

Centre Number	Candidate Number	Name
---------------	------------------	------

CAMBRIDGE INTERNATIONAL EXAMINATIONS  
International General Certificate of Secondary Education

**CHEMISTRY**

**0620/02**

Paper 2

October/November 2003

**1 hour**

Candidates answer on the Question Paper.  
No Additional Materials required

**READ THESE INSTRUCTIONS FIRST**

Write your name, centre number and candidate number in the spaces at the top of this page.  
Write in dark blue or black pen in the spaces provided on the Question Paper.  
You may use a pencil for any diagrams, graphs, or rough working.  
Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **all** questions.  
The number of marks is given in brackets [ ] at the end of each question or part question.  
A copy of the Periodic Table is provided on page 20.

For Examiner's Use	
1	
2	
3	
4	
5	
6	
<b>TOTAL</b>	

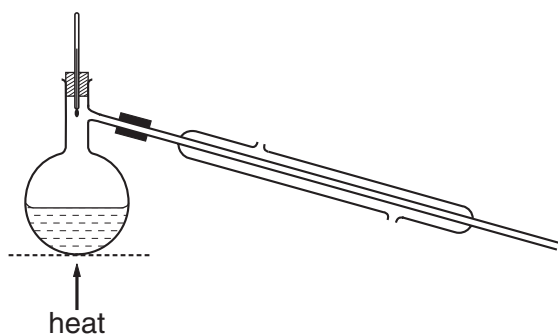
If you have been given a label, look at the details. If any details are incorrect or missing, please fill in your correct details in the space given at the top of this page.

Stick your personal label here, if provided.

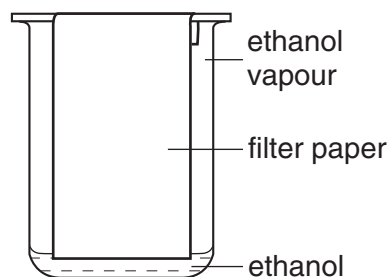
This document consists of **17** printed pages and **3** blank pages.



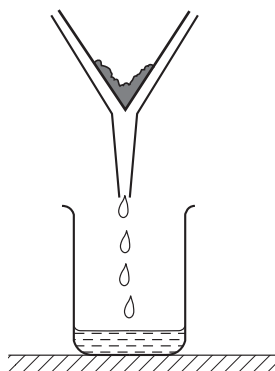
1 The diagrams show four methods of purifying substances.



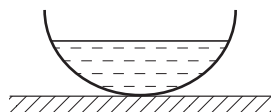
A



B



C



D

(a) Which of these methods, **A**, **B**, **C** or **D**, is best used for

(i) separating the different colours in a sample of ink?

(ii) separating two liquids with different boiling points?

(iii) separating mud from water?

(iv) making crystals of copper sulphate from copper sulphate solution?

[4]

