UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

3836360881

PHYSICAL SCIENCE **0652/21**

Paper 2 (Core) **October/November 2013**

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 pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.
A copy of the Periodic Table is printed on page 24.

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.

This document consists of **24** printed pages.

For Examiner's Use

1 A student investigates the composition of four different inks using paper chromatography.

Fig. 1.1 shows the results of his experiment after one hour.

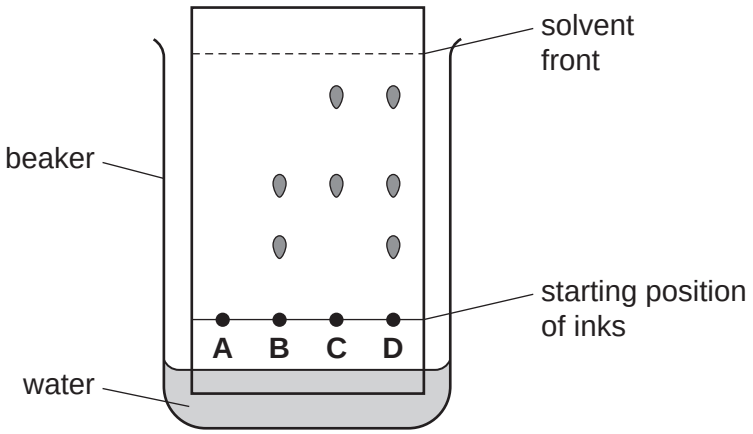


Fig. 1.1

(a) Explain why the water level in the beaker must be below the ink dots at the start of the experiment.

.....

..... [1]

(b) Suggest why ink **A** did not move during the experiment.

..... [1]

(c) **(i)** State how many different components ink **D** contains.

..... [1]

(ii) State **one** similarity and **one** difference in the compositions of inks **B** and **C**.

similarity .....

.....

difference .....

.....

[2]

Please turn over for Question 2.

For Examiner's Use

2 A metre rule is clamped to a ramp. Fig. 2.1 shows the experimental set up.

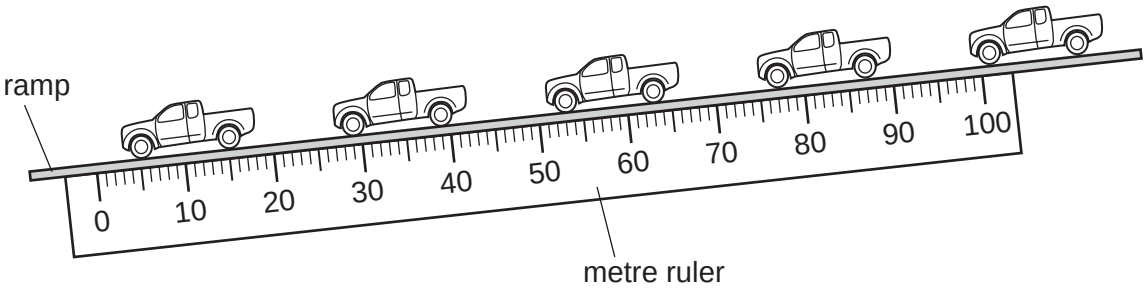


Fig. 2.1

- The ramp is tilted and a toy car is held at the top of the ramp.
- The car is given a gentle push and it moves down the ramp.
- The positions of the car after successive time intervals of 0.20 s are shown.

(a) (i) Read off the positions of the front of the car after each time interval.

Record the values, to the nearest centimetre, in Table 2.1.

Table 2.1

time / s	0.0	0.20	0.40	0.60	0.80
position / cm	99				

[1]

(ii) Describe the pattern in the data in Table 2.1 which suggests that the car is travelling at constant speed.

.....

.....

..... [2]

(iii) Calculate the speed of the car as it moves down the ramp.

