BOTSWANA EXAMINATIONS COUNCIL
Botswana General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

SCIENCE: DOUBLE AWARD

0569/04

Paper 4

October/November 2019

1 hour 30 minutes

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

044

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.

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

1 An experiment is performed to determine the acceleration of free fall g using a simple pendulum.

Fig. 1.1 shows a set-up when measuring length l of the pendulum.

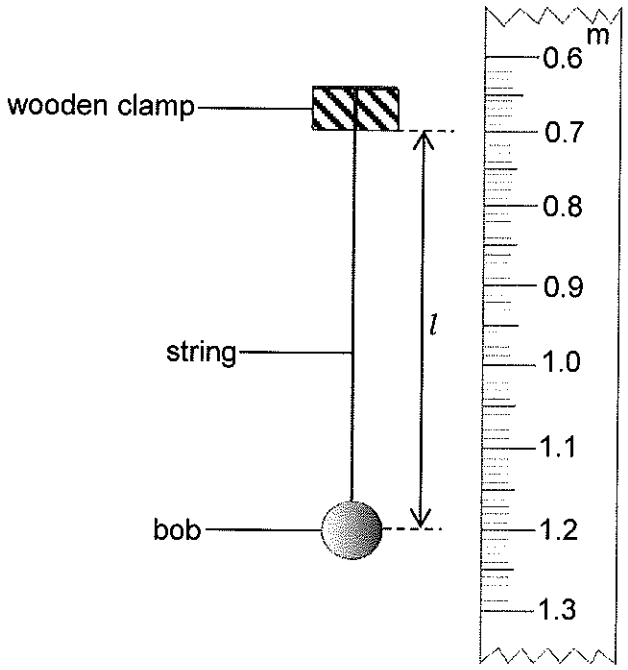

Fig. 1.1

Some of the results of the experiment are shown in Table 1.1.

Table 1.1

l/m	time for 10 swings/s	T / s	T^2/s^2
0.00	0.00	0.00	0.00
0.10	6.30	0.63	0.40
.....	14.20	1.42	2.02
1.00	20.00	2.00	4.00
1.50	.....	2.46	6.06
2.00	28.40	2.84	8.07

(a) (i) Record the length l of the pendulum shown on Fig. 1.1 in Table 1.1, when the time for 10 swings is 14.20 s. [1]

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(ii) Suggest a reason why the length l of the pendulum is measured from the lower part of the wooden clamp as shown in Fig. 1.1.

.....

..... [1]

(iii) Explain why the time is measured for 10 swings instead of 1 swing.

.....

..... [1]

(b) Fig. 1.2 shows the time for 10 swings when the length l of the pendulum is 1.50 m.

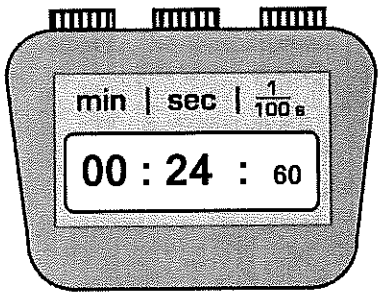

Fig. 1.2

Record the time shown by the stopwatch for the length of 1.50 m in Table 1.1. [1]

