BOTSWANA EXAMINATIONS COUNCIL
Botswana General Certificate of Secondary Education

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER			

SCIENCE: DOUBLE AWARD **0569/04**

Paper 4 Alternative to Practical **October/November 2020**

1 hour 30 minutes

You must answer on the Question Paper
Additional Materials: 300 mm ruler

INSTRUCTIONS

- Answer **all** questions.
- Use black or dark blue pen.
- Write your candidate name, Centre number and candidate number in the spaces provided at the top of this page.
- Write your answer to each question in the space provided.
- Do not use an erasable pen or correction fluid.
- Do not write on any barcodes.
- You may use an HB pencil for any diagrams, graphs or rough working.

INFORMATION

- The total mark for this paper is 60.
- The number of marks for each question or part question is shown in brackets [ ].
- You may lose marks if you do not show your working.
- A copy of the Periodic Table is printed on last page.

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

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

[Turn over

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1 An experiment is performed to determine the resistance R of a resistance wire.

Fig. 1.1 shows the apparatus used for the experiment.

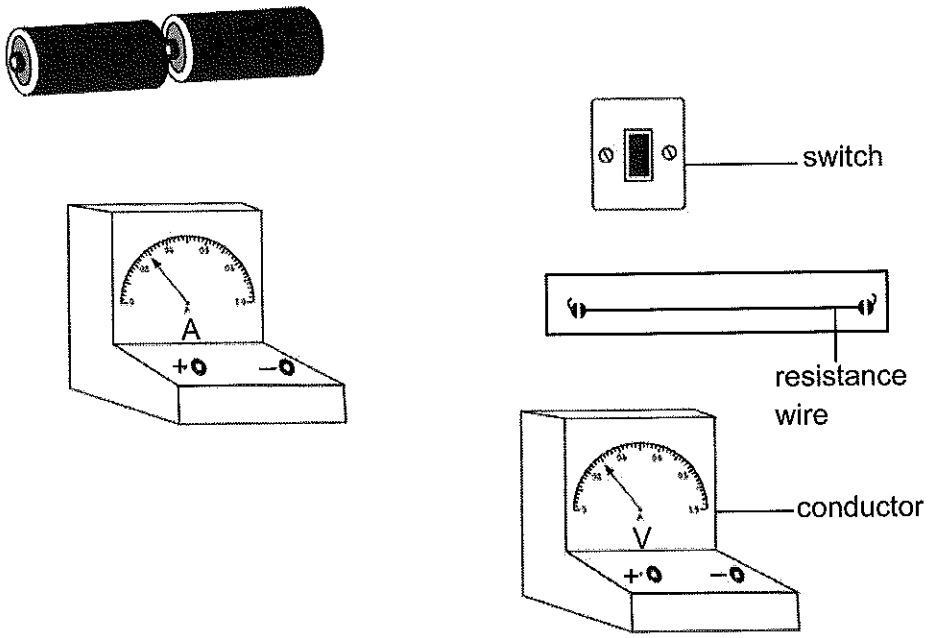


Fig. 1.1

(a) Using the apparatus provided, draw the circuit diagram that could be used to determine the resistance of the wire. You may use standard circuit symbols.

Use the symbol of a fixed resistor for the resistance wire.

[2]

For Examiner's Use

(b) Another experiment is performed to investigate the relationship between resistance R and the length l of a conductor.
Some of the results of the experiment are recorded in Table 1.1.

Table 1.1

l/cm	V/V	I/A	R/Ω
10.0	1.3	0.96	1.4
20.0	2.2	0.76	2.9
30.0	2.5	0.60	
40.0	3.0	0.56	5.4
50.0	3.4	0.48	
60.0	3.7	0.44	8.4

(i) Fig. 1.2(a) and Fig. 1.2(b) show the voltmeter and ammeter that were used in the experiment.