Show your working in the box.

speed = ... unit ..... [3]

For Examiner's Use

(b)
- In a separate experiment the angle of the ramp is increased.
- The car is given a gentle push and it moves down the ramp.
- Fig. 2.2 shows the positions of the car in successive 0.20 s intervals.

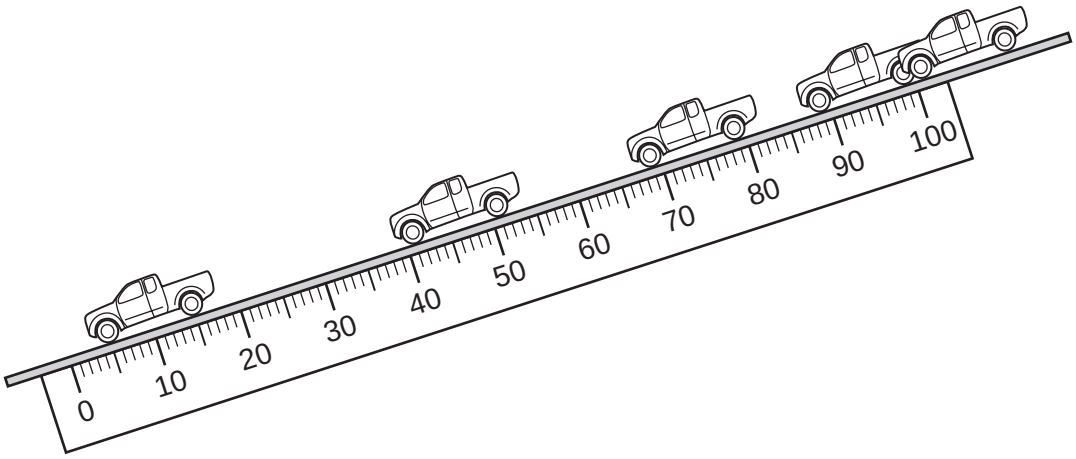


Fig. 2.2

Describe the motion of the car in this experiment.

.....

..... [1]

For Examiner's Use

3 **(a)** Potassium nitrate can be made by reacting an acid with an alkali.

Name these reagents.

acid .....

alkali ..... [2]

(b) State the name given to the reaction of an acid with an alkali.

..... [1]

(c) The potassium nitrate formed is in aqueous solution.

Describe how you could obtain **dry** crystals of potassium nitrate from this solution.

.....

.....

.....

.....

.....

..... [2]

Please turn over for Question 4.

4 Fig. 4.1 shows apparatus used to demonstrate one method of transfer of thermal energy.

For Examiner's Use

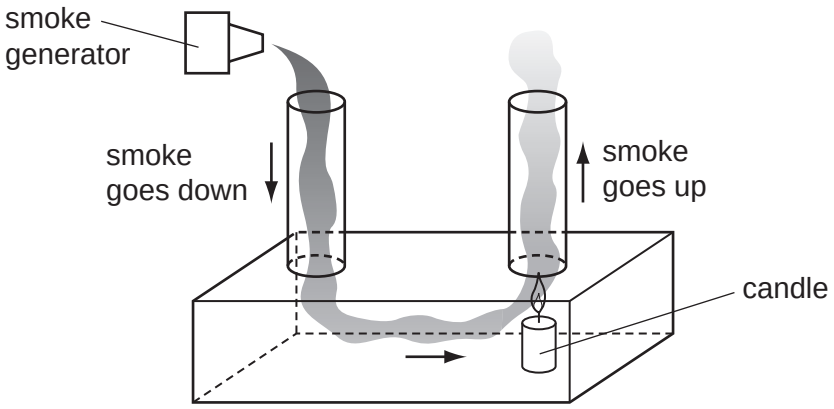


Fig. 4.1

(a) (i) Name the method of thermal energy transfer this experiment demonstrates.

.....

..... [1]

(ii) Explain how the candle makes the smoke rise up the right hand tube.

.....

.....

.....

