



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE
NAME

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COMBINED SCIENCE

0653/02

Paper 2 (Core)

October/November 2007

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	
2	
3	
4	
5	
6	
7	
8	
9	
Total	

This document consists of **19** printed pages and **1** blank page.



1 Fig. 1.1 shows a plant, and also a cell from part of the plant.

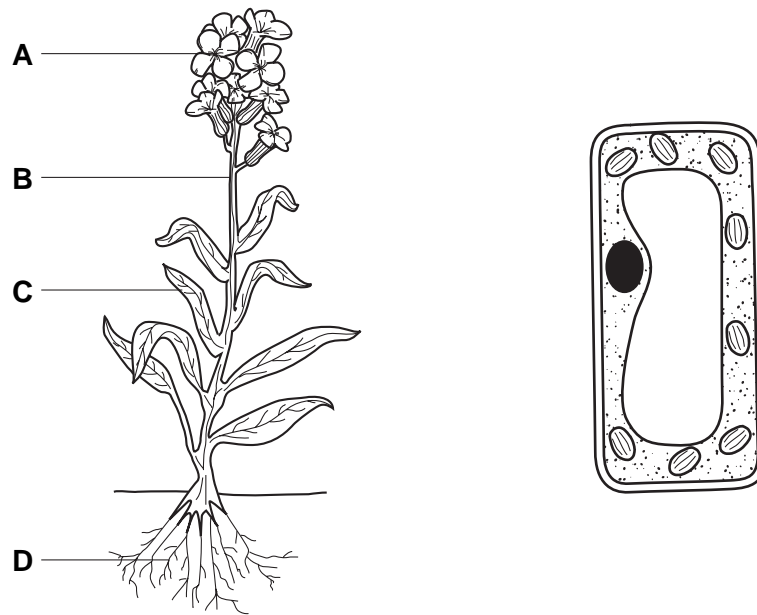


Fig. 1.1

(a) From which part of the plant, **A**, **B**, **C** or **D**, does the cell come?

.....

[1]

(b) On the diagram of **the cell** in Fig. 1.1, label the following structures.

Use label lines and the appropriate letters.

P a partially permeable membrane

Q the part of the cell that contains DNA

R a structure where energy from sunlight is absorbed

[3]

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(c) Describe how you would test a leaf from the plant for starch.

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

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(d) Complete these sentences about part **A** of the plant shown in Fig. 1.1. Use some of these words.

anthers asexual ovules petals sepals sexual stigma

Flowers are responsible forreproduction.

Themake pollen, which contains the male gametes.

The female gametes are found inside the [3]

2 Fig. 2.1 shows the inside of a refrigerator.

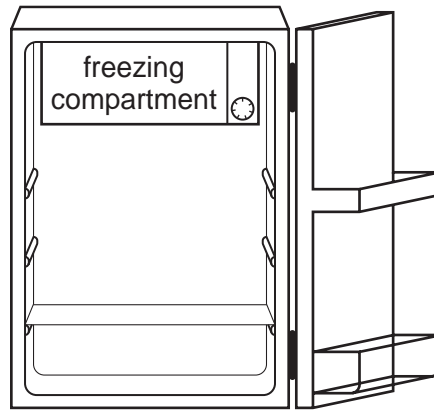


Fig. 2.1

(a) (i) Draw arrows on Fig. 2.1 to show what happens to the air cooled by the freezing compartment. [1]

(ii) Name this method of heat transfer.

..... [1]

(iii) Use the idea of density to explain why this happens.

.....

 [2]

(b) The refrigerator has a lamp inside. The supply voltage is 240 V and the current passing through the lamp when lit is 0.04 A.

Calculate the resistance of the lamp.

State the formula that you use and show your working.

