UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

4719596603

PHYSICAL SCIENCE **0652/33**

Paper 3 (Extended) **October/November 2012**

1 hour 15 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use a soft pencil for any diagrams, graphs, tables or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
A copy of the Periodic Table is printed on page 20.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

For Examiner's Use	
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Total	

This document consists of **18** printed pages and **2** blank pages.

UNIVERSITY of CAMBRIDGE International Examinations

1 Table 1.1 shows elements in a period of the Periodic Table.

Table 1.1

group	I	II	III	IV	V	VI	VII
element	Na	Mg	A*l*	Si	P	S	C*l*

(a) Describe how the electronic structure of successive elements differs across the period.

.....

[1]

(b) Complete Table 1.2 to show which of these elements are metals and which are non-metals.

Table 1.2

metals	**non-metals**

[1]

(c) Calcium forms an ion Ca^{2+}. Chlorine form an ion Cl^{-}.

(i) Deduce the formula for the ionic compound calcium chloride.

.....

[1]

(ii) Describe, in terms of electrons, how calcium and chlorine atoms form calcium chloride.

.....

.....

.....

.....

.....

[3]

(d) Sulfur dioxide is a covalent molecule.

In the box below, draw a diagram to show the arrangement of all the outer electrons in the atoms in a molecule of sulfur dioxide.

[3]

2 Fig. 2.1a shows a high jumper about to leave the ground. Fig. 2.1b shows the same jumper at the top of his flight.

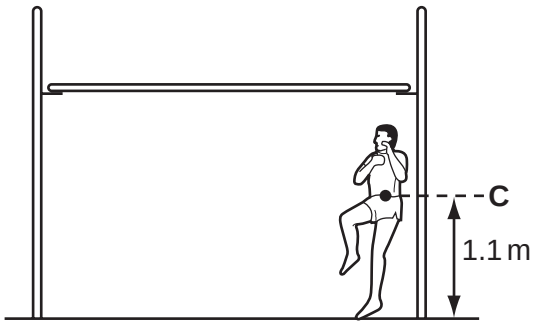


Fig. 2.1a

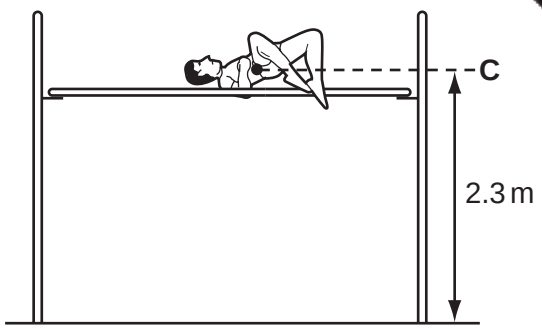


Fig. 2.1b

The high jumper has a mass of 75 kg. Point **C** shows the centre of mass of the high jumper.

(a) Explain what is meant by the term *centre of mass*.

.....

.....

..... [2]

(b) **(i)** Calculate the increase in the gravitational potential energy of the high jumper from when he leaves the ground to when he reaches the top of his flight.

[g = 10 N / kg]

increase in gravitational potential energy = ... [2]

(ii) State the minimum kinetic energy with which the high jumper must leave the ground.

kinetic energy = ... [1]

(c) On a second jump the same high jumper leaves the ground with kinetic energy of

Calculate the speed at which he leaves the ground.

speed = ... [3]

(d) The gain in potential energy of the high jumper is less than the work he does in his take off.

Suggest a reason for this.

.....

..... [1]

3 Magnesium sulfate is a salt that is soluble in water.

It can be made in the laboratory from solid magnesium oxide, MgO, and dilute sulfuric acid, H_2SO_4.

(a) Describe how you would make pure dry crystals of magnesium sulfate from solid magnesium oxide and dilute sulfuric acid.

.....

.....

.....

.....

..... [4]

(b) Write a balanced equation for the reaction between magnesium oxide and sulfuric acid.

Include state symbols in your equation.

..... [3]

(c) Magnesium sulfate can also be made from magnesium hydroxide and sulfuric acid.

$$Mg(OH)_2 + H_2SO_4 \longrightarrow MgSO_4 + 2H_2O$$

What is the maximum mass of magnesium sulfate that could be made from 5.0 g magnesium hydroxide?