..... [3]

(b) Fig. 4.2 shows an eagle gliding round a thermal. A thermal is a column of rising hot air.

For Examiner's Use

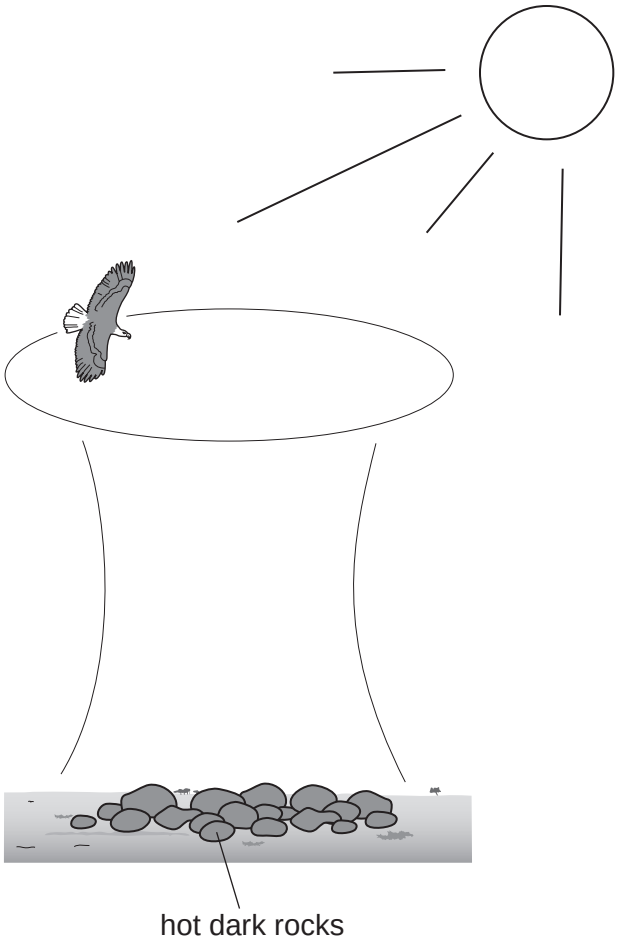


Fig. 4.2

(i) The rocks are heated by electromagnetic radiation from the sun.

Name the type of electromagnetic radiation that heats the rocks.

.....

..... [1]

(ii) Explain how the thermal is formed.

.....

..... [1]

For Examiner's Use

5 Hydrogen has been described as *'a clean fuel which produces no pollution'*.

(a) Write a balanced equation for the burning of hydrogen in air.

.....

[2]

(b) State why the burning of hydrogen is an oxidation reaction.

.....

.....

[1]

(c) Explain why the burning of hydrogen does not produce pollution.

.....

.....

[1]

(d) Give **one** disadvantage of using hydrogen as a fuel instead of petrol.

.....

.....

[1]

For Examiner's Use

6 Fig. 6.1 shows water waves in a ripple tank. The wavefronts pass from the deep water to the shallow water.

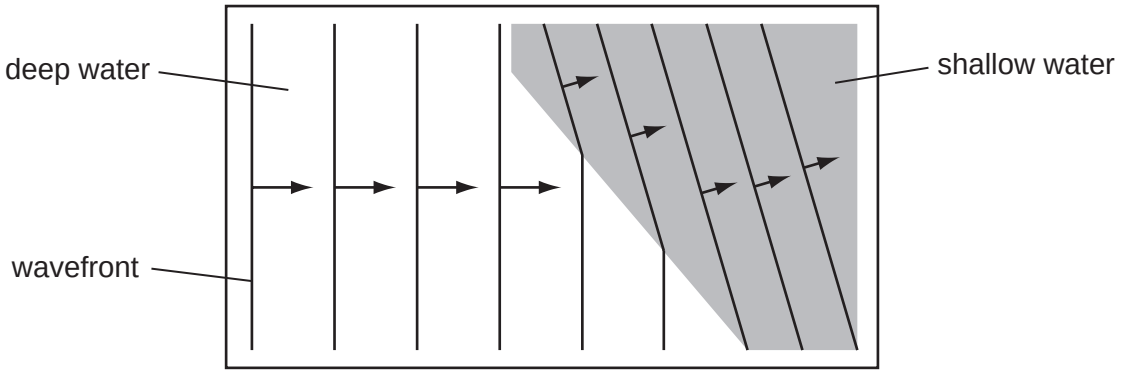


Fig. 6.1

(a) Name the wave behaviour this experiment demonstrates.