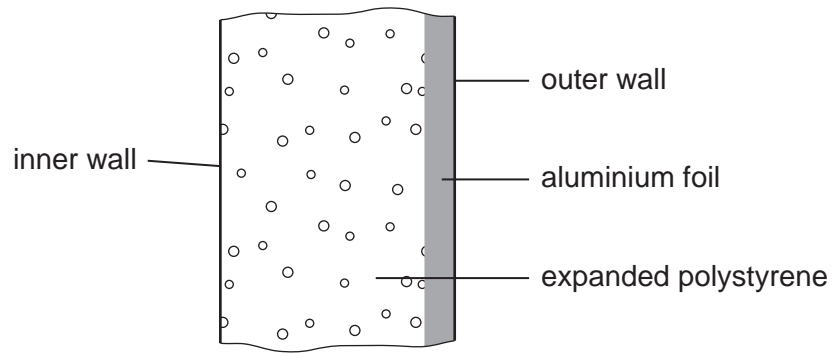
formula used

working

..... Ω [2]

(c) The refrigerator walls are insulated using both expanded polystyrene and aluminium foil.

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Explain how the structure of the refrigerator wall will help to maintain a lower temperature inside the refrigerator.

.....

.....

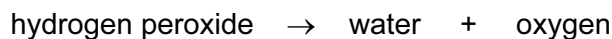
.....

.....

..... [3]

3 Hydrogen peroxide, H_2O_2 , is a colourless liquid.

Hydrogen peroxide slowly decomposes into simpler substances. The equation for the decomposition reaction is shown below.



(a) How many atoms are there in one molecule of hydrogen peroxide?

..... [1]

(b) (i) The decomposition of hydrogen peroxide is usually carried out in the presence of a catalyst.

State the purpose of adding a catalyst to a reaction mixture.

..... [1]

(ii) The solid compound manganese dioxide, MnO_2 , is used as a catalyst in the reaction above. Manganese is a metal in the fourth period of the Periodic Table.

What name is given to the family of metals which contains manganese?

..... [1]

- (c) (i) Hydrogen peroxide contains two non-metallic elements bonded together.

Name the type of chemical bonding in hydrogen peroxide molecules.

..... [1]

- (ii) Oxygen molecules, O₂, are made of two oxygen atoms joined by a **double** bond.

Suggest the displayed formula of an oxygen molecule.

[1]

- (iii) The symbolic equation for the decomposition of hydrogen peroxide is shown below. The equation is not balanced.

Balance the equation.



[1]