[Relative atomic masses: A_r: H,1; Mg,24; O,16; S,32]

Show your working in the box.

mass of magnesium sulfate = ... g [3]

4 Fig. 4.1 shows a wind powered generator which has an efficiency of 30 %.

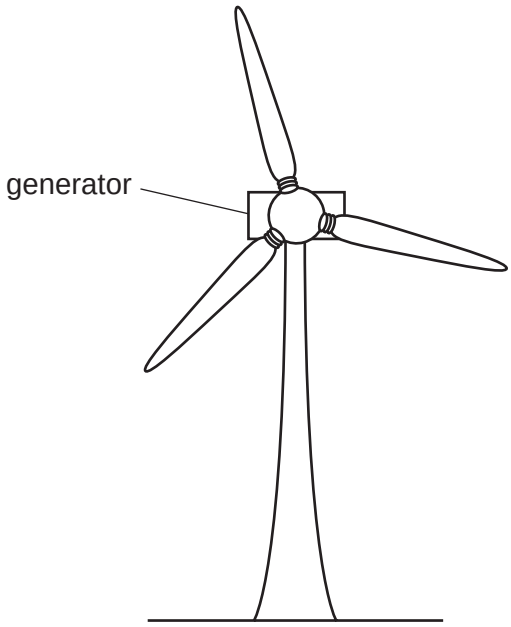


Fig. 4.1

(a) The generator depends on a form of energy possessed by the wind.

Name this form of energy and briefly explain your answer.

.....

.....

..... [2]

(b) Explain what is meant by the phrase *the generator has an efficiency of 30 %*.

.....

.....

..... [2]

(c) The generator has a maximum output of 4500 W at 230 V.

Calculate the maximum current that can be taken from the generator.

current = ... [2]

5 A student uses the apparatus shown in Fig. 5.1 to investigate the reaction be... magnesium and hydrochloric acid.

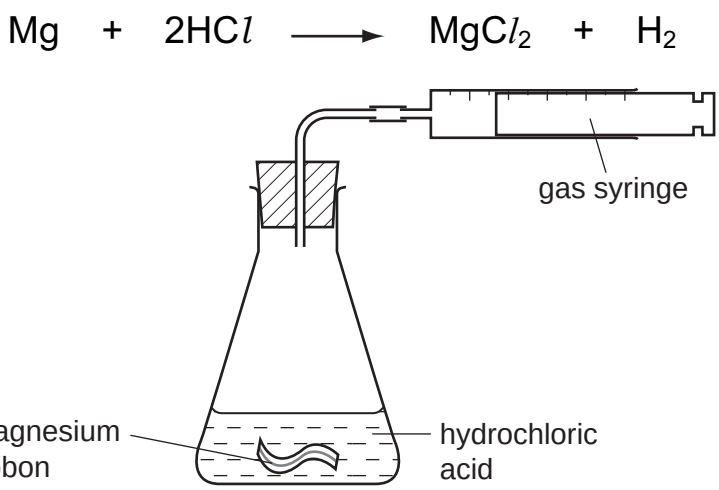


Fig. 5.1

She measures, at room temperature and pressure, the hydrogen given off when magnesium ribbon reacts with an excess of dilute hydrochloric acid.

Results of her investigation are shown in Fig. 5.2.

