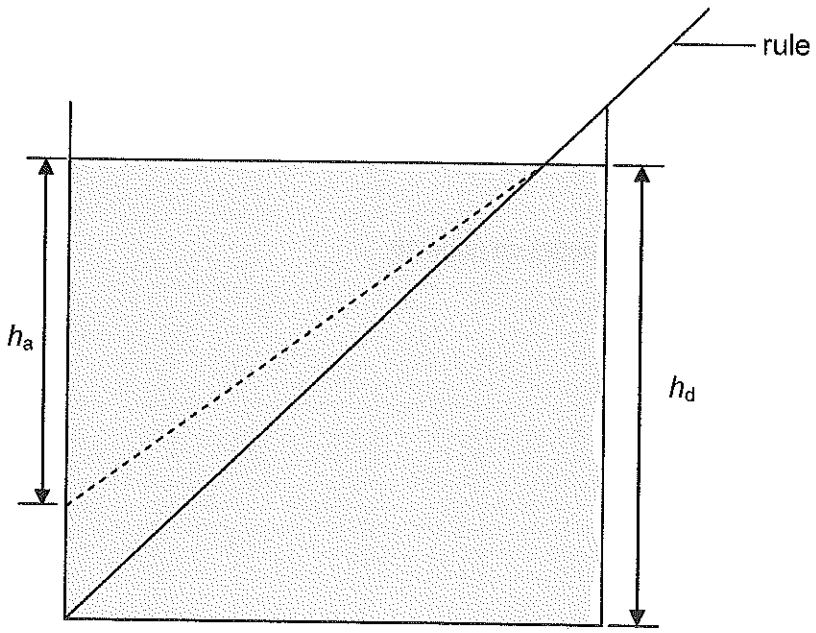


Fig. 1.1

(i) Measure and record the lengths h_d and h_a.

h_d = ...

h_a = ...

[1]

For Examiner's Use

(ii) Determine the refractive index n of water. Use the equation

$$n = \frac{h_d}{h_a}.$$

n = ...[1]

(iii) Suggest **one** source of inaccuracy when doing this experiment.

.....

.....[1]

(iv) The experiment was repeated using the same water with a smaller real depth h_d.
The student suggests that the refractive index will be smaller since h_d is smaller.

State whether the suggestion of the student is **correct** or **wrong**. Explain your answer.

statement.....

explanation.....

.....

[1]

Question 2 begins on page 5.

2 An experiment is performed to find the relationship between the length l of a wire and its resistance R. The total length of the wire is 100 cm.

Fig. 2.1 shows the set-up that is used, with the wire connected between points P and Q. The connection near Q is a sliding contact which can be moved.

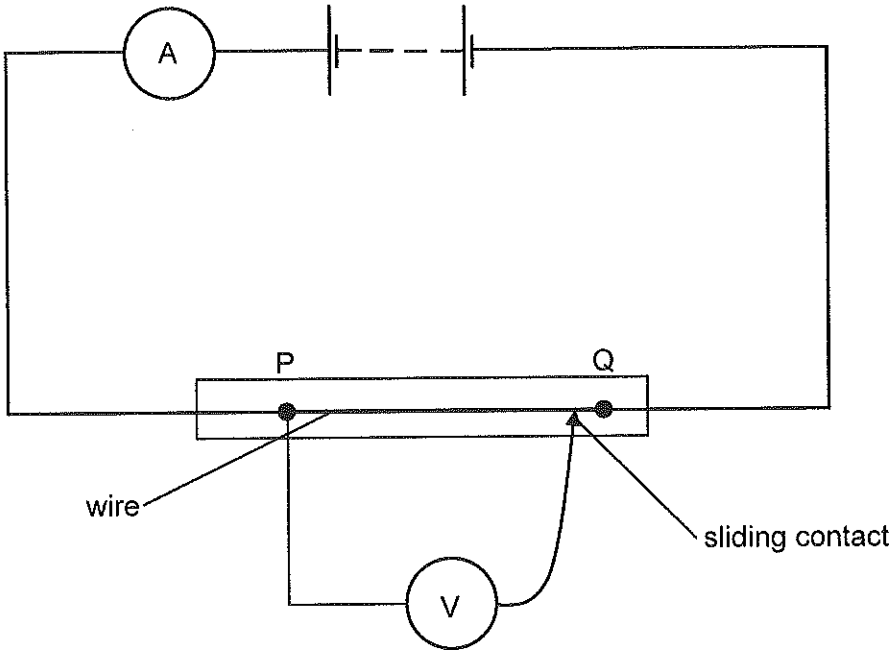


Fig. 2.1

Fig. 2.2(a) and Fig. 2.2(b) show the readings of an ammeter and a voltmeter when the sliding contact is placed at $l = 20$ cm from P.