.....[1]

(b) State the change, if any, to these properties as the waves enter shallow water.

(i) wavelength .....

(ii) frequency .....

(iii) speed .....

[3]

(c) Fig. 6.2 shows the electromagnetic spectrum.

radio waves	micro-waves	infra-red	visible	**Y**	X-rays	γ-rays

Fig. 6.2

(i) Name the type of radiation found in region **Y**.

.....[1]

(ii) When the Sun moves from behind a cloud we feel an increase in warmth and see an increase in brightness at the same time.

State what this suggests about the speeds of different types of electromagnetic radiation.

.....

.....[1]

For Examiner's Use

7 Chlorine is a member of Group VII of the Periodic Table.

(a) Use the electron configuration of chlorine to explain why it is in Group VII.

.....

[1]

(b) Chlorine is a gas at room temperature.

Name another element in Group VII that is a gas at room temperature.

.....

[1]

(c) Name an element in Group VII that is less reactive than chlorine.

.....

[1]

(d) **(i)** Name the compound formed when chlorine reacts with sodium.

.....

[1]

(ii) Name the type of bonding in this compound.

.....

[1]

(e) Name a metal in the same **period** as chlorine.

.....

[1]

Please turn over for Question 8.

For Examiner's Use

8 Fig. 8.1a shows a long conducting wire connected to a switch and power supply. A small plotting compass is placed near the wire.

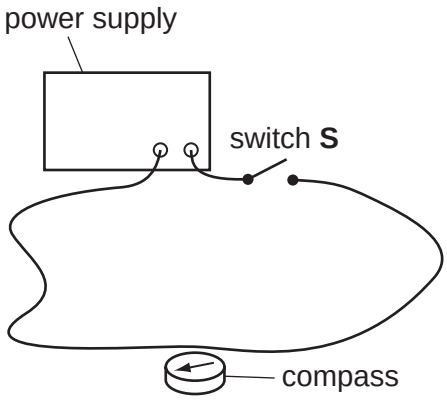


Fig. 8.1a

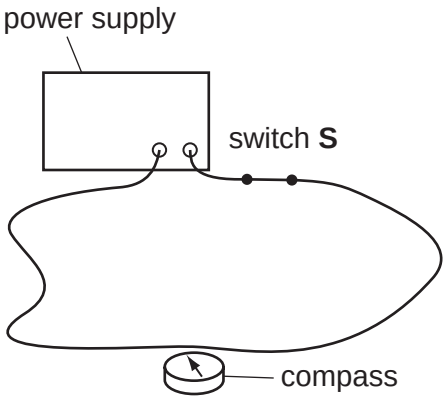


Fig. 8.1b

Switch **S** is closed and the plotting compass needle moves to the position shown in Fig. 8.1b.

(a) State the conclusion that can be made from this experiment.

.....

..... [1]

(b) A student takes a similar wire and wraps it around a cylindrical piece of soft ion. She connects it to a switch and a power supply.

She holds the soft iron above some light iron nails which are on the work bench, as shown in Fig. 8.2.