(b) State the name given to the method of separation shown in

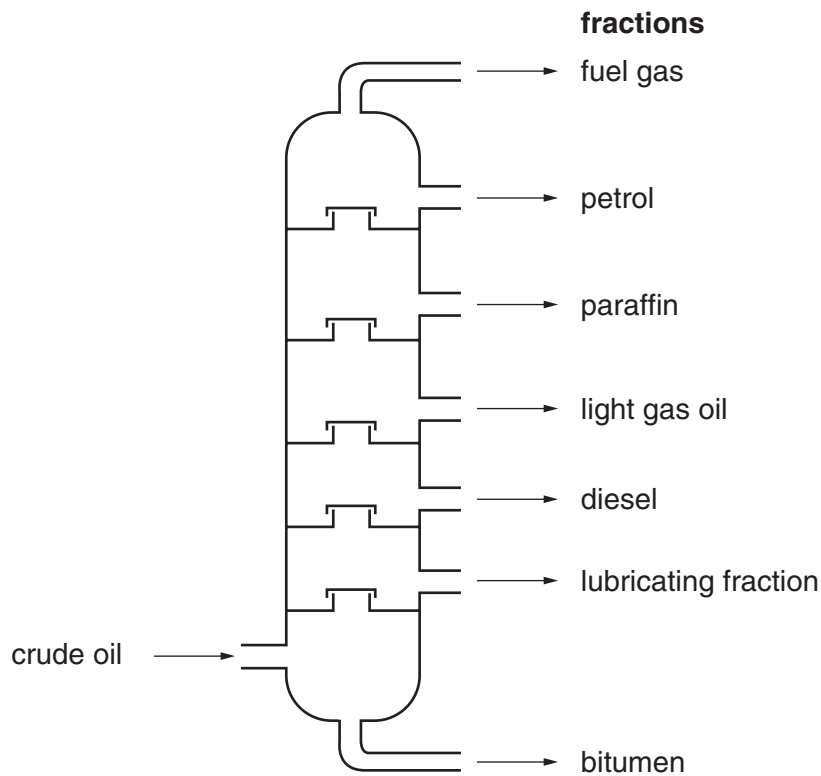
(i) diagram **A**, .....

(ii) diagram **B**.....

[2]

(c) Method A can be modified to separate petroleum into useful fractions.

The diagram below shows the different fractions obtained from a fractionating column.



(i) Which of these fractions has the lowest boiling point?

.....

(ii) State **one** use for each of the following fractions.

paraffin .....

bitumen .....

[3]

(d) Petroleum is a mixture of organic compounds.

Which **one** of the following best describes the compounds found in petroleum?

Put a ring around the correct answer.

**acids**

**alcohols**

**carbohydrates**

**hydrocarbons**

[1]

- (e) Before petroleum is fractionated, it is often heated to remove dissolved natural gas. Most of this natural gas is methane,  $\text{CH}_4$ . Draw a diagram to show how the electrons are arranged in methane.

show hydrogen electrons as

•

show carbon electrons as

×

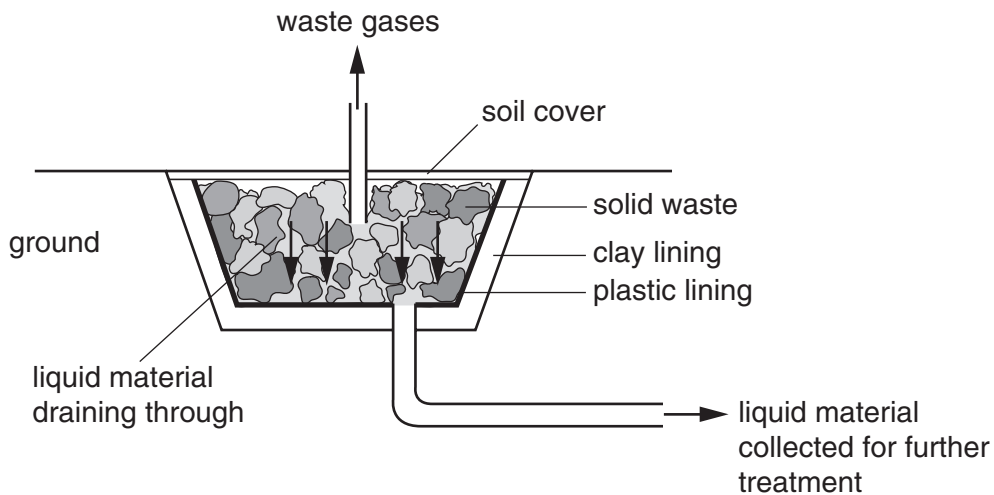
[2]

- (f) Methane, ethane and propane belong to a particular homologous series of compounds. State the name of the homologous series to which these three compounds belong.

.....

[1]

2 The diagram below shows a modern landfill site for the disposal of waste materials.



The waste materials are broken down naturally in several stages.

- (a) In the first stage, micro-organisms (mainly bacteria) break down some of the organic material in the waste to carbon dioxide.  
What is the name given to the process by which organisms use food to produce carbon dioxide?