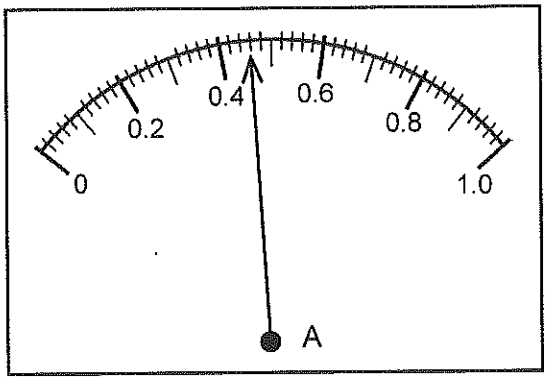


Fig. 2.2 (a)

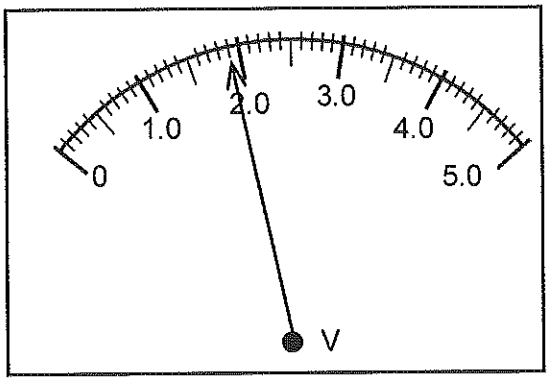


Fig. 2.2 (b)

(a) Table 2.1 shows some of the results of the experiment.

Table 2.1

l/cm	*I*/.....	*V*/V	*R*/.....
0	0.00	0.0	
10	0.45	0.9	
20			
30	0.44	2.8	
40	0.45	3.7	
50	0.43	4.4	

Complete Table 2.1 by

(i) writing the SI units of I and R at the headings, [1]

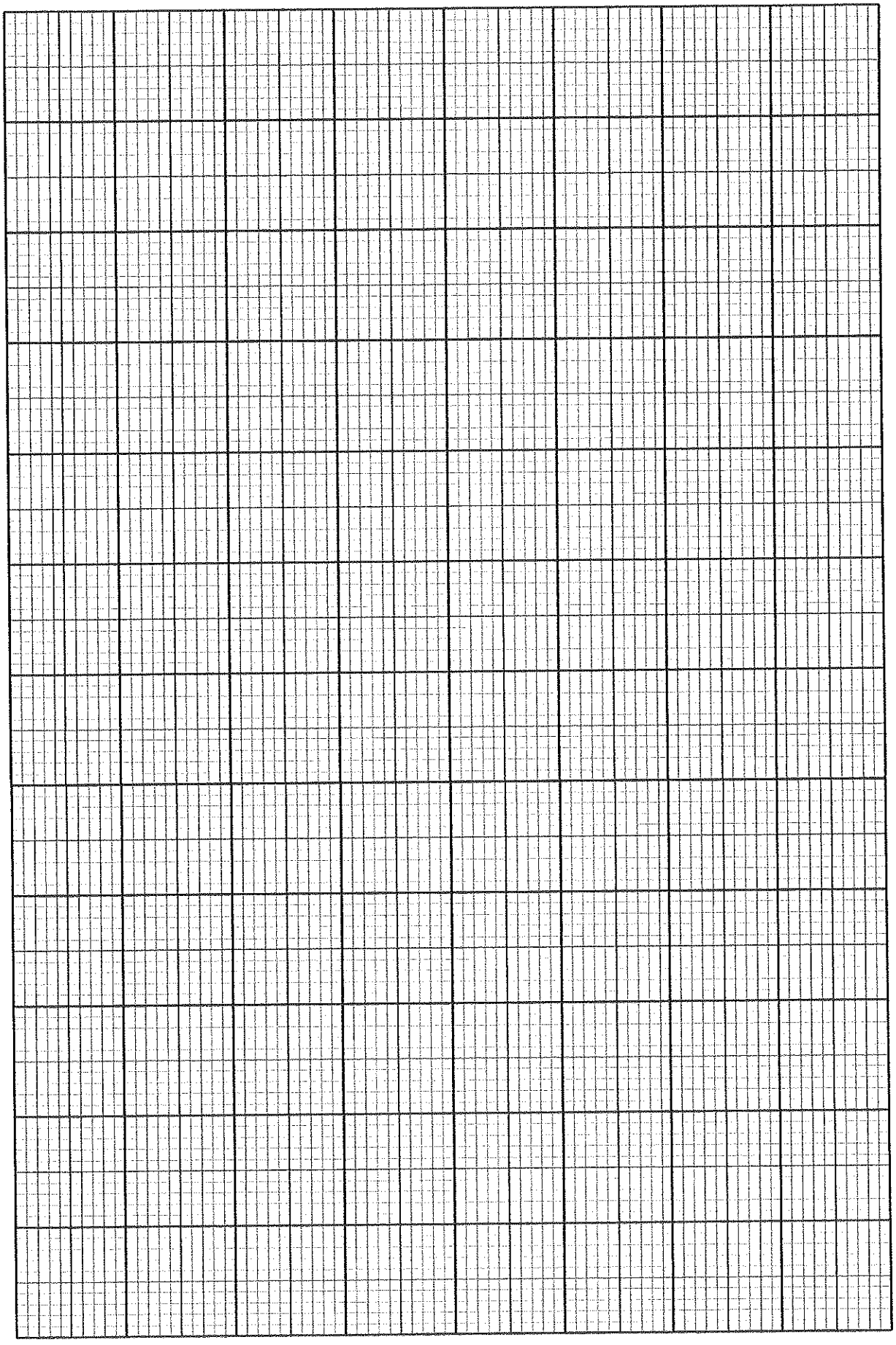
(ii) recording the ammeter and voltmeter readings for $l = 20$ cm as shown in Fig. 2.2(a) and Fig. 2.2(b), [1]

