



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE
NAME

CENTRE
NUMBER

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CANDIDATE
NUMBER

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COMBINED SCIENCE

0653/21

Paper 2 (Core)

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	
1	
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9	
Total	

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



- 1 (a) Complete Table 1.1 by choosing one of the words from the list to match statement.

ammeter ampere electron insulator
ohm volt voltmeter watt

Table 1.1

statement	word
a particle with a negative electrical charge	
an instrument that measures electrical current	
the unit of potential difference	
a material that does not conduct electricity	

[4]

- (b) Fig. 1.1 shows two circuits, **A** and **B**. All the lamps and both cells are the same.

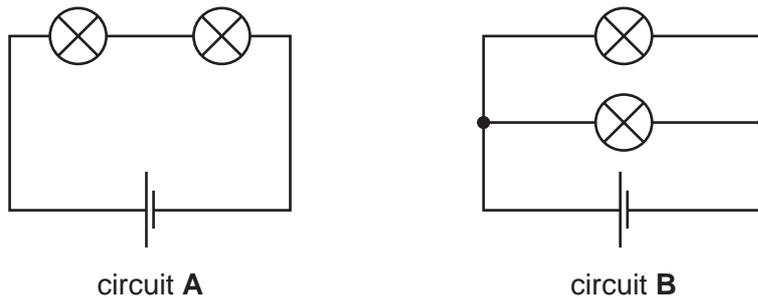


Fig. 1.1

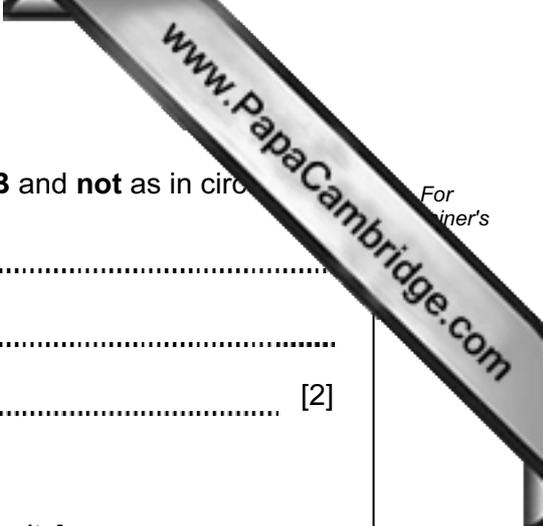
- (i) One lamp is unscrewed from circuit **A**.

State what happens to the other lamp.

Explain your answer.

.....

[2]



(ii) Explain why lights in a house are connected as in circuit **B** and **not** as in circuit **A**.

.....
.....
..... [2]

(iii) The resistance of each lamp is $1.2\ \Omega$.

Calculate the combined resistance of the two lamps in circuit **A**.

State the formula that you use and show your working.

formula used

working

..... Ω [2]

2 (a) Fig. 2.1 shows part of the carbon cycle.

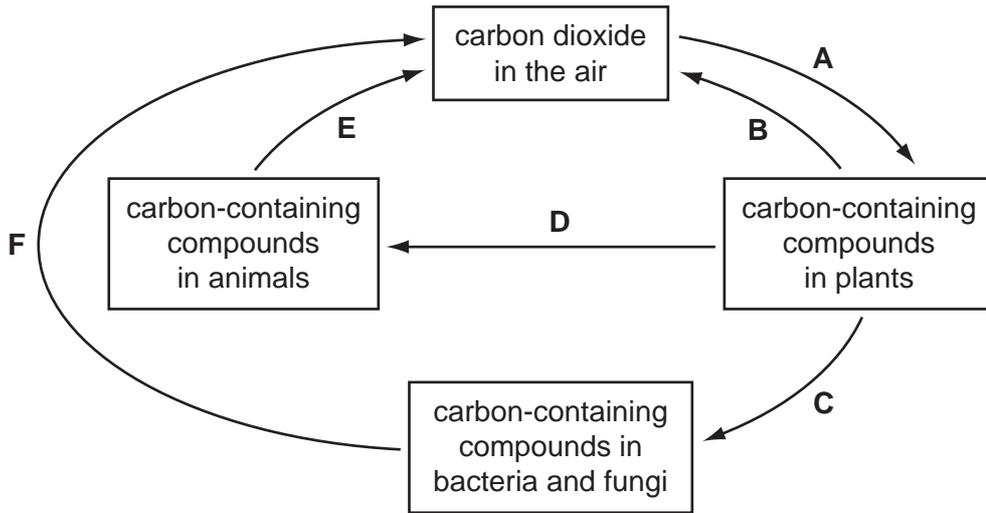


Fig. 2.1

(i) State the letter that represents photosynthesis in Fig. 2.1. [1]