.....[1]

- (b) In the second stage, the micro-organisms break down organic substances to produce ammonia, hydrogen and more carbon dioxide.

- (i) Describe a test for hydrogen.

test .....

result .....

- (ii) The large volumes of hydrogen produced may be hazardous.  
Explain why hydrogen may be hazardous when mixed with air.

.....

- (iii) Ammonia is a base.  
Describe a test for ammonia.

test .....

result .....

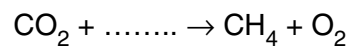
[5]

- (c) In the third stage, ethanoic acid is produced.  
Draw the structure of ethanoic acid showing all atoms and bonds.

[1]

- (d) In the fourth stage, carbon dioxide reacts with hydrogen to form methane and oxygen.

- (i) Complete the equation for this reaction.



- (ii) State one use of methane.

.....

- (iii) Methane is a gas.  
Which **two** of the following statements about gas molecules are true?  
Tick **two** boxes.

The molecules are far apart.

The molecules are not moving.

The molecules are randomly arranged.

The molecules are arranged in a regular manner.

[4]

- (e) The list below shows some of the substances which are found in the liquid which drains through the waste.

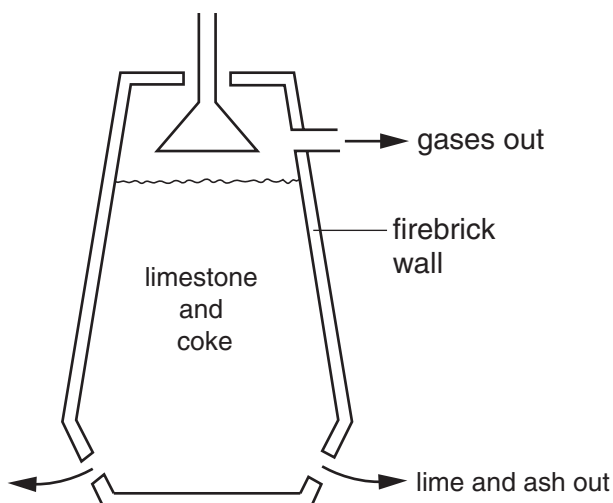
aluminium  
calcium carbonate  
iron  
lead  
magnesium  
nickel  
sodium sulphate  
zinc

From this list choose

- (i) a metal used to galvanise iron. ....
- (ii) a transition metal. ....
- (iii) a metal which is in Group IV of the periodic table. ....
- (iv) a substance which will release carbon dioxide when an acid is added.  
.....
- (v) a metal which is used to make aircraft bodies. ....

[5]

- 3 One way of making lime from limestone (calcium carbonate) is shown in the diagram.



The limestone is mixed with coke and dropped into the limekiln. The coke is burnt and releases heat.

- (a) State **one** use of limestone, other than in making lime.

.....[1]

- (b) Coke is mainly carbon.  
Write a symbol equation for the burning of carbon.

[2]

- (c) State the name of the type of reaction which releases heat energy.

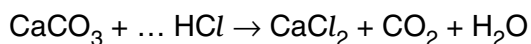
.....[1]

- (d) The heat produced by the burning coke causes thermal decomposition of the limestone. Complete the word equation for the thermal decomposition of calcium carbonate.

calcium carbonate → ..... +  
.....  
[2]



- (e) (i) Complete the following equation for the reaction of calcium carbonate with hydrochloric acid.



- (ii) Describe how you would test for the gas given off in this reaction.

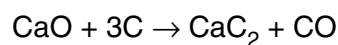
test .....

result .....

[3]

- (f) Quicklime, CaO, is a product of the thermal decomposition of calcium carbonate.

When quicklime is heated strongly with coke, calcium carbide is formed.



- (i) What type of reaction is the conversion of C to CO?  
Explain your answer.

.....

.....