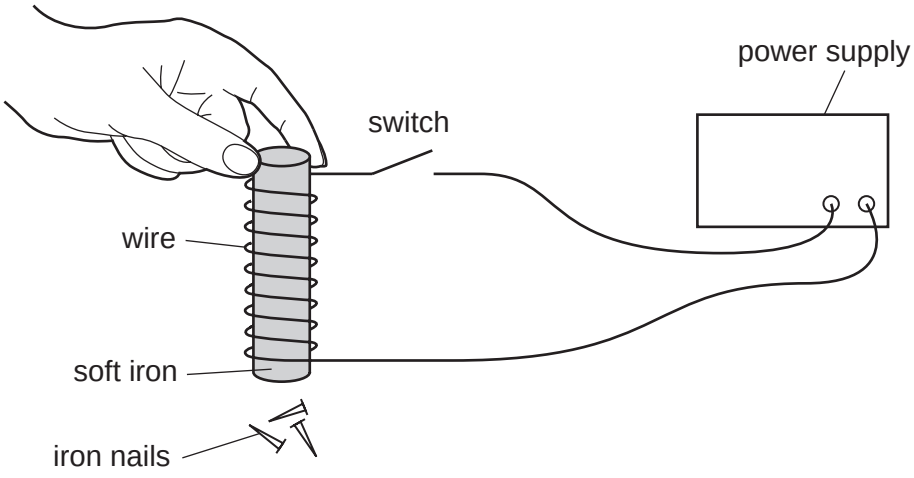


Fig. 8.2

(i) State what the student observes when the switch is closed. Give a reason for your answer.

observation .....

.....

reason .....

..... [2]

(ii) State what the student observes when the switch is opened again. Give a reason for your answer.

observation .....

.....

reason .....

..... [2]

(iii) She replaces the soft iron with a steel cylinder of the same size. Describe what she observes when she

closes the switch, ...

.....

opens the switch. .....

..... [2]

For Examiner's Use

9 **(a)** The treatment of water to make it safe for domestic use involves two main steps.

Name these steps.

step 1 .....

step 2 ..... [2]

(b) Anhydrous copper(II) sulfate can be used to test for the presence of water.

Describe the change that shows water is present.

.....

..... [1]

(c) Describe how you could show that a liquid is pure water.

.....

.....

..... [2]

Please turn over for Question 10.

10 Fig. 10.1 shows a circuit diagram with a battery of e.m.f. 6.0 V, an ammeter, and two resistors of 4.0 Ω and 8.0 Ω.

For Examiner's Use

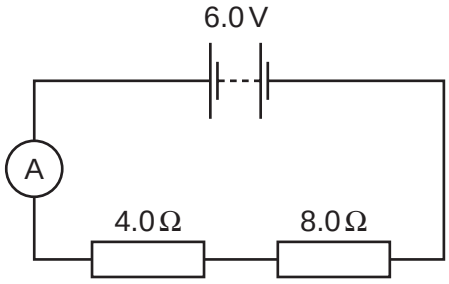


Fig. 10.1

(a) (i) Calculate the resistance in the circuit.

resistance = ... Ω [1]

(ii) Calculate the current in the circuit and give the unit.

current = ... unit ..... [2]

(b) A teacher wants to show his students the potential difference across the 4.0 Ω resistor.

(i) Name the instrument that he should use.

..... [1]

(ii) On Fig. 10.1, show how the instrument should be connected. [1]

(iii) Calculate the potential difference across the 4.0 Ω resistor and give the unit.

potential difference = ... unit ..... [2]

(c) The teacher rearranges the resistors so that they are in parallel.

(i) Complete Fig. 10.2 to show this circuit. [1]

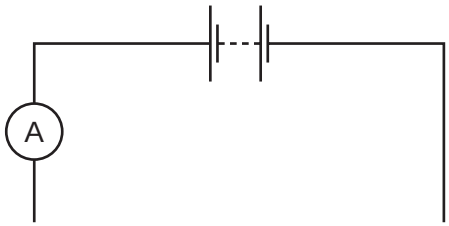


Fig. 10.2

(ii) State how the current from the battery in Fig. 10.2 compares with the current from the battery in Fig. 10.1.