(ii) State the **three** letters that represent respiration in Fig. 2.1.
 [1]

(iii) Name **one** carbon-containing compound in plants.
 [1]

(iv) State the approximate percentage of carbon dioxide in the air.
 [1]

(b) (i) Earthworms play an important part in the carbon cycle. They eat leaves, and egest material containing plant nutrients into the soil.

Explain the meaning of the term *egest*.

.....

 [2]

(ii) Underline the **two** words that describe the position of an earthworm in a food chain.

- carnivore consumer herbivore producer**

[1]

(iii) Fishermen catch large numbers of earthworms to use as bait.

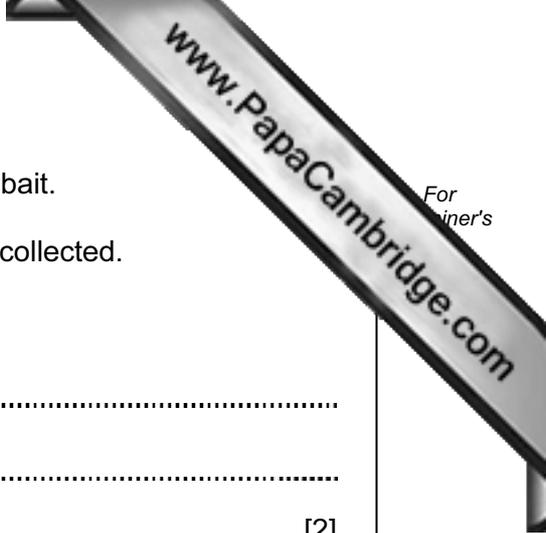
There are concerns that too many earthworms are being collected.

Suggest why it is important to conserve earthworms.

.....

.....

..... [2]



- 3 (a) Fig. 3.1 shows how a digital pH meter is used to measure the pH of some liquids.

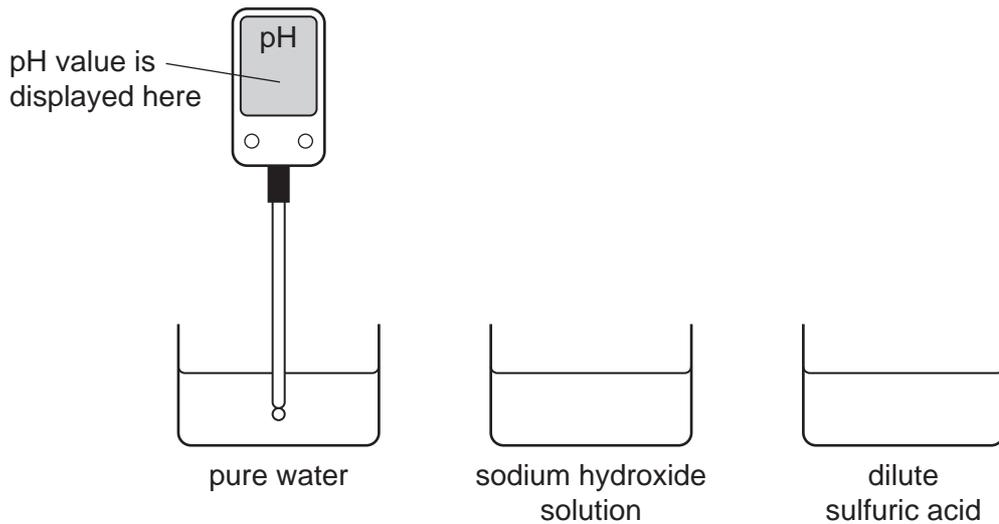


Fig. 3.1

- (i) Complete Table 3.1 by suggesting suitable pH values for the different liquids.