- (ii) When water is added to calcium carbide, CaC<sub>2</sub>, acetylene is formed.  
State a use of acetylene.

.....

[3]

4 Bromine is an element in Group VII of the Periodic Table.

(a) State the name given to the Group VII elements.

.....[1]

(b) Bromine has two isotopes.

The nucleon (mass) number of bromine-79 is 79 and of bromine-81 is 81.

(i) What is the meaning of the term *isotopes*?

.....  
.....

(ii) Complete the table to show the numbers of electrons, neutrons and protons in one atom of bromine-79 and bromine-81. A copy of the Periodic Table is printed on page 20.

number of	bromine-79	bromine-81
electrons		
neutrons		
protons		

[5]

(c) Bromine is extracted from seawater by treatment with chlorine.

When chlorine is bubbled through a solution of potassium bromide, the solution turns orange-red.

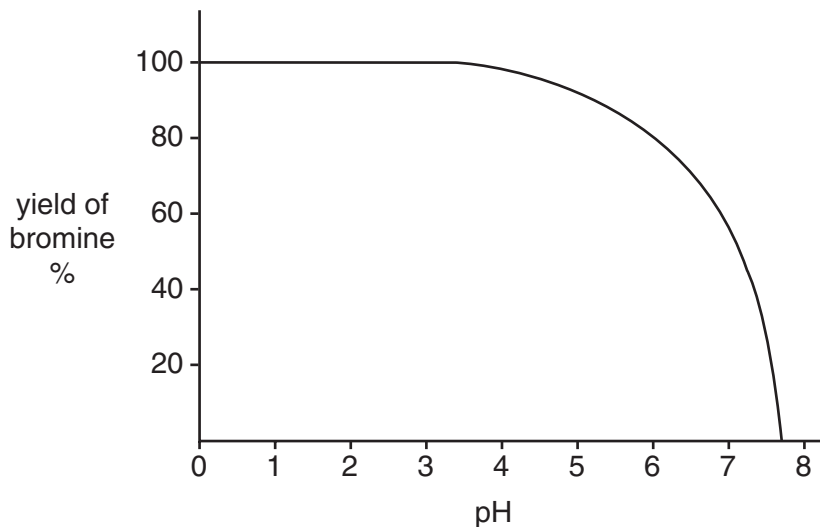
(i) What does this tell you about the reactivity of chlorine compared with bromine?

.....

(ii) Write a word equation for this reaction.

[2]

- (d) In order to get the maximum yield of bromine from seawater, acid is added during the extraction procedure.  
The graph shows how the yield of bromine changes with pH.



- (i) What is the highest pH at which the yield of bromine is 100%?

.....

- (ii) The pH scale is used to measure acidity.  
Some pH values are given below.

pH 3

pH 5

pH 7

pH 9

pH 11

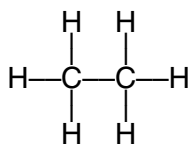
From this list of pH values choose

the pH which is most acidic. ....

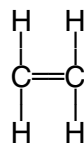
the pH of a neutral solution. ....

[3]

- (e) Bromine water can be used to distinguish between ethane and ethene.



ethane



ethene

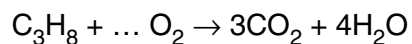
Describe what you would observe when bromine water is added to ethene.

.....

[1]

5 When fuels are burnt, carbon dioxide and water are formed.

(a) Complete the equation for the burning of propane.



[1]

(b) Describe a chemical test for water.

test .....

result .....