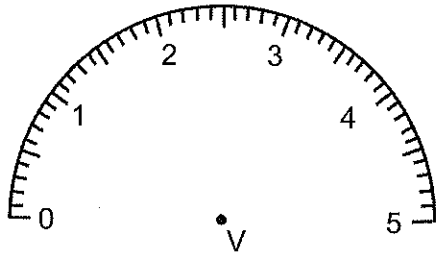


Fig. 1.2(a)

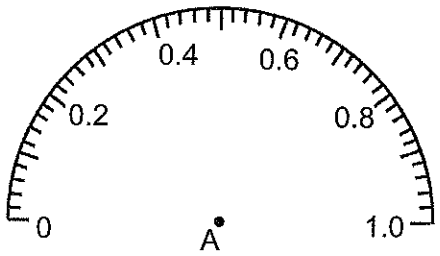


Fig. 1.2(b)

Use an arrow to mark the position of the voltmeter and the ammeter needle when the length l is 60.0 cm. [2]

(ii) Complete Table 1.1 by calculating the resistance R of the conductor.
Use the equation $R = \frac{V}{I}$. Give your answers to two significant figures. [1]

(c) The circuit is switched off after taking the readings for each set of results.

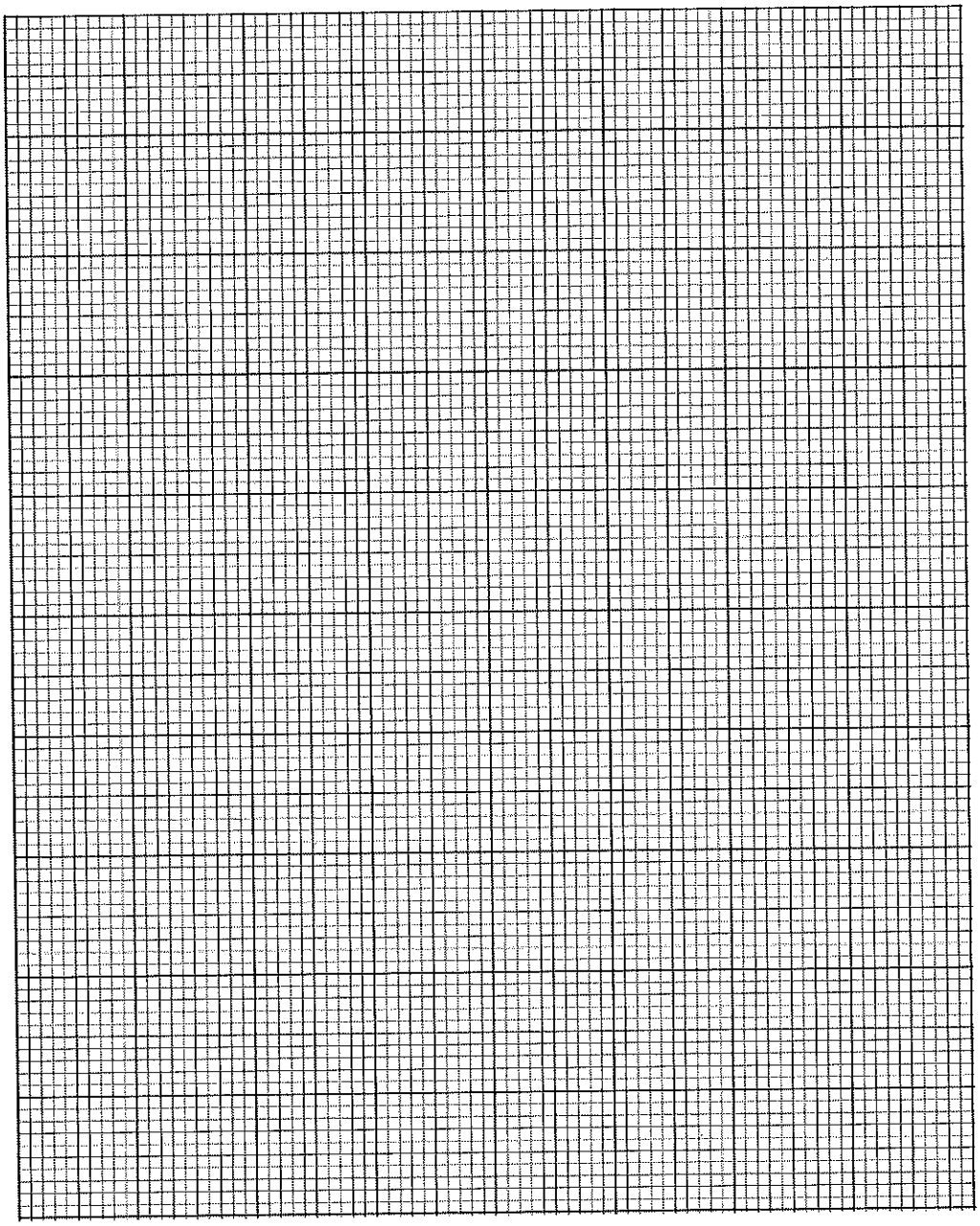
Explain the reason for switching off the circuit.