Table 3.1

liquid	pH
pure water	
sodium hydroxide solution	
dilute sulfuric acid	

[3]

- (ii) Suggest **one** advantage of using a digital pH meter rather than a piece of litmus paper to compare the acidity of two different acid solutions.

.....

 [1]

- (b) Describe how a student could use a solution of acidified silver nitrate to find out whether or not an unlabelled solution contains sodium chloride.

.....

 [2]

- (c) When a reactive metal is added to a dilute acid, the metal reacts and dissolves and a gas is given off.

- (i) Name **one** reactive metal that must **not** be added to a dilute acid.

Explain why this metal should not be added to acid.

metal

explanation

..... [2]

- (ii) Fig. 3.2 shows how a student tested the gas given off when magnesium was added to dilute hydrochloric acid.

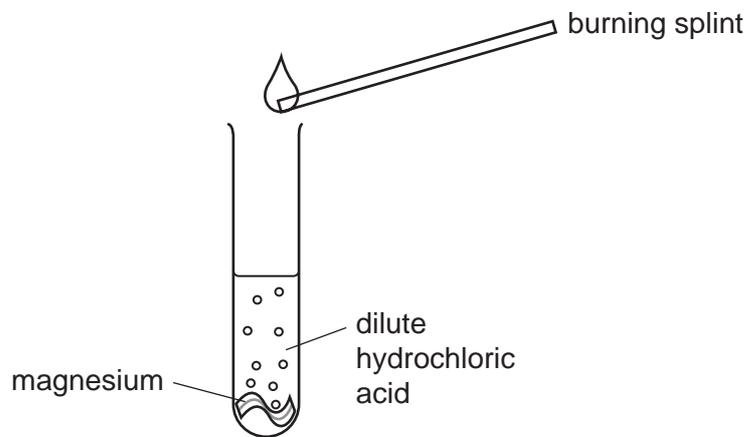


Fig. 3.2

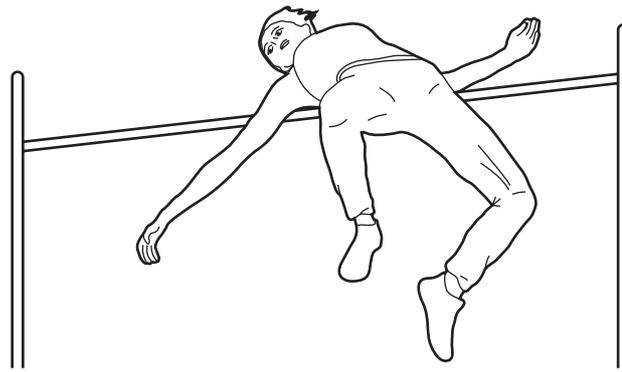
State and explain what the student observed when he carried out this test.

observation

explanation

[2]

4 An athlete competes in the high jump.



(a) Describe the energy changes that take place between the athlete taking off and landing after the high jump.

.....
.....
.....
..... [3]

(b) After jumping, the athlete is sweating.

(i) Describe, in terms of particles, how evaporation occurs from the surface of a liquid.

.....
.....
..... [2]

(ii) Explain how this process will cool down the athlete.

.....
.....
..... [1]

Please turn over for Question 5.

5 Table 5.1 shows some of the nutrients contained in 100 g of five foods.

Table 5.1

food	nutrients			
	sugar/g	starch/g	protein/g	fat/g
A	0	0	13	10
B	14	6	7	0
C	0	0	14	6
D	6	8	12	14
E	9	14	3	0

(a) (i) Which **two** nutrients listed in Table 5.1 are carbohydrates?

..... and [2]

(ii) Which nutrient listed in Table 5.1 contains nitrogen atoms in its molecules?

..... [1]

(iii) State the letters of **two** foods in Table 5.1 that could have come from animals.

..... and [1]

(iv) State the letter of **one** food that would appear orange-brown when tested with iodine solution, and give a purple colour when tested with biuret reagent.

..... [1]

(v) State the letter of the food that provides the most energy per 100g.

..... [1]

(b) Table 5.1 does **not** contain information about vitamins or minerals.