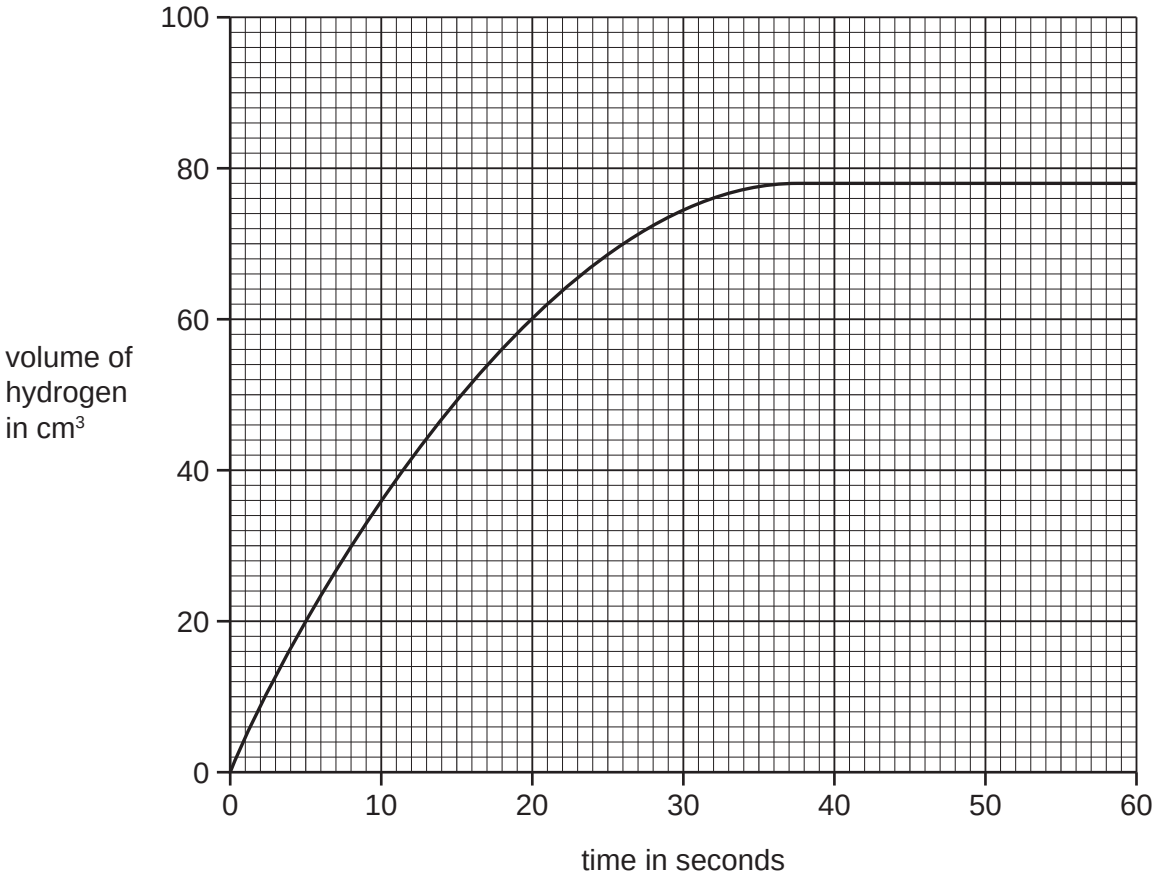


Fig. 5.2

(a) **(i)** State the time at which the reaction stopped.

.....

(ii) Explain why the reaction stopped.

..... [1]

(b) The experiment is repeated using the same mass of magnesium ribbon and a more concentrated solution of hydrochloric acid.

On Fig. 5.2, sketch the line you would expect for this second experiment. [2]

(c) Calculate the mass of magnesium used in the reaction.

[Relative atomic masses: A_r: H,1; C*l*,35.5; Mg,24.]

The volume of one mole of any gas is 24 dm^3 at room temperature and pressure.

Show your working in the box.

mass of magnesium = ... g [4]

6 **(a)** Fig. 6.1 shows a parallel beam of light incident on a converging lens.

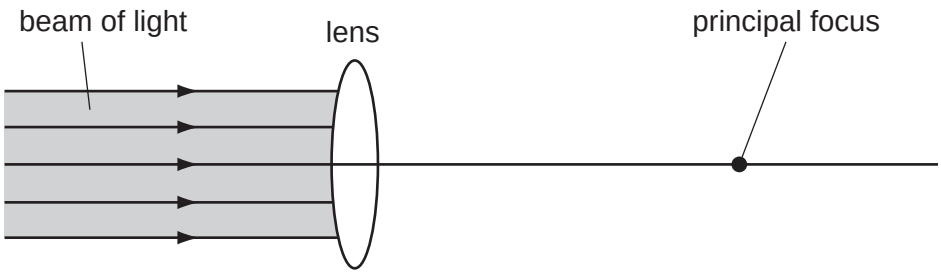


Fig. 6.1

(i) On Fig. 6.1, draw rays to show the path of the light after it passes through the lens. [3]

(ii) On Fig. 6.1, draw an arrow to show the focal length of the lens. [1]

(b) (i) Jan uses a converging lens of focal length 10.5 cm to study a small insect. Point **P** on the insect is 5.0 cm from the centre of the lens.