.....

..... [1]

For Examiner's Use

(d) On the grid provided plot a graph of R/Ω (y-axis) against l/cm (x-axis). [4]



(e) State the relationship between resistance and length.

.....

..... [1]

For Examiner's Use

2 A student is asked to determine the weight of a small stone.
The student is provided with:

- a wooden pivot,
- a 0.5 N weight,
- a stone of unknown weight and
- a uniform metre rule.

(a) Suggest how the metre rule can be tested to check that it is uniform.

.....

..... [1]

(b) Draw a labelled diagram to show the arrangement of a set-up used to determine the weight of the stone using the apparatus available.

[2]

(c) State **one** variable that is measured when carrying out the experiment.

..... [1]

(d) Describe how the weight of the stone is determined.

.....

.....

.....

.....

..... [3]

(e) Suggest how the results of the experiment can be made more reliable.

..... [1]

(f) State **one** source of inaccuracy when performing this experiment.

..... [1]

3 A student performs an experiment to determine the volume of dilute nitric acid required to neutralise 25.0 cm^3 of 0.1 mol / dm^3 sodium hydroxide solution.
The pH of the solution is measured during titration.

(a) Fig. 3.1 show burettes at the beginning and at the end of three titrations.

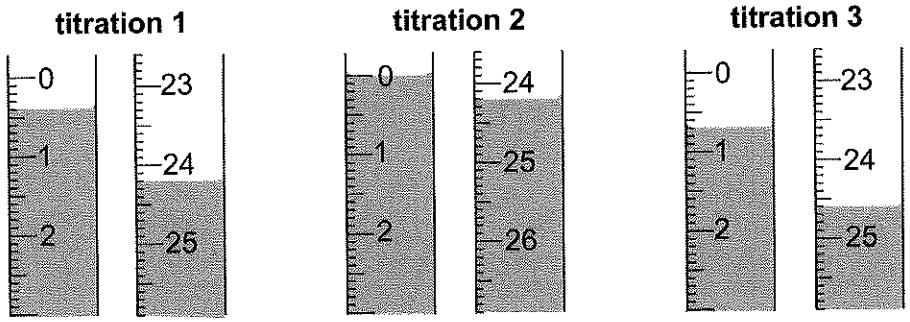


Fig. 3.1

(i) Complete Table 3.1 to show the volume of nitric acid used.