[2]

(c) In which **two** of the following is carbon dioxide produced.  
Tick **two** boxes.

a car driven by a petrol engine

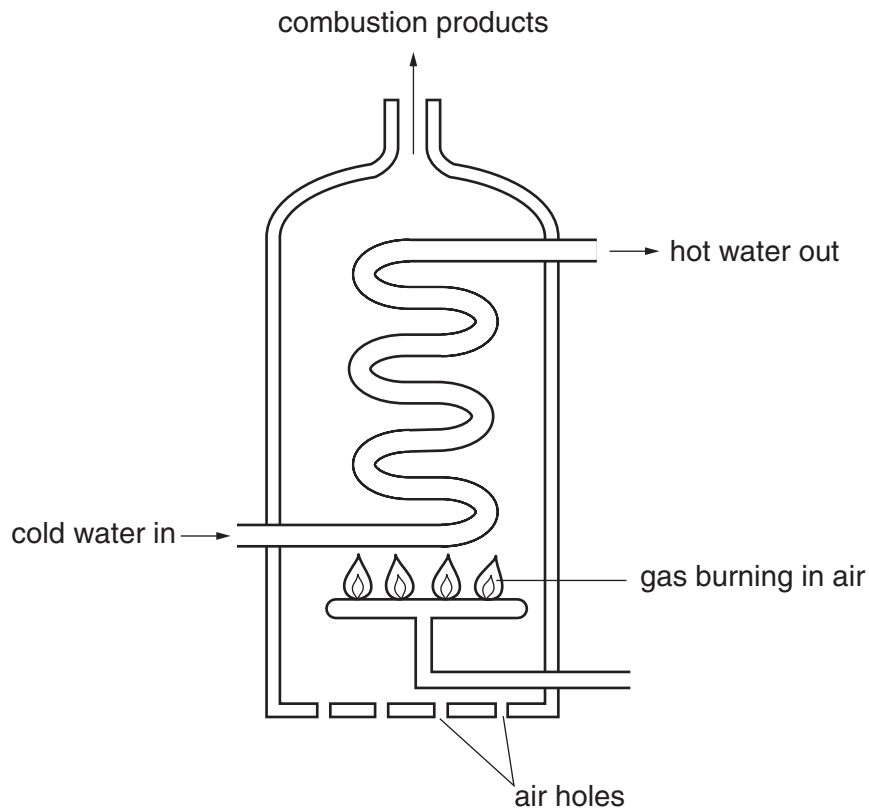
magnesium carbonate reacting with an acid

sodium reacting with water

zinc reacting with hydrochloric acid

[2]

(d) The diagram shows a water heater.



If some of the air holes become blocked, a poisonous gas is produced.

(i) State the name of this poisonous gas.

.....

(ii) Explain how this poisonous gas has been formed.

.....

.....

[2]

- (e) The table below compares the amounts of carbon dioxide and sulphur dioxide formed when 1 kilogram of different fuels are burnt.

fuel	mass of carbon dioxide produced / g	mass of sulphur dioxide produced / g
oil	2900	5.0
gas	2500	0.1
coal	2500	11.0

- (i) Which fuel is **least** polluting?

.....

- (ii) Which fuel when burnt, contributes most to the formation of acid rain?

.....

- (iii) State two harmful effects of acid rain.

.....

.....

- (iv) When acid rain falls on the ground, it can react with insoluble aluminium compounds in the soil. A solution of aluminium ions is formed.

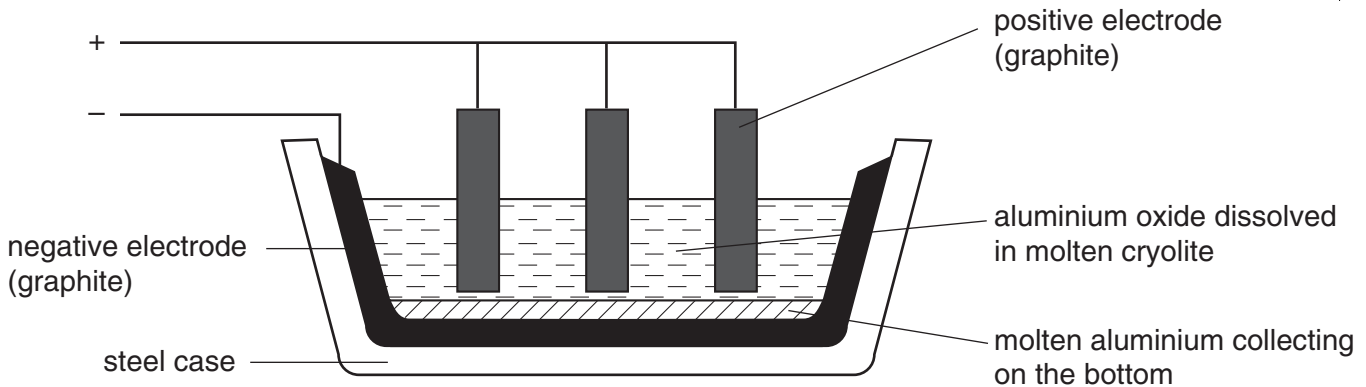
Describe what you would observe when aqueous sodium hydroxide is added to a solution containing aluminium ions.