(iii) calculating R, of each length of wire. Use the equation

$$R = \frac{V}{I}.$$ [2]

For Examiner's Use

(b) Plot a graph of R (y-axis) against l (x-axis). [4]



For Examiner's Use

(c) What is the conclusion that can be made from this experiment?

.....

.....[1]

(d) State **one** precaution which should be taken when doing this experiment.

.....

.....[1]

(e) The average ammeter reading for the experiment is 0.45 A.

Use your graph to determine the voltmeter reading when the length of the wire is 45 cm from P. Use the equation

$V = IR$.

voltmeter reading = ... [2]

3 Some tests are made on solid P and solution Q.
Table 3.1 shows the tests, observations and conclusions.

Complete Table 3.1.

Table 3.1

tests	observations	conclusions
(a) Solution Q is divided into two portions. A blue litmus paper is dipped into one portion of solution Q.	blue litmus paper turns red	....[1]
b) A few drops of acidified barium nitrate solution are added to another portion of solution Q.	....[2]	sulphate ion, SO_4^{2-} present in solution Q.
(c) Solid P is dissolved in solution Q. The gas produced is tested with lime water.	production of bubbles lime water turns milky	solid P contains ..... [1]
(d) To a portion of a mixture from **(c)** add **(i)**..... .....[1] **(ii)**..... ....[1]	....[1] ....[1]	Zn^{2+} or Ca^{2+} are suspected. Ca^{2+} present.

(e) Identify solid P and solution Q.

solid P .....

solution Q.....
[2]

For Examiner's Use

4 Fig. 4.1 shows the set-up of an experiment used to determine the concentration of hydrochloric acid by titration with sodium hydroxide solution.