Table 3.1

titration	1	2	3
final burette reading / cm^3			
initial burette reading / cm^3			
volume of nitric acid used / cm^3			
tick (✓) the best result			

[5]

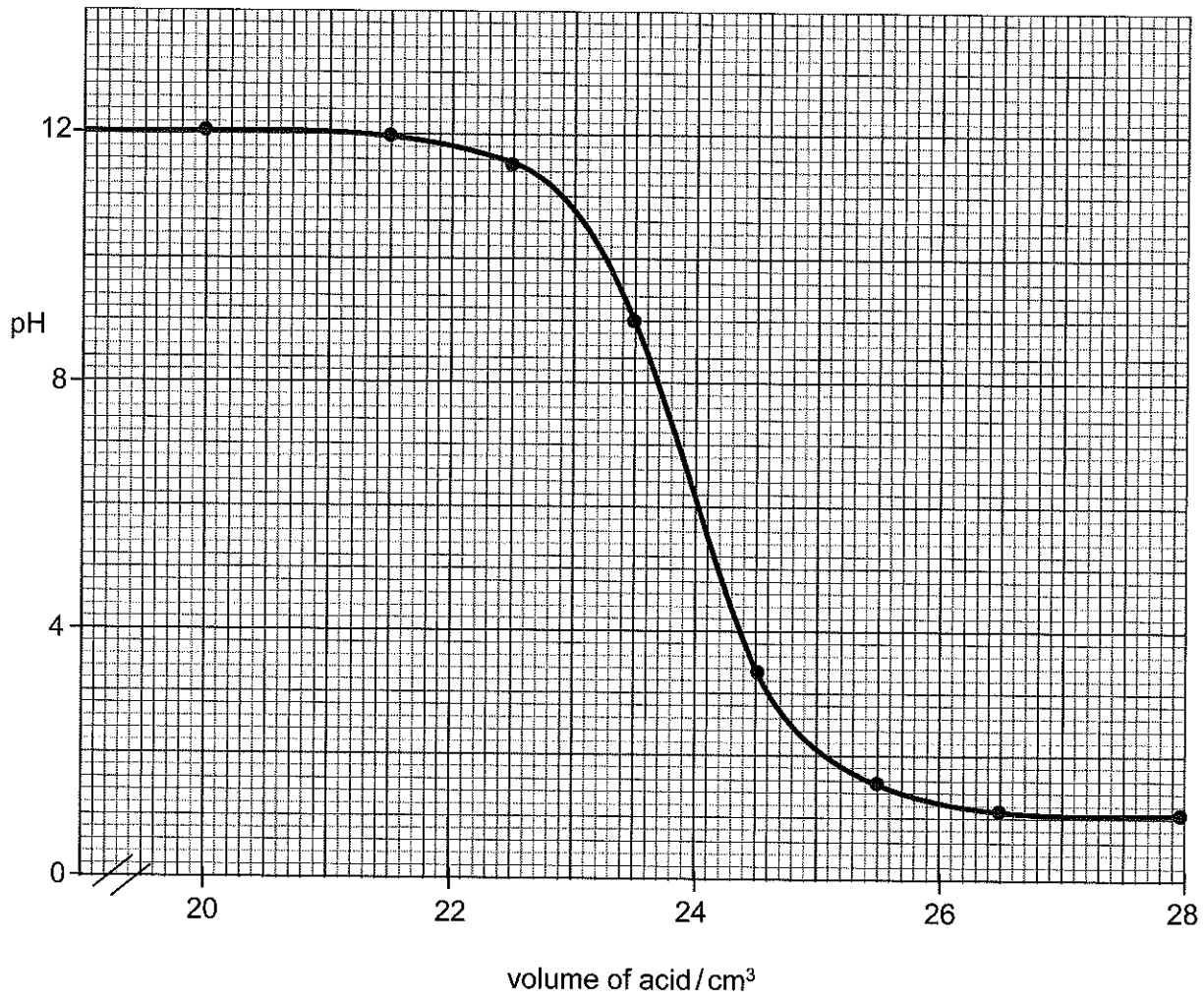
(ii) Use the ticked values to calculate the average volume V_{av} of nitric acid used.

V_{av} ..... cm^3 [1]

For Examiner's Use

(b) The pH of the mixture is measured each time the acid is added to sodium hydroxide.

The graph shows the pH of the mixture against the volume of the acid added.