4 Fig. 4.1 shows part of the carbon cycle.

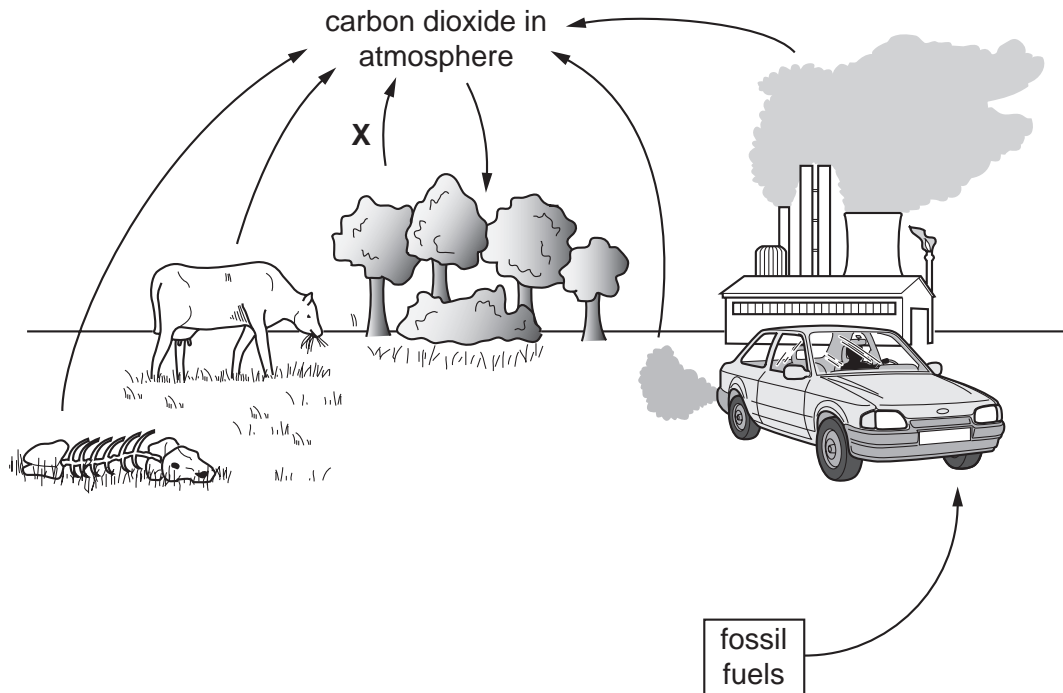


Fig. 4.1

(a) Name the process labelled **X** on Fig. 4.1.

.....

[1]

(b) Explain how carbon dioxide is returned to the air from the bodies of dead organisms.

.....

[2]

(c) Describe how fossil fuels are formed.

.....

[2]

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(d) Fig. 4.2 shows changes in the concentration of carbon dioxide in the atmosphere in the last 160 000 years.

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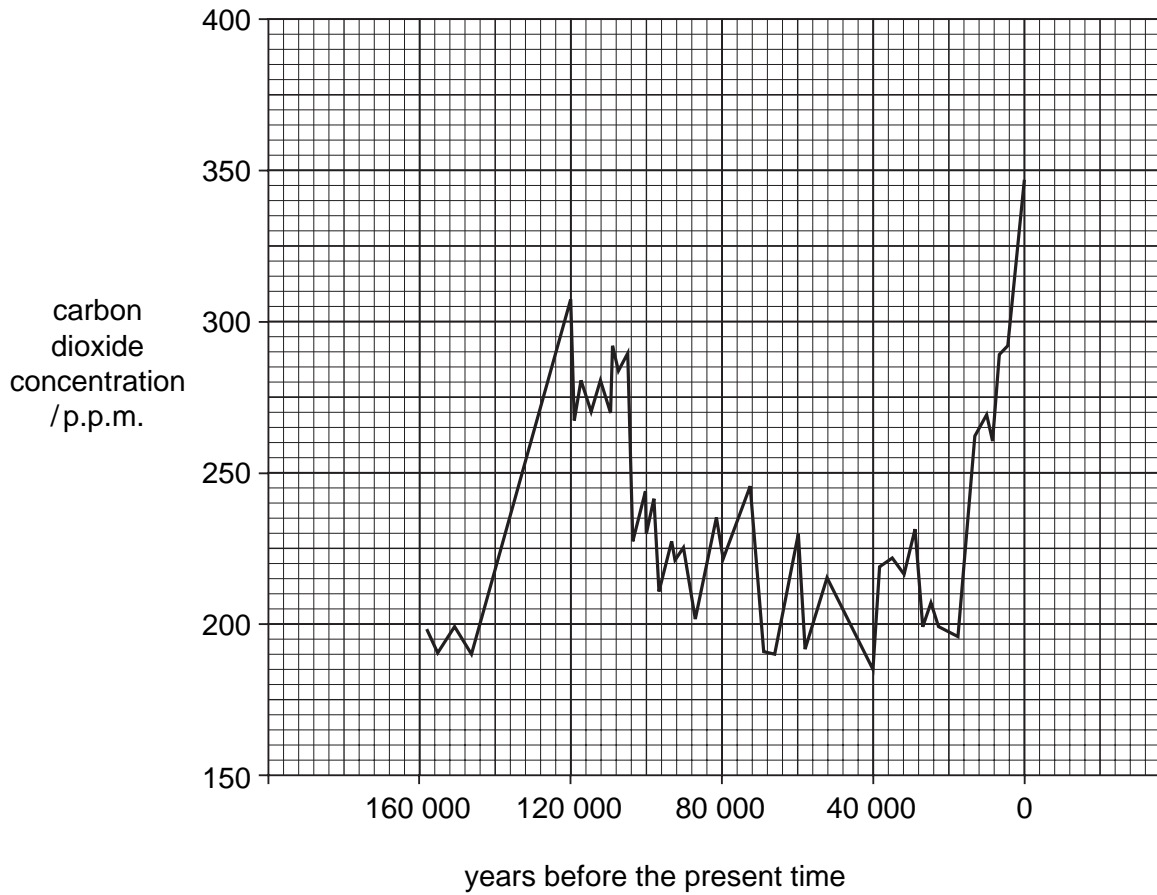


Fig. 4.2

(i) Suggest **one** human activity that is causing the current increase in carbon dioxide concentration in the atmosphere.