Outline the symptoms that a person may develop if their diet is deficient in

(i) vitamin D,

..... [1]

(ii) iron.

..... [1]



(c) Explain why eating a lot of foods containing sugar can increase the risk of tooth decay.

.....

.....

.....

.....

..... [3]

- 6 Some types of firework are made by filling a cardboard tube with firework mixture. The mixture is made from several solid substances which have been powdered and mixed together.

Fig. 6.1 shows a typical firework.

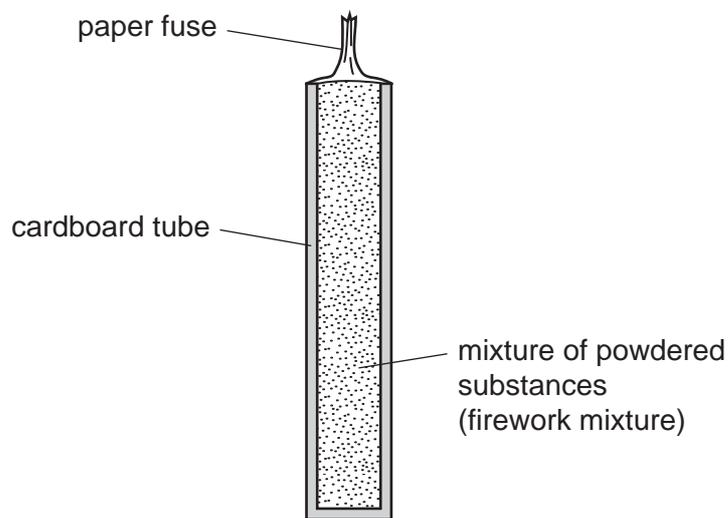


Fig. 6.1

When the paper fuse is lit, exothermic chemical reactions occur inside the firework.

- (a) (i) State **two** forms of energy that are released when the firework mixture reacts.

1

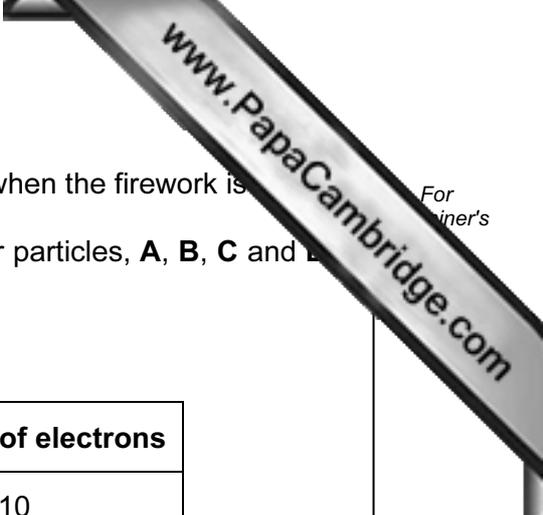
2

[2]

- (ii) State the effect on the rate of reaction of using firework mixture in the form of a powder.

.....

[1]



(b) Some firework mixtures contain aluminium which is oxidised when the firework is lit.

Table 6.1 shows the numbers of protons and electrons in four particles, **A**, **B**, **C** and **D** which are involved in the oxidation of aluminium.

Table 6.1

particle	number of protons	number of electrons
A	8	10
B	13	13
C	8	8
D	13	10

(i) Atoms of the element aluminium have the proton number 13.

State and explain which particle, **B** or **D**, in Table 6.1 is an **atom** of aluminium.

particle

explanation

..... [1]

(ii) State and explain which **two** particles in Table 6.1 could be found bonded together in aluminium oxide.

particles and

explanation

.....

..... [3]

(c) Firework mixtures contain the compound potassium perchlorate, $KClO_4$.

When potassium perchlorate is heated, a colourless gas is given off which re-lights a glowing splint.