(i) Use the average titration volume to determine the pH of the mixture at the end point. Show your working.

24
+12
36

pH 36 [1]

(ii) Suggest the colour of methyl orange indicator after the addition of 26.5 cm^3 of acid.

..... [1]

(c) Describe how the student can prepare a 1.0 mol / dm^3 sodium hydroxide solution.

.....

.....

.....

..... [3]

Question 4 begins on page 10.

4 A student performs an experiment to prepare an insoluble salt, silver chloride.
The reagents are silver nitrate solution and a solution of salt Q.

Fig. 4.1 shows a set-up used for the experiment.

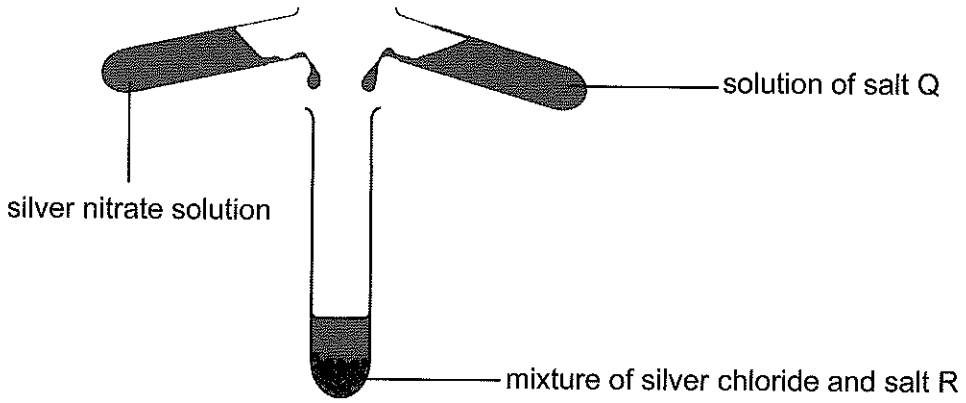


Fig. 4.1

(a) Draw a labelled diagram to show how the mixture of silver chloride and a solution of salt R can be separated.

[3]

(b) A solution of salt R obtained in **(a)** is divided into two portions.

A few drops of aqueous ammonia are added to the first portion.
A white precipitate is observed.

(i) Suggest the cation in the salt R.

..... [1]

(ii) Excess aqueous ammonia is then added, the precipitate dissolves.

State the ion present in the salt confirmed by this observation.

..... [1]

(c) State the name of salt Q.

..... [1]

(d) The second portion of the solution which contains nitrate ions, is warmed with aqueous sodium hydroxide and aluminium powder and a gas is produced.

(i) State the name of the gas produced.

..... [1]

(ii) State a test and the result of the test that the student can carry out to confirm the identity of the gas.

test .....

result .....
[2]

5 Fig. 5.1(a) shows a photograph of a cross section of a tomato.
Fig. 5.1(b) shows a photograph of a cross section of an orange.

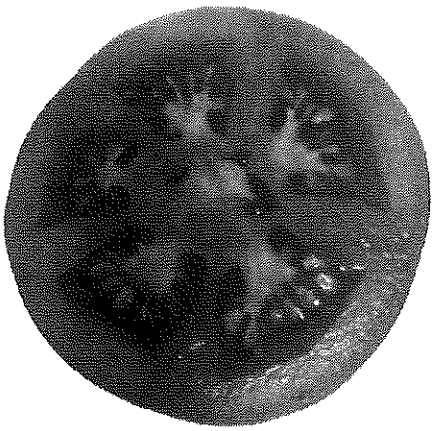


Fig. 5.1(a)