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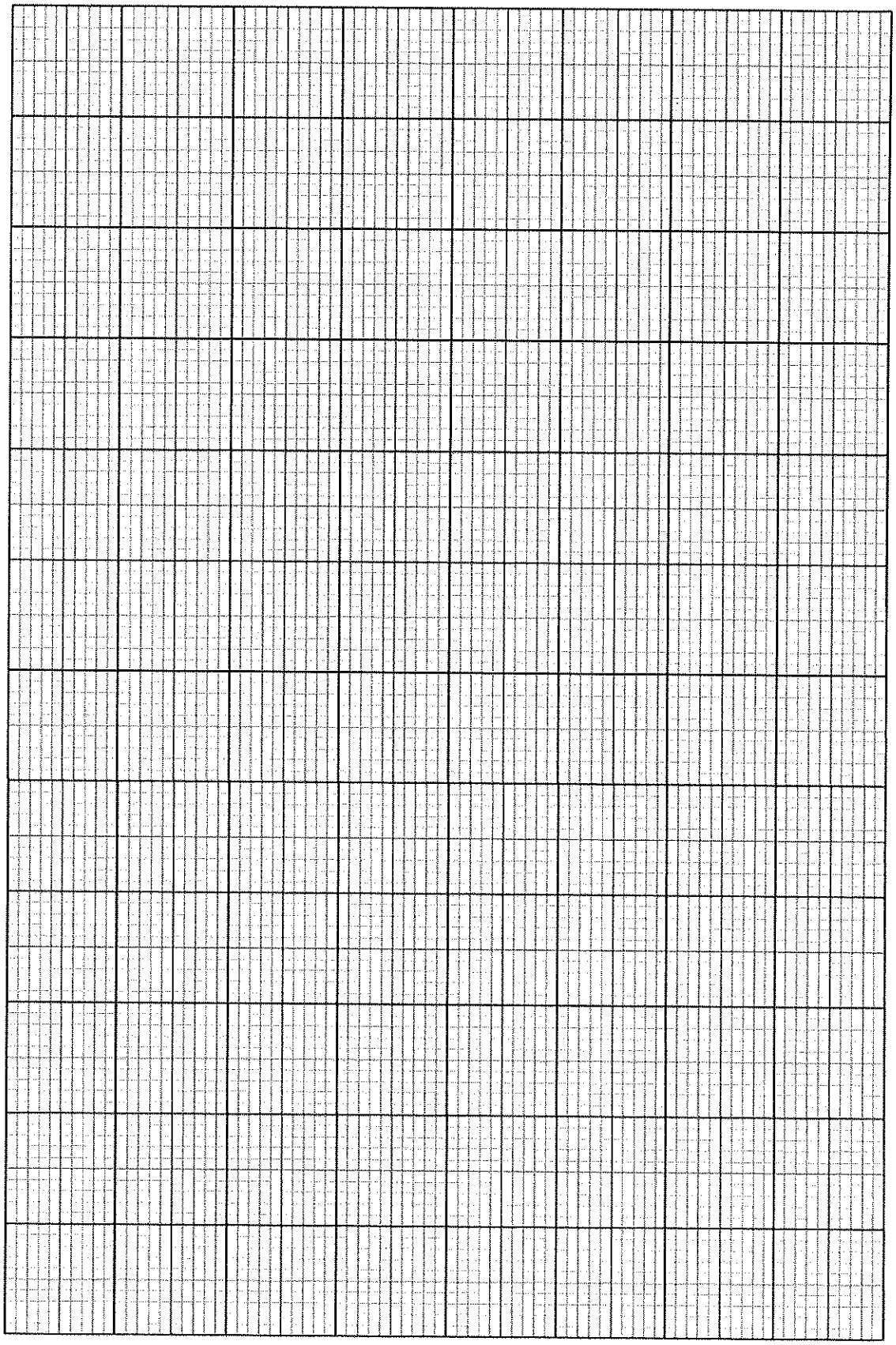
(c) (i) Plot a graph of T^2 (y-axis) against l (x-axis). [4]



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(ii) Determine the gradient G of the graph.

G = ... [2]

(iii) Calculate g using the equation

$$g = \frac{39.48}{G}.$$

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g = ... [1]

(d) A student investigates whether the mass of the bob affects the period of a pendulum. The student has 5 bobs of different masses.

State **two** variables that should be kept constant in this investigation.

1 .....

2 .....

[2]

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2 **(a)** A student is provided with alcohol, oil, two identical test tubes, a ruler and a water bath.

Describe an experiment the student can carry out to compare the thermal expansions of the alcohol and the oil. You may draw a diagram.

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..... [4]

(b) Give a reason for using a water bath.

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.....

..... [1]

(c) Suggest what change in the apparatus used would improve this experiment and give a reason.

suggestion .....

.....

reason .....

.....

[2]

3 An experiment is performed to investigate the percentage of water of crystallisation in hydrated copper(II) sulphate crystals. The crystals are placed in a crucible, weighed, heated and weighed again.

Fig. 3.1(a), Fig. 3.1(b) and Fig. 3.1(c) show the scale readings when measuring the mass of the crucible, the mass of the crucible and hydrated copper(II) sulphate and the mass of the crucible and anhydrous copper(II) sulphate, respectively.

(a) Record the scale readings in the spaces provided.

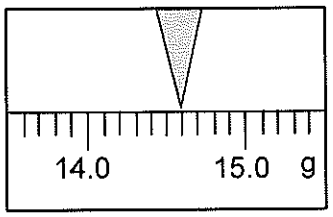

Fig. 3.1(a)

mass of crucible = ...

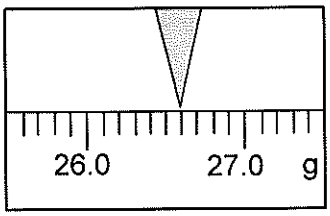

Fig. 3.1(b)

mass of crucible and hydrated copper(II) sulphate = ...

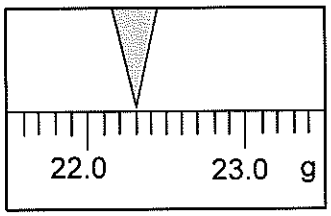

Fig. 3.1(c)

mass of crucible and anhydrous copper(II) sulphate = ...