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

(ii) Explain how the information in Fig. 4.2 suggests that human activities are not entirely to blame for increases in the concentration of carbon dioxide in the atmosphere.

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

(iii) Explain why many people are worried about this increase in carbon dioxide concentration.

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

5 A space rocket is launched to the Moon.

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(a) After launch, the empty fuel tanks are released and fall back to Earth. As a tank falls, two forces act on it as shown in Fig. 5.1.

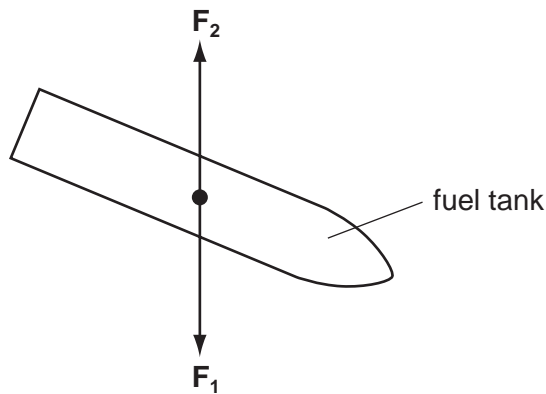


Fig. 5.1

(i) Name forces F_1 and F_2 .

F_1

F_2

[2]

(ii) As it falls, the tank accelerates. What does this tell you about the two forces?

.....

[1]

(b) The rocket travels 400 000 km to the Moon in 80 hours.

Calculate the average speed of the rocket.

State the formula that you use and show your working.

formula used

working

..... km/h [2]

(c) One of the astronauts on the rocket has a mass of 90 kg. The gravitational field strength of the Moon is about one-sixth that of the Earth.

State the differences, if any, between

(i) the mass of the astronaut on the Earth and on the Moon,

..... [1]

(ii) the weight of the astronaut on the Earth and on the Moon.

..... [1]

(d) There is no atmosphere and there are no fossil fuel deposits on the Moon. To provide the energy needed to use his equipment on the Moon, the astronaut needs to use renewable energy resources.

Suggest **one** renewable energy resource which is naturally available on the Moon.

..... [1]

- 6 The apparatus in Fig. 6.1 can be used to study the reaction between potassium and oxygen.

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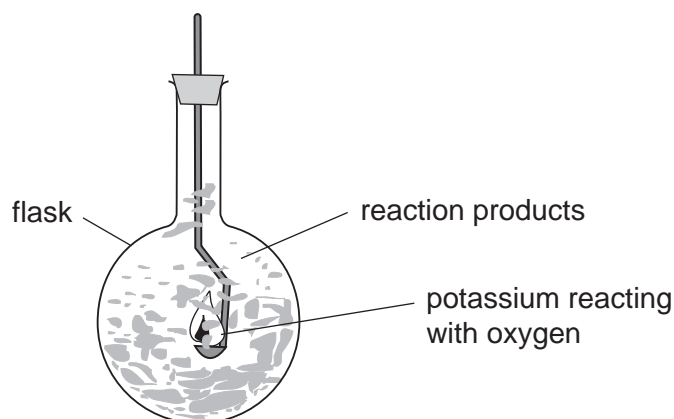


Fig. 6.1

- (a) Suggest why the flask becomes warm during the reaction.

.....
 [1]

- (b) One of the compounds formed in this reaction is potassium oxide.

The chemical formula of potassium oxide is K_2O .

- (i) Explain the meaning of this formula.

