



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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**CHEMISTRY**

**0620/22**

Paper 2

**May/June 2010**

**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 in the spaces at the top of this page.

Write in dark blue or black pen.

You may need to use a pencil for any diagrams, graphs 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 16.

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	
<b>Total</b>	

This document consists of **15** printed pages and **1** blank page.



- 1 The diagram shows part of the Periodic Table.  
Only some of the elements are shown.

Li				
Na	Mg			
K	Ca		Ti	V
			Zr	Nb

- (a) Answer the following questions by choosing only from the elements shown in the diagram.

You can use each element once, more than once or not at all.

- (i) State the names of **two** transition elements shown in the diagram.

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

- (ii) State the name of an element which is in Period 3 of the Periodic Table.

..... [1]

- (iii) Which element has the electronic structure 2,8,1?

..... [1]

- (iv) Which element has the fastest reaction with water?

..... [1]

- (v) Which element has 23 protons in its nucleus?

..... [1]

- (b) Sodium reacts with oxygen to form sodium peroxide,  $\text{Na}_2\text{O}_2$ .  
Complete the symbol equation for this reaction.



[2]

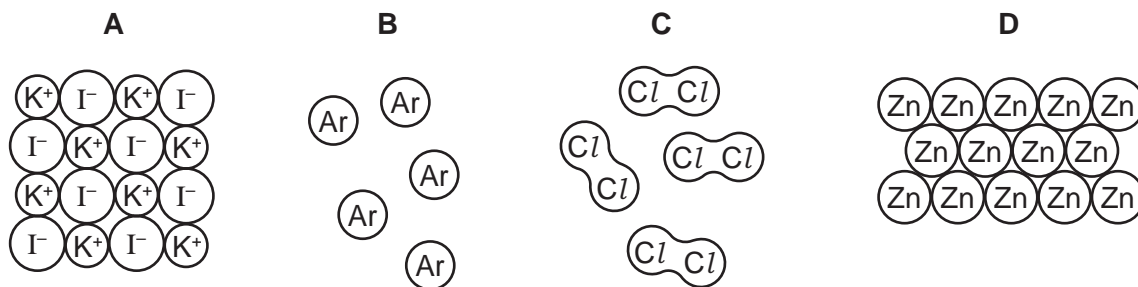
[Total: 8]

- 2 The list describes five types of chemical structures.

For  
Examiner's  
Use

giant covalent  
giant ionic  
metallic  
simple atomic  
simple molecular

- (a) The diagrams below show four types of chemical structures.



- (i) Use the list to match these structures with the diagrams.

structure **A** is ..... [1]

structure **B** is ..... [1]

structure **C** is ..... [1]

structure **D** is ..... [1]

- (ii) Which **two** of the structures **A**, **B**, **C** or **D** have low melting points?

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

- (b) Sodium chloride is an ionic solid.

Complete the following sentences using words from the list.

**electrons      ionic      molecular      molten      solid**

Sodium chloride does not conduct electricity when it is a .....

because the ions cannot move. When it is ..... sodium chloride does

conduct electricity because the ions are free to move. [2]

[Total: 7]

3 Water is an important raw material in industry.

(a) State **one** use of water in industry.

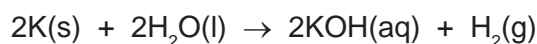
..... [1]

(b) Describe a chemical test for water.

test .....

result ..... [2]

(c) A small piece of potassium was placed in a beaker of water.  
The equation for the reaction is



(i) Describe a test for the gas given off in this reaction.

test .....

result ..... [2]

(ii) What is the most likely pH of the solution in the beaker when the reaction is complete?

Put a ring around the correct answer.

pH2

pH6

pH7

pH8

pH12

[1]

(d) Water is formed when propane burns.

(i) Complete the equation for this reaction.



[2]

(ii) Which of the following best describes this reaction?

Put a ring around the correct answer.