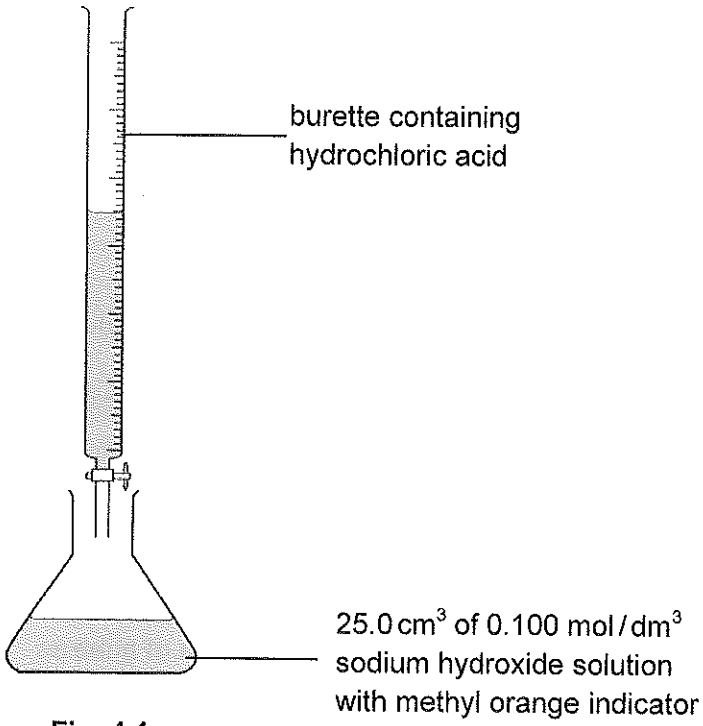


Fig. 4.1

(a) Name the apparatus used to measure accurately 25.0 cm^3 of sodium hydroxide solution.

.....[1]

(b) Fig. 4.2 shows the burette readings before and after each titration.

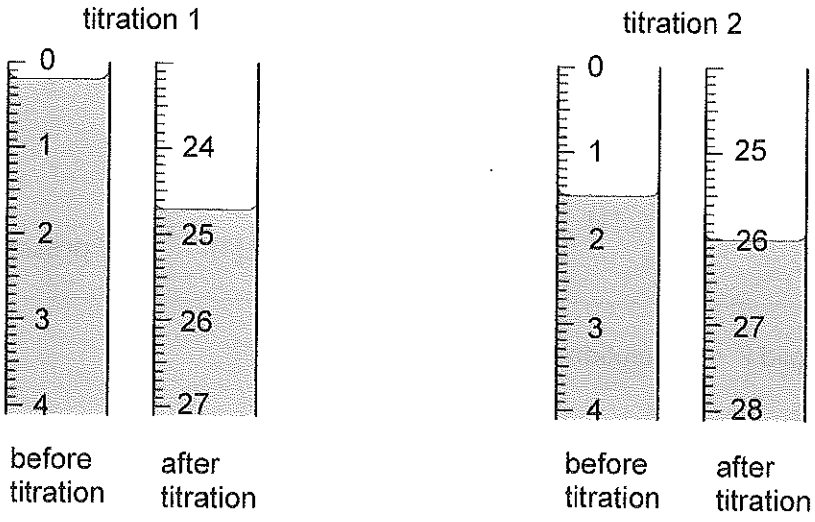


Fig. 4.2

Complete Table 4.1 by recording the burette readings.

Table 4.1

	titration 1	titration 2
reading after titration / cm^3		
reading before titration / cm^3		
volume added / cm^3		

[3]

(c) Calculate the average volume V_{av} of the acid used.

V_{av} =.....[1]

(d) The equation for the reaction is:

$$NaOH(aq) + HCl(aq) \longrightarrow NaCl(aq) + H_2O(l)$$

Calculate the concentration of hydrochloric acid.

concentration = ... mol/dm^3 [1]

(e) A student is given 4.0 g of solid sodium hydroxide.
The student is asked to prepare 1.0 dm^3 of 0.100 mol/dm^3 stock solution of sodium hydroxide.

Describe how the student can prepare the solution.

.....

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.....[4]

For Examiner's Use

5 Fig. 5.1(a) and Fig. 5.1(b) show photographs of leaves of two plants.

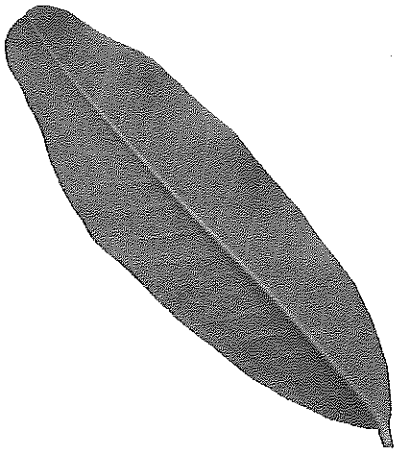

Fig. 5.1(a)