.....
 [1]

- (ii) Potassium oxide is made of positive and negative ions.

Explain, in terms of protons and electrons, the difference between a **positive** ion and a **neutral** atom.

.....

 [2]

- (c) When the reaction in Fig. 6.1 had finished, a student added water containing Universal Indicator to the flask.

Predict the colour change of the Universal Indicator.

Explain your prediction.

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

- (d) Potassium metal reacts with water to form a solution of potassium hydroxide. During the reaction a gas is given off.

- (i) Write the chemical formula of potassium hydroxide.

..... [1]

- (ii) Name the gas which is given off and describe a test for this gas.

name of gas

test

..... [3]

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7 Tuberculosis (TB) is an infectious disease caused by a bacterium. HIV/AIDS is caused by a virus.

(a) Table 7.1 shows the percentage of people with TB and HIV/AIDS in four parts of the world in 2005.

Table 7.1

part of the world	percentage of people with TB	percentage of people with HIV/AIDS
sub-Saharan Africa	0.51	7.2
Southeast Asia	0.35	1.1
Americas	0.07	0.7
Europe	0.06	0.5

(i) In which of these four parts of the world was there the largest percentage of people with TB?

..... [1]

(ii) Describe any pattern that seems to link the percentages of people with TB and with HIV/AIDS.

..... [1]

(iii) The virus that causes AIDS infects white blood cells. Explain how this could be responsible for the pattern that you have described in (ii).

..... [2]

(b) The TB bacterium usually infects cells in the lungs. Many of the cells in the alveoli are destroyed.

Explain how this can lead to a person feeling very tired and unable to carry out energetic exercise.

..... [2]

(c) (i) HIV/AIDS can be transmitted through sexual intercourse. Name two other diseases that can be transmitted in this way.

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1.

2.

[2]

(ii) How can the spread of these diseases be reduced?

.....

[1]

8 A student is having a medical examination.

(a) A dentist checks the student's teeth using a dental mirror. This is shown in Fig. 8.1.

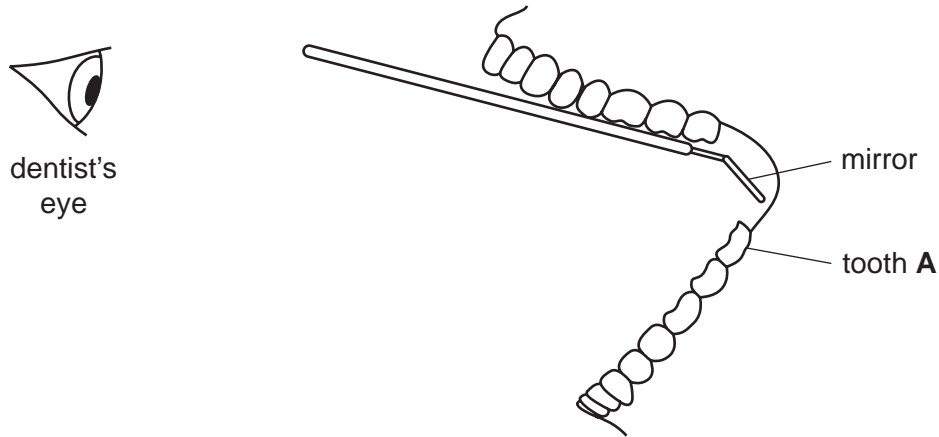


Fig. 8.1

Draw a ray of light from the back of tooth **A** to the dentist's eye to show how the dentist is able to see the back of the tooth.

On the ray, draw arrows showing the direction in which the light travels. [3]

(b) A doctor tests the student's hearing and confirms that the lowest and highest frequencies the student can hear are normal for a young person.

(i) Suggest a value for each of these.

lowest frequency Hz

highest frequency Hz

[2]

(ii) What is meant by the *frequency* of a wave?

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

(iii) Sound is one form of energy.

Name two other forms of energy.

1.

2. [1]

- (c) The doctor wants to use a small torch to look down the student's throat. When he switches the torch on, it does not work.