On Fig. 6.2, draw **two** rays from point **P** to show how and where the image of the insect is formed. [3]

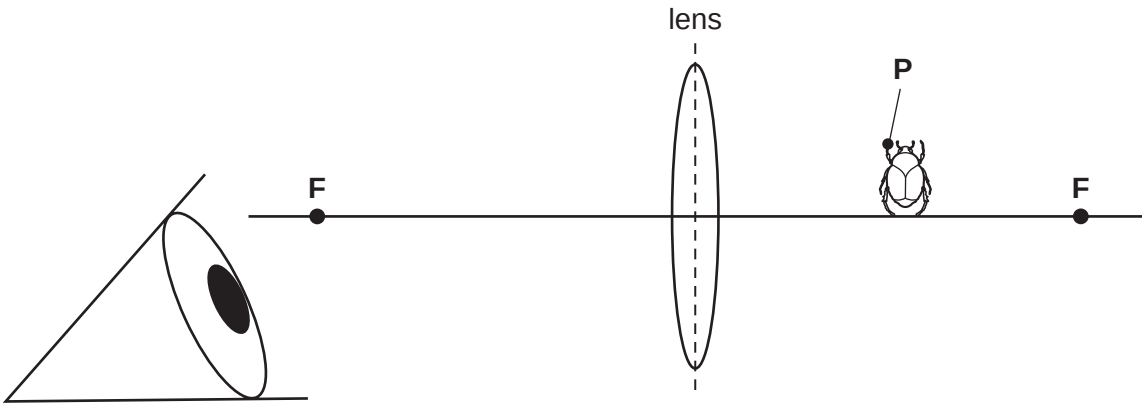


Fig. 6.2

(ii) Give a full description of the image.

.... [2]

7 Zinc and copper are two commonly used metals.

(a) Zinc is mixed with copper to make the alloy brass.

Brass is stronger than either pure metal. Explain why.

.....

.....

.....

.....

..... [3]

(b) Zinc is used to make galvanised steel.

(i) What is galvanised steel?

..... [1]

(ii) Explain how galvanised steel is more useful than steel that has not been galvanised.

..... [1]

(iii) Explain how zinc makes this improvement to steel.

.....

.....

.....

..... [2]

(c) Copper is used to make saucepans.

State which property of copper makes it a good choice for this application.

..... [1]

8 Daniel is investigating the resistance of a length of nichrome wire. He builds the circuit shown in Fig. 8.1.

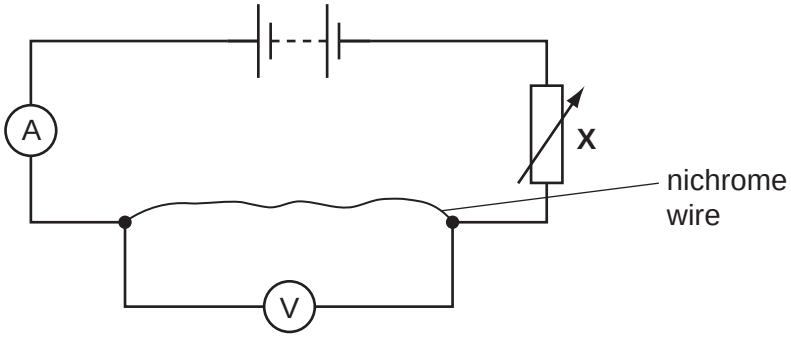


Fig. 8.1

(a) He takes a series of readings of the current with different potential differences across the nichrome wire. He uses his results to draw the graph shown in Fig. 8.2.