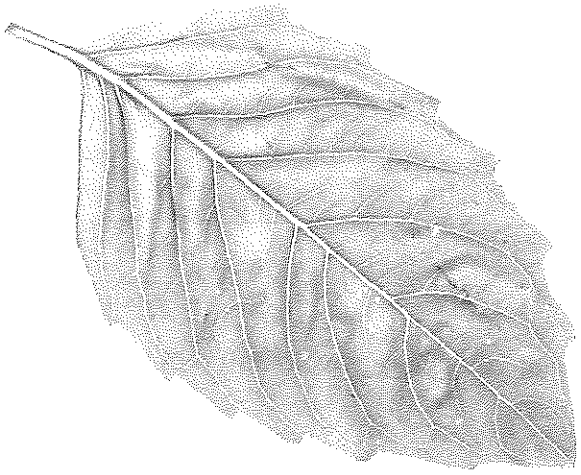

Fig. 5.1(b)

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

1 .....

2 .....

[2]

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

[3]

For Examiner's Use

(c) Measure and record:

- the length of the longest side of the leaf in the photograph in Fig. 5.1(b).
- the length of the same side of the leaf in your drawing.

Draw lines on Fig. 5.1(b) and on your drawing to indicate where the measurements were taken.

longest of photograph = ...

longest of drawing = ...

[2]

(d) Calculate the magnification of your drawing. Use the equation

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

magnification = ...[1]

For Examiner's Use

6 A student cuts a potato strip and tests it for starch by adding iodine solution to it.

(a) State the result of a positive test for starch.

.....[1]

(b) A student investigates the action of amylase solution on starch.
She uses the set-up shown in Fig. 6.1.

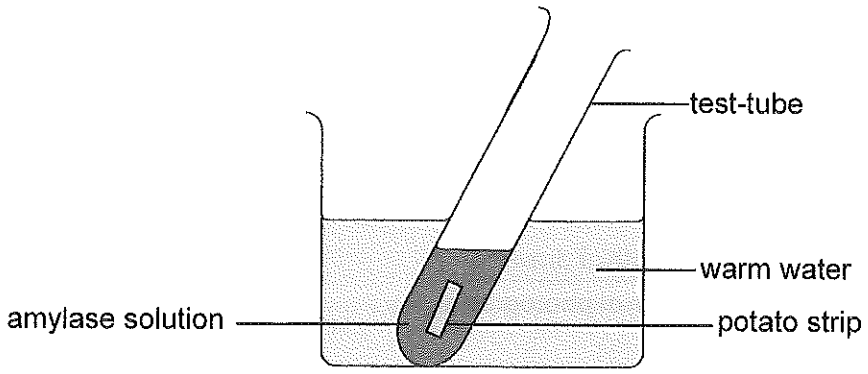

Fig. 6.1

(i) Suggest a control for the experiment.

.....[1]

(ii) After 30 minutes, the student used iodine solution to test the contents of the test-tube for starch.

Predict and explain the result that she would obtain.

result.....

explanation.....
[1]

(iii) Explain why the potato strip and amylase solution should be placed in warm water.

.....

.....[1]

(c) The student suggests that a potato strip contains less sugar than a pumpkin strip.

Describe an experiment which can be carried out to find out whether the suggestion is correct.

.....

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.....

.....

.....[4]

For Examiner's Use

(d) A student cuts strips from stem tubers of plants E and F.
She places the strips in a sugar solution.
Fig. 6.2 shows the strips before they were placed in the sugar solution.

plant E strip plant F strip

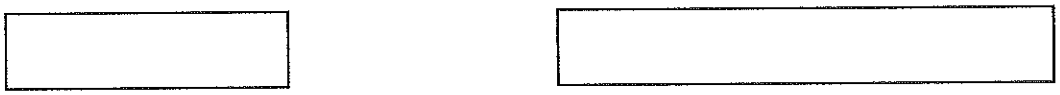
Fig. 6.2

(i) Measure and record the lengths of the strips.

plant E length of strip = ...

plant F length of strip = ...
[1]

(ii) Fig. 6.3 shows the strips after they have been left in the sugar solution for 30 minutes.



plant E strip plant F strip

Fig. 6.3

Measure and record the new lengths of the strips.

plant E length of strip = ...

plant F length of strip = ...
[1]

(iii) The student suggests that the cell sap of plant F has more sugar than the cell sap of plant E, since it has a greater increase in length.

Do the results of the experiment support the suggestion? Justify your answer.

results.....

justification.....

.....
[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 = 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.).