[2]

(b) Calculate

(i) the mass of hydrated copper(II) sulphate,

mass of hydrated copper(II) sulphate = ... [1]

(ii) the mass of the water lost,

mass of water lost = ... [1]

(iii) the percentage of water of crystallisation in the sample.

percentage = ... [1]

(c) Draw and label the set-up that could be used when heating the hydrated copper(II) sulphate crystals.

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[2]

(d) The hydrated copper(II) sulphate crystals contain barium sulphate impurities.

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Suggest how pure crystals of copper(II) sulphate could be obtained.

.....

.....

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.....

.....

..... [4]

4 Some tests are carried out on metal X.
Table 4.1 shows some tests, observations and conclusions.

Complete Table 4.1.

Table 4.1

	tests	observations	conclusions
(a)	Metal X is added to dilute hydrochloric acid in a test tube. The gas produced is tested with .... [1]	.... [1] pop sound produced	.... [1]
	The solution is divided into three portions.		
(b)(i)	To the first portion, a few drops of sodium hydroxide solution are added.	.... [2]	Zn^{2+} / Al^{3+} ions suspected.
(ii)	Excess sodium hydroxide solution is added.	.... [1]	
(c)(i)	To the second portion, ... [1] is added,	.... [1]	
(ii)	then, the substance in **(c)(i)** is added in excess.	.... [1]	Zn^{2+} ions confirmed.

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5 Fig. 5.1(a) shows a photograph of a cross-section of a pomegranate.

Fig. 5.1(b) shows a photograph of a cross-section of a squash.

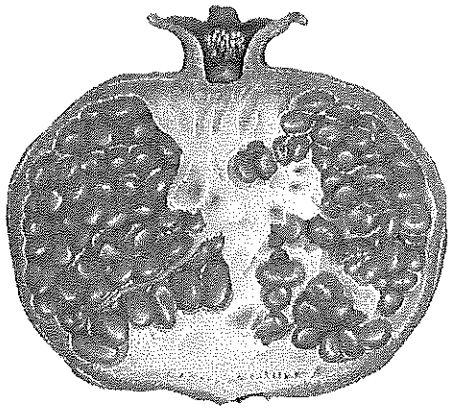

Fig. 5.1(a)

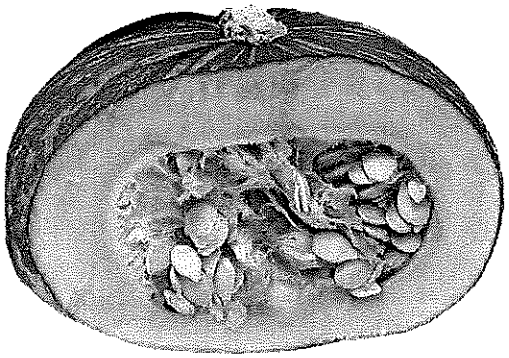

Fig. 5.1(b)

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

[4]

(b) (i) Draw corresponding lines on Fig. 5.1(a) and your drawing to show the longest diameter of the pomegranate. [1]

(ii) Measure and record:

- the length of the longest diameter of the photograph of the pomegranate in Fig 5.1(a).
- the length of the same diameter of the pomegranate in your drawing.

length of longest diameter of photograph = ...

length of longest diameter of drawing = ...
[1]

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

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

magnification = ... [1]

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

1.....

2 .....
[2]

(d) A student wanted to test the squash for fats.

(i) State the name of the reagent the student should use.

.....[1]

(ii) State the result of a positive test for fats.

.....[1]

6 A potato is cut into cylinders as shown in Fig. 6.1.

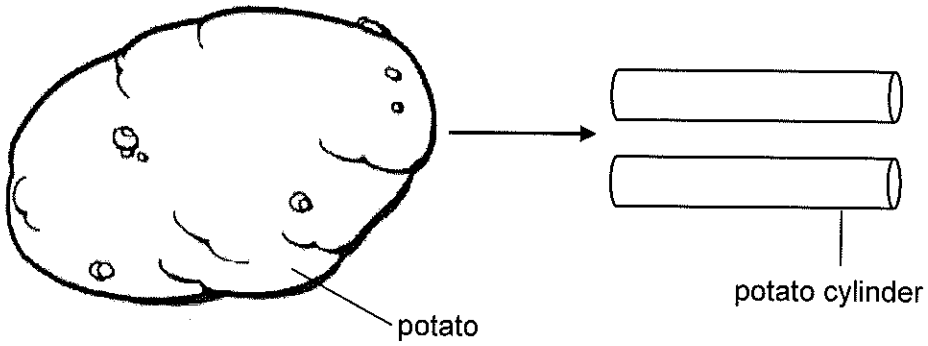

Fig. 6.1

The potato cylinders are placed in salt solutions of different concentrations.
Table 6.1 shows the percentage change in length of the potato cylinders.