**carbonisation**

**combustion**

**dehydration**

**hydrogenation**

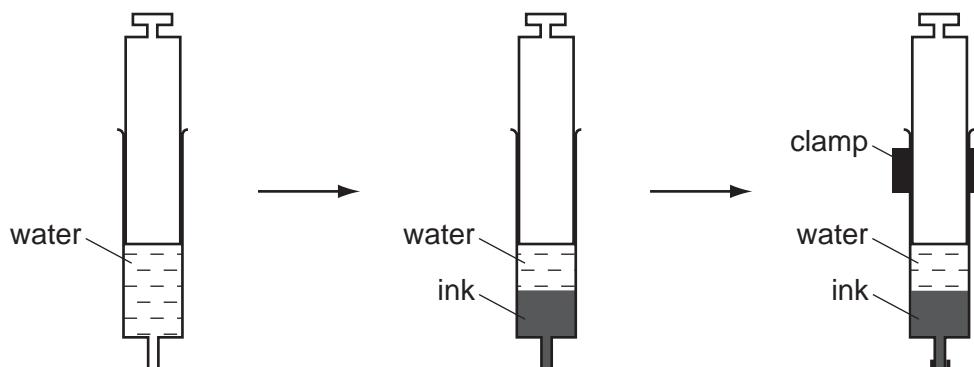
[1]

(iii) When 4.4 g of propane are burnt in excess oxygen, 7.2 g of water are formed.  
Calculate the mass of water formed when 22 g of propane are burnt.

[1]

[Total: 10]

- 4 A student half-filled a syringe with water. She then carefully drew up some blue ink into the syringe so that it formed a separate layer below the water. She then left the syringe in a clamp for twenty hours.



After twenty hours the blue colour of the ink had spread throughout the water.

- (a) Use the kinetic particle theory to explain these observations.

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

- (b) Ink is a mixture of many chemicals. What do you understand by the term *mixture*?

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

- (c) The list shows some of the substances present in ink.

**carboxylic acids**  
**cobalt(II) ions**  
**ethanol**  
**iron(II) ions**  
**nickel(II) ions**  
**tannins**  
**water**

- (i) Water is a good solvent. From the list choose **one** other substance that is a good solvent.

..... [1]

- (ii) What is the meaning of the symbol (II) in iron(II)?  
Tick **one** box.

the number of outer shell electrons

the difference between the  
neutron and proton number

the oxidation state

the type of isotope

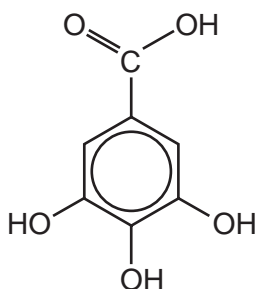
[1]

- (iii) Tannins are polymers.  
What do you understand by the term *polymer*?

.....

..... [2]

- (d) One of the carboxylic acids present in ink is gallic acid.  
The structure of gallic acid is shown below.



- (i) On the structure above, put a ring around the carboxylic acid functional group. [1]

- (ii) Gallic acid is a good reducing agent.  
What do you understand by the term *reduction*?

..... [1]

[Total: 9]

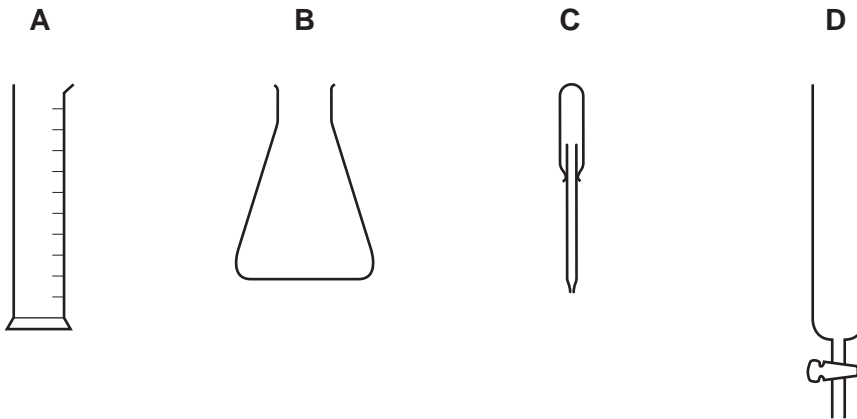
- 5 A student wants to separate the coloured pigments in a plant leaf by chromatography. He grinds the plant leaf and separates the solids from the green solution.