(i) State the name of this gas. [1]

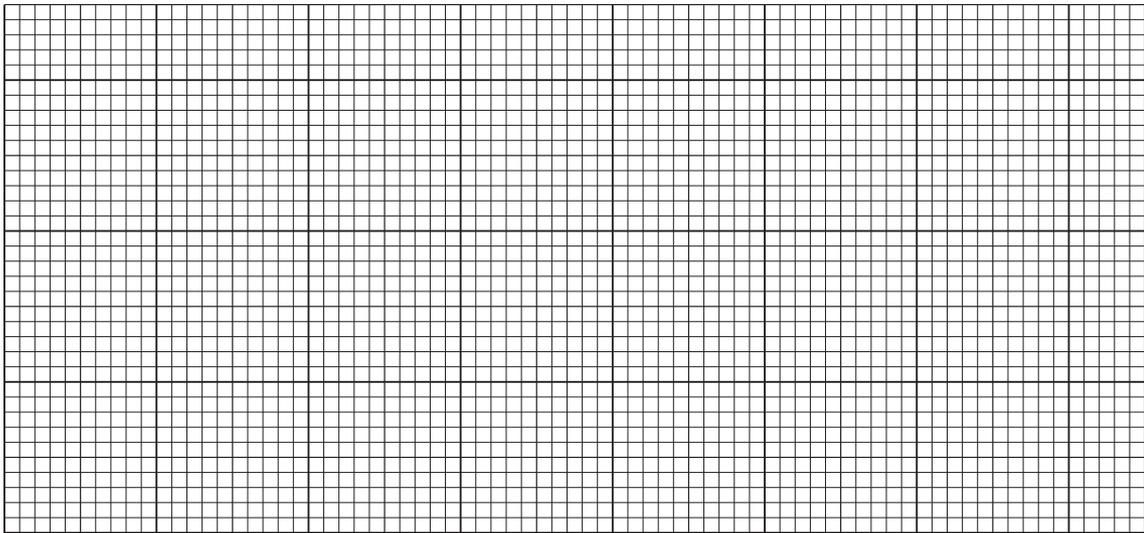
(ii) Suggest how potassium perchlorate in the firework mixture helps the mixture to burn.

.....

.....

..... [2]

- 7 (a) On the grid below, draw a wave with an amplitude of 2 cm and a wavelength of 4 cm.
On your diagram, clearly label the amplitude and the wavelength.



[3]

- (b) (i) Two sound waves, **A** and **B**, have the same frequency. **A** has a greater amplitude than **B**.

What difference would you hear?

..... [1]

- (ii) Two sound waves, **X** and **Y**, have the same amplitude. **X** has a greater frequency than **Y**.

What difference would you hear?

..... [1]

- (c) Energy travels to the Earth from the Sun.

State whether this transfer of energy is by conduction, convection or radiation.

Explain your answer.

.....

.....

..... [2]

8 Fig. 8.1 shows the male reproductive system.

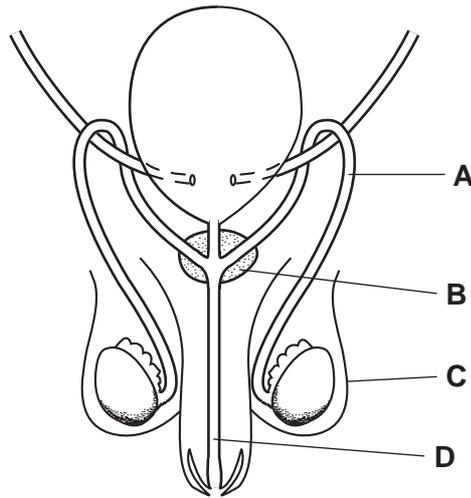


Fig. 8.1

(a) (i) Name parts C and D.

C

D

[2]

(ii) State the functions of parts A and B.

A

B

[2]

(iii) On Fig. 8.1, use a label line and the letter S to indicate where male gametes are made. [1]

(b) The human immunodeficiency virus (HIV) can be transmitted during sexual intercourse.

Outline **two** other ways in which HIV can be transmitted.

1

.....

2

.....

[2]

9 Chlorine is released when hydrochloric acid reacts with the compound, manganese dioxide.

(a) (i) Explain why chlorine is an example of an *element* and **not** a *compound*.

.....

.....

.....

..... [2]

(ii) Describe a safe test for chlorine gas.

.....

..... [2]

(b) Chlorine is produced in the chemical industry by electrolysis.

A simplified diagram of the apparatus used to produce chlorine is shown in Fig. 9.1.