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Table 6.1

concentration of salt solution / mol per dm^3	percentage change in length
0.0	10
0.2	4
0.4	−4
0.6	−5
0.8	−5

(a) Suggest why the percentage change in length remains constant when the concentration increases from 0.6 mol / dm^3 to 0.8 mol / dm^3.

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.....

..... [1]

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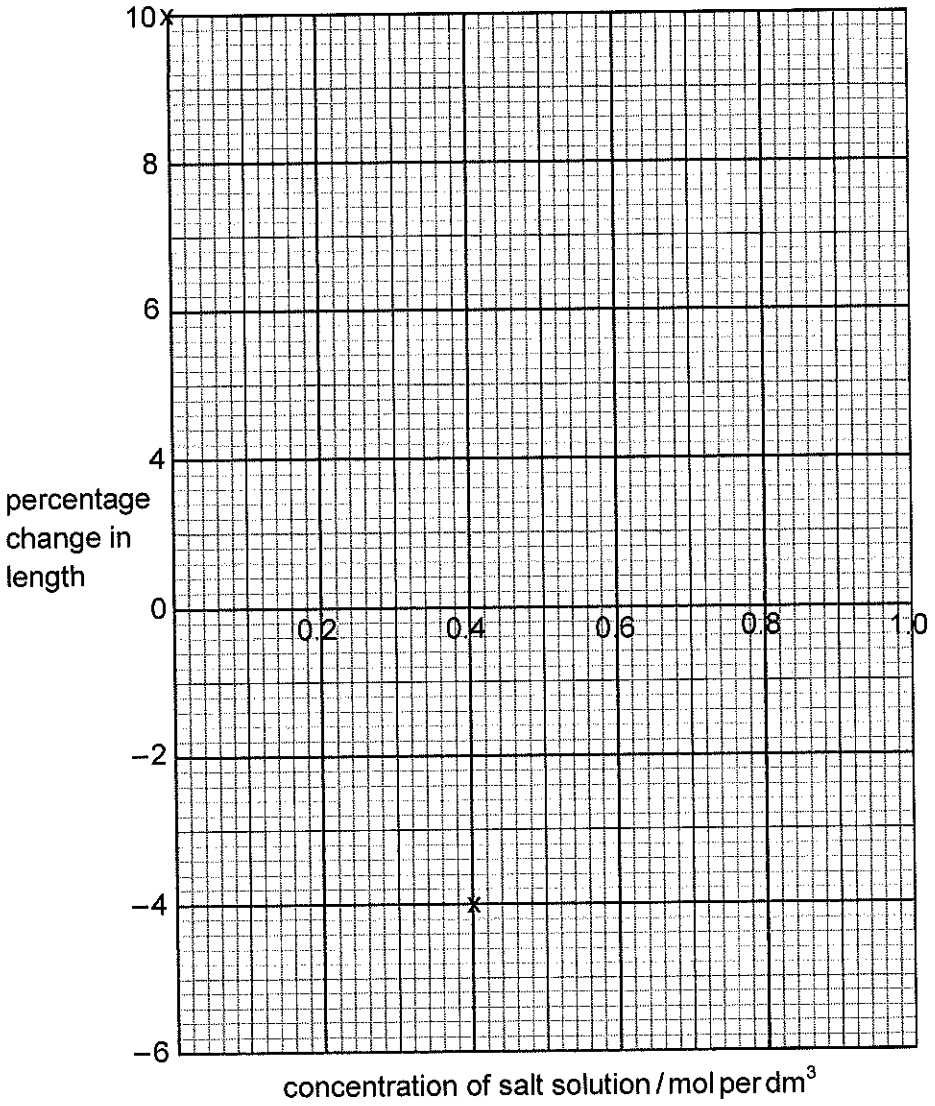
(b) The graph shows the percentage change in length of the potato cylinders. Only two points have been plotted on the graph.

On the grid provided, plot the other three points and draw a best fit line. [2]



(c) **(i)** From the graph, determine the concentration of the cell sap of the potato.

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

(ii) Explain your answer in **(c)(i)**.

.....

..... [1]

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(d) The potato cylinder that was placed in a salt solution of concentration of $0.2\,mol/dm^3$ had an initial length of 5.0 cm.

Calculate the final length of the potato cylinder. Use the equation

$$\frac{\text{final length} - \text{initial length}}{\text{initial length}} = \frac{\text{percentage change in length}}{100}.$$

Show your working.

final length = ... [1]

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(e) A student is provided with two potatoes.

Suggest an experiment that can be performed to compare the cell sap concentration of the two potatoes.

.....

.....

.....

.....

.....

..... [3]

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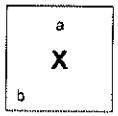
DATA SHEET
The Periodic Table of the Elements

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 †															

*58-71 Lanthanoid series
†90-103 Actinoid series

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	

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.).