.....

.....

[6]

- 6 Aluminium is extracted from its ore, bauxite.  
The bauxite is purified to give aluminium oxide.  
Electrolysis is then used to extract the aluminium from aluminium oxide dissolved in cryolite.



The melting point of pure aluminium oxide is 2070 °C.  
The melting point of the mixture of aluminium oxide and cryolite is about 1000 °C.

- (a) Suggest why electrolysis is used to extract aluminium from aluminium oxide rather than reduction using carbon.

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

- (b) How is the electrolyte of aluminium oxide and cryolite kept molten?

.....[1]

- (c) What property of graphite makes it suitable for use as electrodes?

.....[1]

- (d) State the name given to the negative electrode.

.....[1]

- (e) The melting point of steel is about 1500 °C.  
Suggest **two** reasons why molten aluminium oxide is not used by itself in this electrolysis.

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

- (f) During the electrolysis, hot oxygen is formed at the positive electrodes.  
Suggest why the positive electrodes have to be replaced frequently.

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

- (g) Aluminium is formed at the negative electrode.  
Complete the following equation for the reaction at the negative electrode.



[1]

- (h) Why do aluminium ions move towards the negative electrode?

.....[1]

- (i) A sample of bauxite ore had the following composition:

aluminium oxide	120g
iron(III) oxide	30g
silica	40g
titanium(IV) oxide	10g

Calculate the percentage of aluminium oxide in this sample of bauxite.

[1]

- (j) Aluminium is a metal in Group III of the Periodic Table.  
State three physical properties which are typical of most metals.

1 .....

2 .....

3 .....

[3]