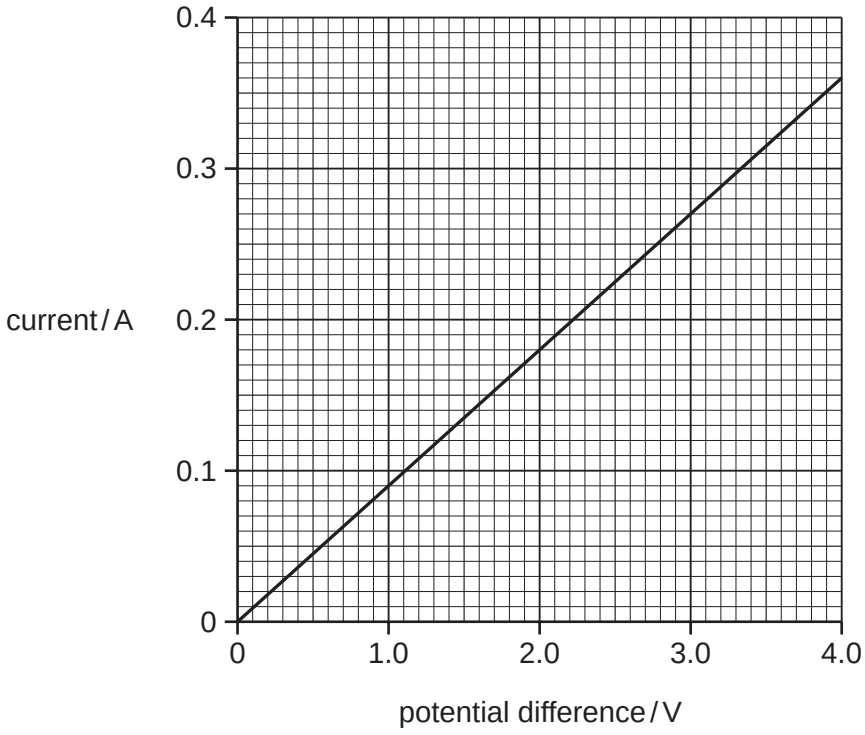


Fig. 8.2

(i) Describe how he varies the potential difference across the nichrome wire.

.....

..... [1]

(ii) Use the graph to determine the resistance of the nichrome wire.

Show your working.

resistance = ... [3]

(b) Daniel then uses a second piece of nichrome wire half the diameter of the original wire.

Calculate the resistance of this piece of wire.

resistance = ... [2]

9 Poly(ethene) is made from ethene, C_2H_4.

(a) Ethene is an unsaturated compound.

Explain the meaning of the term *unsaturated*.

.....

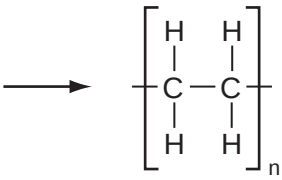
..... [1]

(b) Describe how the ethene for this process is made.

.....

..... [2]

(c) Complete this equation to show the formation of poly(ethene) from ethene.



[2]

Please turn over for Question 10.

10 Fig. 10.1 shows a transformer.

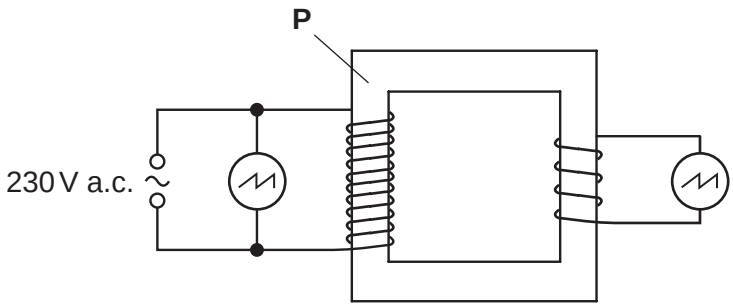


Fig. 10.1

The input is connected to a cathode ray oscilloscope (c.r.o.) and the output is connected to another c.r.o.

(a) (i) The transformer works by electromagnetic induction.

Explain what is meant by *electromagnetic induction*.

.....

.....

..... [2]

(ii) Explain why the input to the transformer must be an alternating voltage.

.....

.....

..... [2]

(iii) **P** is the transformer core.

Name the material that **P** is made from. ..... [1]

(iv) Outline the role of **P** in the operation of the transformer. Your answer should include the properties of the material which make it suitable.

.....

.....

..... [2]

(b) (i) This transformer allows an appliance designed to be used on a 115 V supply to be used on a 230 V supply.

Calculate the turns ratio of the primary coil to the secondary coil ($N_{primary}$: $N_{secondary}$).

($N_{primary}$: $N_{secondary}$) = ... [1]

(ii) Fig. 10.2 shows the screen of the c.r.o. that is connected to the input.

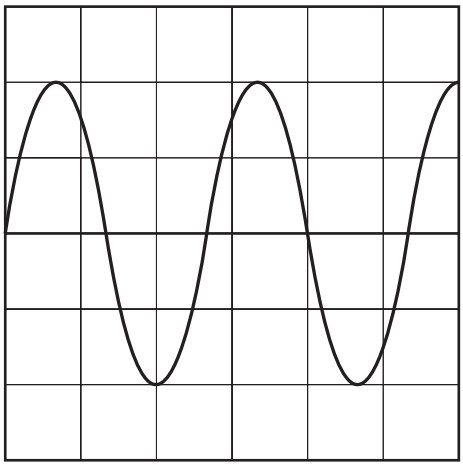


Fig. 10.2

On Fig. 10.2, draw the trace that would be obtained on the c.r.o. connected to the output.

You should assume that the time base and y-gain settings of the two cathode ray oscilloscopes are the same. [2]

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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 Sulfur 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 Radius 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.).