(a) What method can he use to separate the solids from the solution?

..... [1]

(b) The student takes a drop of the green solution and puts a spot of it onto a piece of chromatography paper.

From the diagrams below choose the letter for the most suitable piece of apparatus for this task.



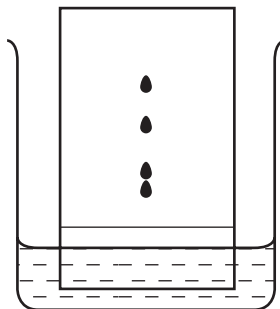
letter .....

[1]

(c) The student sets up the chromatography apparatus as shown.

(i) Label the diagram to show:

- the solvent,
- the original position of the spot of green solution,
- the chromatography paper.

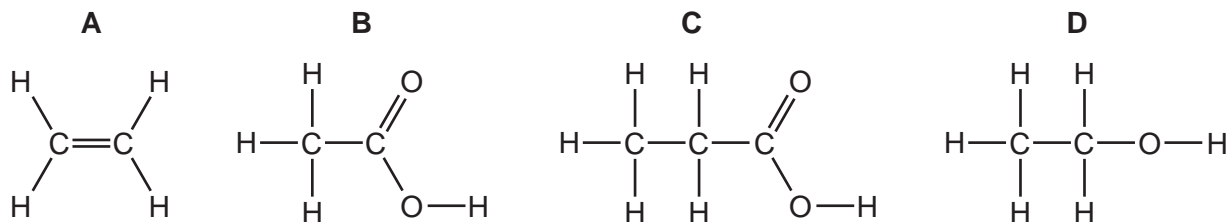


[3]

(ii) How many different pigments were present in the plant leaf?

..... [1]

(d) The structure of some organic compounds found in plant leaves are shown below.



(i) Which one of these compounds is an unsaturated hydrocarbon?

..... [1]

(ii) Describe a chemical test for an unsaturated hydrocarbon.

test .....

result ..... [2]

(iii) What do you understand by the term *hydrocarbon*?

..... [1]

(iv) State the name of compound **B**.

..... [1]

(v) To which homologous series does compound **D** belong?

..... [1]

[Total: 12]



6 Lead is a grey metal.

(a) State **two** physical properties which are characteristic of metals.

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

(b) To which Group in the Periodic Table does lead belong?

..... [1]

(c) An isotope of lead has the mass number 208.

Complete the table to show the number of subatomic particles in an atom of this isotope of lead.

Use the Periodic Table to help you.

type of particle	number of particles
electrons	
protons	
neutrons	

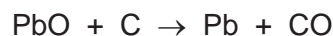
[3]

(d) When lead is heated in oxygen, lead(II) oxide is formed.

Write a word equation for this reaction.

..... [1]

(e) When lead(II) oxide is heated with carbon, lead and carbon monoxide are formed.



(i) Which substance becomes oxidised during this reaction?

..... [1]

(ii) Carbon monoxide is a covalent compound.

Which one of these statements about carbon monoxide is correct?

Tick **one** box.

It is a solid with a high melting point.

It conducts electricity when it is a liquid.

It is a gas at room temperature.

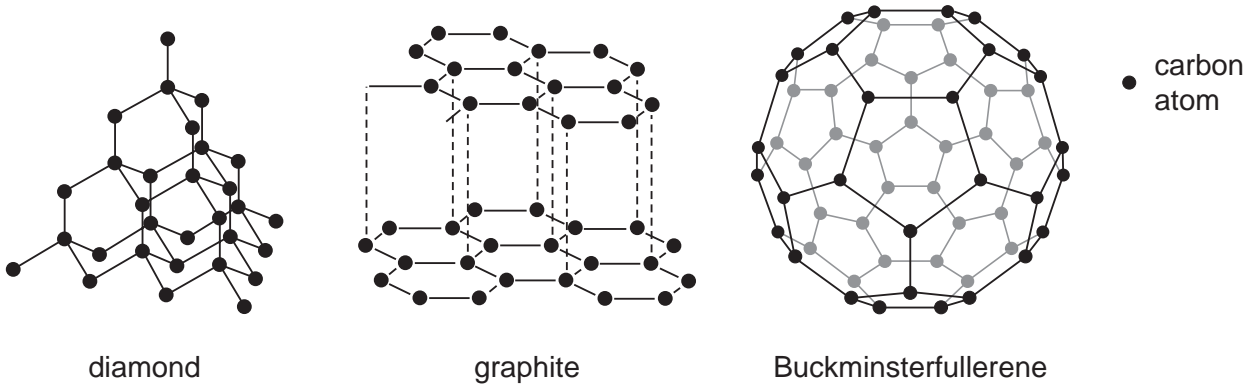
It forms about 1 % of the atmosphere.