**DATA SHEET**  
**The Periodic Table of the Elements**

		Group										
I	II	III	IV	V	VI	VII	0					0
		1 <b>H</b> Hydrogen 1										4 <b>He</b> Helium 2
7 <b>Li</b> Lithium 3	9 <b>Be</b> Beryllium 4											20 <b>Ne</b> Neon 10
23 <b>Na</b> Sodium 11	24 <b>Mg</b> Magnesium 12											35.5 <b>Cl</b> Chlorine 17
39 <b>K</b> Potassium 19	40 <b>Ca</b> Calcium 20	45 <b>Sc</b> Scandium 21	48 <b>Ti</b> Titanium 22	51 <b>V</b> Vanadium 23	52 <b>Cr</b> Chromium 24	55 <b>Mn</b> Manganese 25	56 <b>Fe</b> Iron 26	59 <b>Co</b> Cobalt 27	59 <b>Ni</b> Nickel 28	64 <b>Cu</b> Copper 29	65 <b>Zn</b> Zinc 30	84 <b>Kr</b> Krypton 36
85 <b>Rb</b> Rubidium 37	88 <b>Sr</b> Strontium 38	89 <b>Y</b> Yttrium 39	91 <b>Zr</b> Zirconium 40	93 <b>Nb</b> Niobium 41	96 <b>Mo</b> Molybdenum 42	101 <b>Ru</b> Ruthenium 44	106 <b>Pd</b> Palladium 46	103 <b>Rh</b> Rhodium 45	106 <b>Pd</b> Palladium 46	108 <b>Ag</b> Silver 47	112 <b>Cd</b> Cadmium 48	131 <b>Xe</b> Xenon 54
133 <b>Cs</b> Caesium 55	137 <b>Ba</b> Barium 56	139 <b>La</b> Lanthanum 57	178 <b>Hf</b> Hafnium 72	181 <b>Ta</b> Tantalum 73	184 <b>W</b> Tungsten 74	186 <b>Re</b> Rhenium 75	190 <b>Os</b> Osmium 76	192 <b>Ir</b> Iridium 77	195 <b>Pt</b> Platinum 78	197 <b>Au</b> Gold 79	201 <b>Hg</b> Mercury 80	209 <b>Po</b> Polonium 84
226 <b>Ra</b> Radium 88	227 <b>Ac</b> Actinium 89											209 <b>Po</b> Polonium 84
*58-71 Lanthanoid series												
†90-103 Actinoid series												
												167 <b>Er</b> Erbium 68
												173 <b>Yb</b> Ytterbium 70
												175 <b>Lu</b> Lutetium 71
												103 <b>Lr</b> Lawrencium 103
												101 <b>Md</b> Mendelevium 101
												102 <b>No</b> Nobelium 102
												99 <b>Es</b> Einsteinium 99
												98 <b>Cf</b> Californium 98
												97 <b>Bk</b> Berkelium 97
												96 <b>Cm</b> Curium 96
												95 <b>Am</b> Americium 95
												94 <b>Pu</b> Plutonium 94
												93 <b>Np</b> Neptunium 93
												92 <b>U</b> Uranium 92
												91 <b>Pa</b> Protactinium 91
												90 <b>Th</b> Thorium 90
												82 <b>Pb</b> Lead 82
												85 <b>At</b> Astatine 85
												86 <b>Rn</b> Radon 86
												82 <b>Pb</b> Lead 82
												83 <b>Bi</b> Bismuth 83
												84 <b>Po</b> Polonium 84
												85 <b>At</b> Astatine 85
												86 <b>Rn</b> Radon 86
												87 <b>Fr</b> Francium 87
												88 <b>Ra</b> Radium 88
												89 <b>Ac</b> Actinium 89
												90 <b>Th</b> Thorium 90
												91 <b>Pa</b> Protactinium 91
												92 <b>U</b> Uranium 92
												93 <b>Np</b> Neptunium 93
												94 <b>Pu</b> Plutonium 94
												95 <b>Am</b> Americium 95
												96 <b>Cm</b> Curium 96
												97 <b>Bk</b> Berkelium 97
												98 <b>Cf</b> Californium 98
												99 <b>Es</b> Einsteinium 99
												100 <b>Fm</b> Fermium 100
												101 <b>Md</b> Mendelevium 101
												102 <b>No</b> Nobelium 102
												103 <b>Lr</b> Lawrencium 103
												104 <b>Rf</b> Rutherfordium 104
												105 <b>Db</b> Dubnium 105
												106 <b>Sg</b> Seaborgium 106
												107 <b>Bh</b> Bohrium 107
												108 <b>Hs</b> Hassium 108
												109 <b>Mt</b> Meitnerium 109
												110 <b>Ds</b> Darmstadtium 110
												111 <b>Rg</b> Roentgenium 111
												112 <b>Cn</b> Copernicium 112
												113 <b>Nh</b> Nihonium 113
												114 <b>Fl</b> Flerovium 114
												115 <b>Mc</b> Moscovium 115
												116 <b>Lv</b> Livermorium 116
												117 <b>Ts</b> Tennessine 117
												118 <b>Og</b> Oganesson 118

**Key**

a	<b>X</b>
b	

a = relative atomic mass  
X = atomic symbol  
b = proton (atomic) number

The volume of one mole of any gas is 24 dm<sup>3</sup> at room temperature and pressure (r.t.p.).