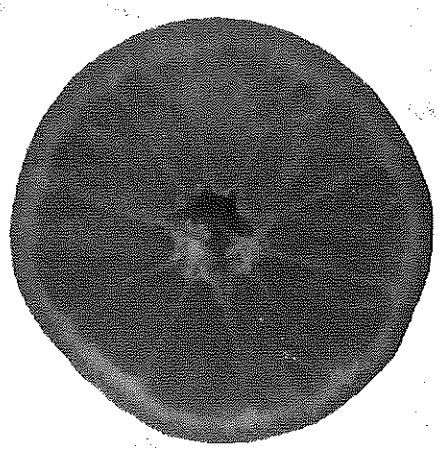
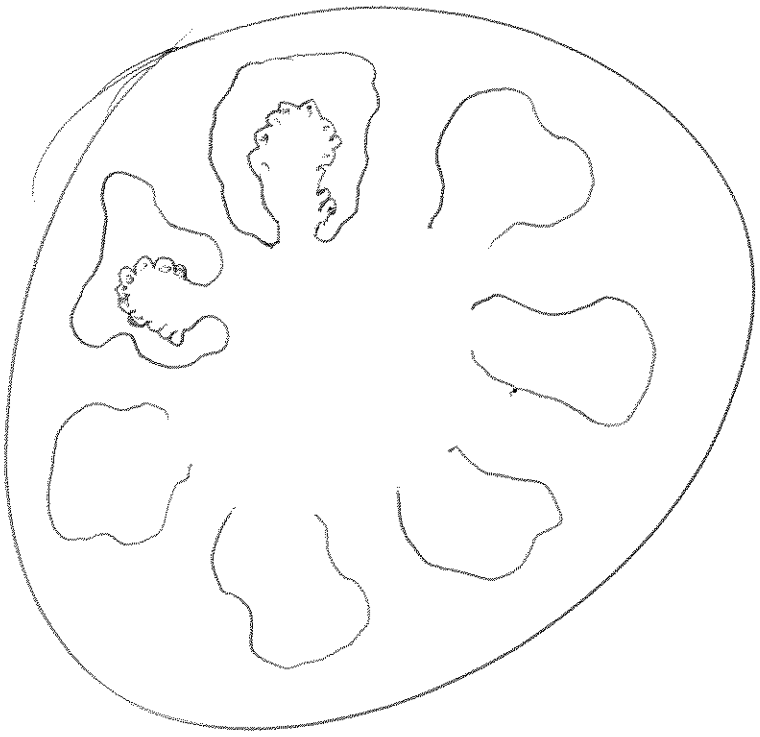


Fig. 5.1(b)

(a) Make a large drawing of the cross section of the tomato shown in Fig. 5.1(a).



[4]

For Examiner's Use

(b) (i) State **one** visible similarity between the tomato in Fig. 5.1(a) and the orange in Fig. 5.1(b).

.....

..... [1]

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

1 .....

.....

2 .....

.....

[2]

(c) (i) Measure and record:

- the maximum diameter of your drawing.
- the maximum diameter of the cross-section of the tomato in the photograph in Fig. 5.1(a).

the maximum diameter of your drawing = ...

the maximum diameter of the photograph = ...

[1]

(ii) Calculate the magnification of your drawing using the equation

$$\text{magnification} = \frac{\text{maximum diameter of the drawing}}{\text{maximum diameter of the photograph}}$$

magnification = ... [2]

For Examiner's Use

(d) Describe an experiment a student can carry out to investigate the effect of temperature on germination of tomato seeds.

You may draw a diagram to help you.

.....

.....

.....

.....

.....

.....

..... [3]

For Examiner's Use

6 A student is given two solid food samples, P and Q.
The student tests each sample for reducing sugars to determine the sample that contains more reducing sugars.

(a) (i) State the name of the reagent used to test for reducing sugars.

..... [1]

(ii) Describe how the samples are tested for reducing sugars.

.....

.....

.....

..... [3]

(iii) The results of the tests show that P has more reducing sugars than Q.

Suggest the possible colours for P and Q after the tests.

colour of P .....

colour of Q .....
[1]

(b) State **two** safety precautions taken when performing this experiment.

1 .....

2 ..... [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 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