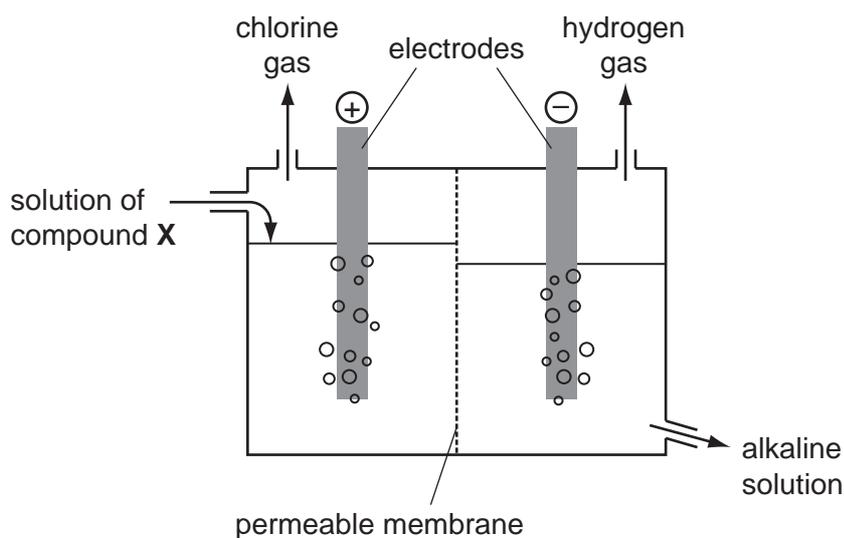


Fig. 9.1

(i) State the meaning of the term *anode*.

.....

..... [1]

- (ii) A student knows that compound **X** in Fig. 9.1 is either sodium hydroxide, NaOH, or sodium chloride, NaCl.

Using information from Fig. 9.1, deduce whether compound **X** is sodium hydroxide or sodium chloride.

Explain your answer.

X is

explanation

..... [1]

- (c) Chlorine is found in Group 7 of the Periodic Table. Two of the other elements in Group 7 are bromine and iodine.

- (i) Chlorine is a gas at room temperature.

What are the physical states of bromine and iodine at room temperature?

bromine

iodine [2]

- (ii) Explain briefly why a solution of sodium bromide turns orange when chlorine is bubbled through it.

.....

..... [2]

DATA SHEET
The Periodic Table of the Elements

		Group																						
	I	II	III	IV	V	VI	VII	0																
	1 H Hydrogen 1																							
7 Li Lithium 3	9 Be Beryllium 4																							
23 Na Sodium 11	24 Mg Magnesium 12																							
39 K Potassium 19	40 Ca Calcium 20	51 V Vanadium 23	48 Ti Titanium 22	45 Sc Scandium 21	59 Co Cobalt 27	56 Fe Iron 26	55 Mn Manganese 25	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	93 Nb Niobium 41	91 Zr Zirconium 40	89 Y Yttrium 39	101 Ru Ruthenium 44	101 Ru Ruthenium 44	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	181 Ta Tantalum 73	178 Hf Hafnium 72	139 La Lanthanum 57	190 Os Osmium 76	190 Os Osmium 76	195 Pt Platinum 78	197 Au Gold 79	201 Hg Mercury 80	204 Tl Thallium 81	207 Pb Lead 82	209 Bi Bismuth 83	210 Po Polonium 84	210 At Astatine 85	210 Rn Radon 86									
226 Ra Radium 88	227 Ac Actinium 89																							
*58-71 Lanthanoid series											140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60	150 Sm Samarium 62	152 Eu Europium 63	157 Gd Gadolinium 64	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	238 Pa Protactinium 91	238 U Uranium 92	238 Np Neptunium 93	238 Pu Plutonium 94	238 Am Americium 95	238 Cm Curium 96	238 Bk Berkelium 97	238 Cf Californium 98	238 Es Einsteinium 99	238 Fm Fermium 100	238 Md Mendelevium 101	238 No Nobelium 102	238 Lr Lawrencium 103

a = relative atomic mass

X = atomic symbol

b = proton (atomic) number

Key

a	X
b	

The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).