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Fig. 8.2 shows the circuit diagram for the torch.

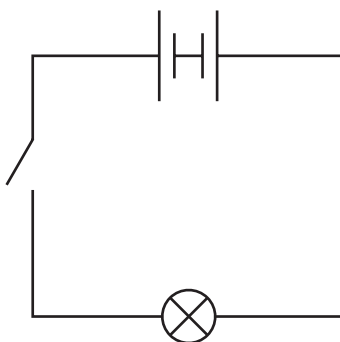


Fig. 8.2

- (i) Explain what is wrong with the torch.

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

- (ii) Draw the correct circuit diagram.

[1]

9 Aluminium, iron, sodium and chlorine are important elements produced by the chemical industry.

(a) Use the copy of the Periodic Table on page 20 to help you to answer this question.

State which of the elements above

(i) is **not** in the same period of the Periodic Table as the other three,

..... [1]

(ii) has atoms which contain 11 electrons.

..... [1]

(b) Aluminium is a metal which resists corrosion and has a relatively low density. The strength of aluminium can be improved by making it into an alloy.

Explain why aluminium alloys are important materials for use in aircraft construction.

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

(c) Iron is produced when iron oxide reacts with carbon monoxide in a blast furnace. Most iron is converted into steel.

(i) The equation for the reaction between iron oxide and carbon monoxide is shown below.



Explain which substance has been **reduced** in this reaction.

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

(ii) State two advantages of steel compared to iron from a blast furnace.

- 1.
- 2. [2]

(d) The chemical symbol for chlorine is Cl.

Write the chemical formula of a chlorine molecule. [1]

DATA SHEET
The Periodic Table of the Elements

		Group																																			
		I	II	III	IV	V	VI	VII	VIII	IX	X																										
		1 H Hydrogen 1																																			
		4 He Helium 2																																			
7	9	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20																		
Li Lithium	Be Beryllium	B Boron	C Carbon	N Nitrogen	O Oxygen	F Fluorine	Ne Neon	Na Sodium	Mg Magnesium	Al Aluminium	Si Silicon	P Phosphorus	S Sulphur	Cl Chlorine	Ar Argon	K Potassium	Ca Calcium	Sc Scandium	Ti Titanium	V Vanadium	Cr Chromium	Mn Manganese	Fe Iron	Co Cobalt	Ni Nickel	Cu Copper	Zn Zinc	Ga Gallium	Ge Germanium	As Arsenic	Se Selenium	Br Bromine	Kr Krypton				
85	88	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	
Rb Rubidium	Sr Strontium	Y Yttrium	Zr Zirconium	Nb Niobium	Mo Molybdenum	Tc Technetium	Ru Ruthenium	Rh Rhodium	Pd Palladium	Ag Silver	Cd Cadmium	In Indium	Sn Tin	Sb Antimony	Te Tellurium	I Iodine	Xe Xenon	Cs Caesium	Ba Barium	La Lanthanum	Ce Cerium	Pr Praseodymium	Nd Neodymium	Pm Promethium	Sm Samarium	Eu Europium	Gd Gadolinium	Tb Terbium	Dy Dysprosium	Ho Holmium	Er Erbium	Tm Thulium	Yb Ytterbium	Lu Lutetium			
133	137	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	
Fr Francium	Ra Radium	Ac Actinium	Th Thorium	Pa Protactinium	U Uranium	Np Neptunium	Pu Plutonium	Am Americium	Cm Curium	Bk Berkelium	Cf Californium	Es Einsteinium	Fm Fermium	Md Mendelevium	No Nobelium	Lr Lawrencium																					
226	227	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122
Fr Francium	Ra Radium	Ac Actinium	Th Thorium	Pa Protactinium	U Uranium	Np Neptunium	Pu Plutonium	Am Americium	Cm Curium	Bk Berkelium	Cf Californium	Es Einsteinium	Fm Fermium	Md Mendelevium	No Nobelium	Lr Lawrencium																					

*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 dm³ at room temperature and pressure (r.t.p.).

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