Explain your answer.

.....

.....

.....

..... [2]

For Examiner's Use

11 Organic compounds are often arranged in homologous series.

(a) Give **two** characteristics of an homologous series.

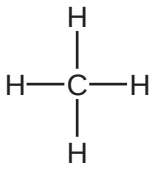
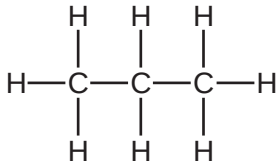
1 .....

2 ..... [2]

(b) The alkanes are an homologous series.

Complete Table 11.1.

Table 11.1

alkane	molecular formula	structural formula
methane		
ethane	C_2H_6	
propane		

[3]

(c) State **one** use of methane.

.....

..... [1]

For Examiner's Use

(d) The alkenes are another homologous series.

(i) Describe the difference in bonding between alkanes and alkenes.

.....

.....

..... [2]

(ii) Describe a chemical test to show that a compound is an alkene rather than an alkane.

test .....

result ..... [2]

12 Fig. 12.1 shows some of the principal parts of a nuclear reactor used to generate electricity.

For Examiner's Use

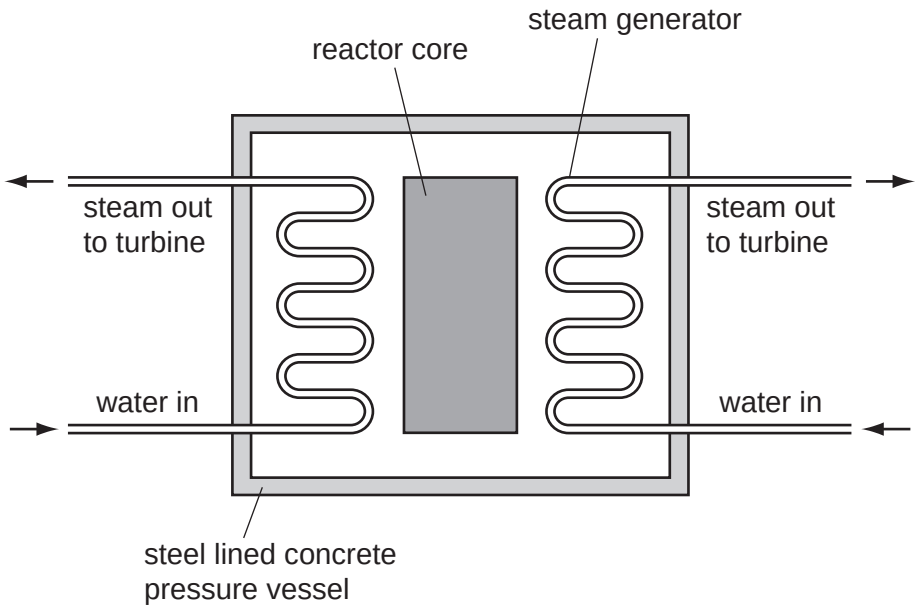


Fig. 12.1

The reactor is fuelled with uranium which undergoes nuclear fission.

(a) (i) Explain what is meant by *nuclear fission*.

.....

.....

..... [2]

(ii) During the fission process particles are released with very high speeds.

Name the form of energy that these particles have due to their motion.

..... [1]

(b) Suggest a reason why the pressure vessel is made from steel and thick concrete.

.....

..... [1]

For Examiner's Use

13 Potassium nitrate, KNO_3, and potassium phosphate, K_3PO_4, are both used as fertilizers.

(a) Calculate the relative molecular mass of potassium nitrate.
[relative atomic masses, A_r: K, 39; N, 14; O, 16]

Write your working in the box.

answer ..... [1]

(b) Show, by calculation, that potassium phosphate contains more than 50% potassium by mass.
[relative atomic masses, A_r: K, 39; O, 16; P, 31;]

Write your working in the box.

[3]

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** 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 **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.).