[1]

[Total: 9]



7 Three forms of carbon are diamond, graphite and Buckminsterfullerene.



(a) (i) State **one** difference in structure between Buckminsterfullerene and diamond.

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

(ii) State **two** differences in structure between graphite and diamond.

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

(b) State the type of bonding between the carbon atoms in diamond.

..... [1]

(c) Suggest why graphite is used as a lubricant.  
 Refer to the layers in your answer.

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

(d) State **one** use for diamond.

..... [1]

- (e) Coal is a fuel containing carbon.  
When coal is burnt, carbon dioxide is produced.  
Explain how the increase in carbon dioxide concentration in the atmosphere affects the world's climate.

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

- (f) Coal also contains small amounts of sulfur.  
Explain how burning coal leads to acid rain.

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

- (g) Methane is a fuel.

- (i) Which one of the following is a natural source of methane?  
Tick **one** box.

- waste gases from respiration in plants
- waste gases from digestion in animals
- gases from photosynthesis in plants
- gases from forest fires

[1]

- (ii) Draw a diagram to show the arrangement of the electrons in a molecule of methane, CH<sub>4</sub>.

Use

- for an electron from a carbon atom
- × for an electron from a hydrogen atom

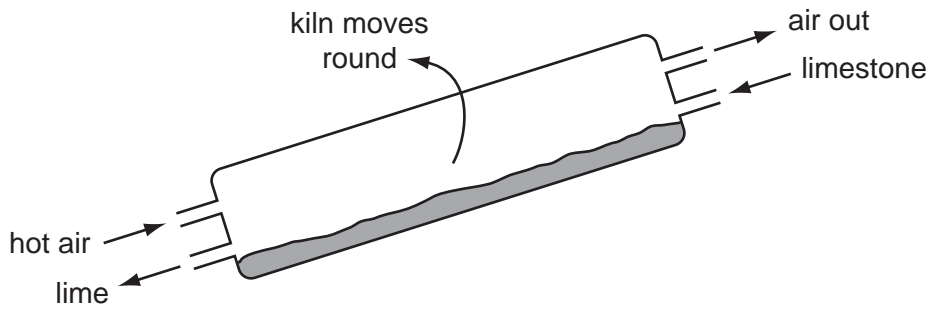
[1]

- (iii) Methane belongs to the alkane homologous series.  
Name **one** other alkane.

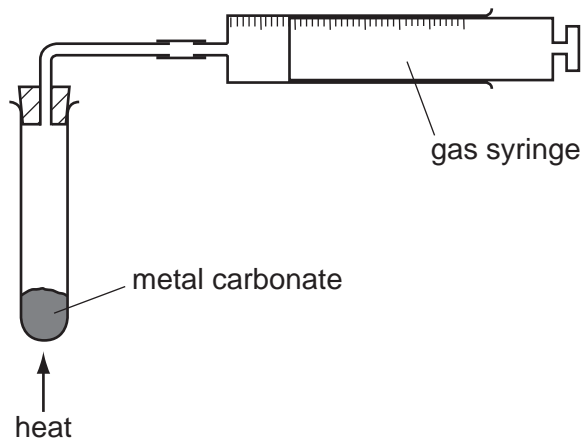
..... [1]

[Total: 13]

- 8 The diagram shows a rotary kiln used to make lime from limestone. Limestone is fed in at the top of the kiln and lime comes out at the bottom.

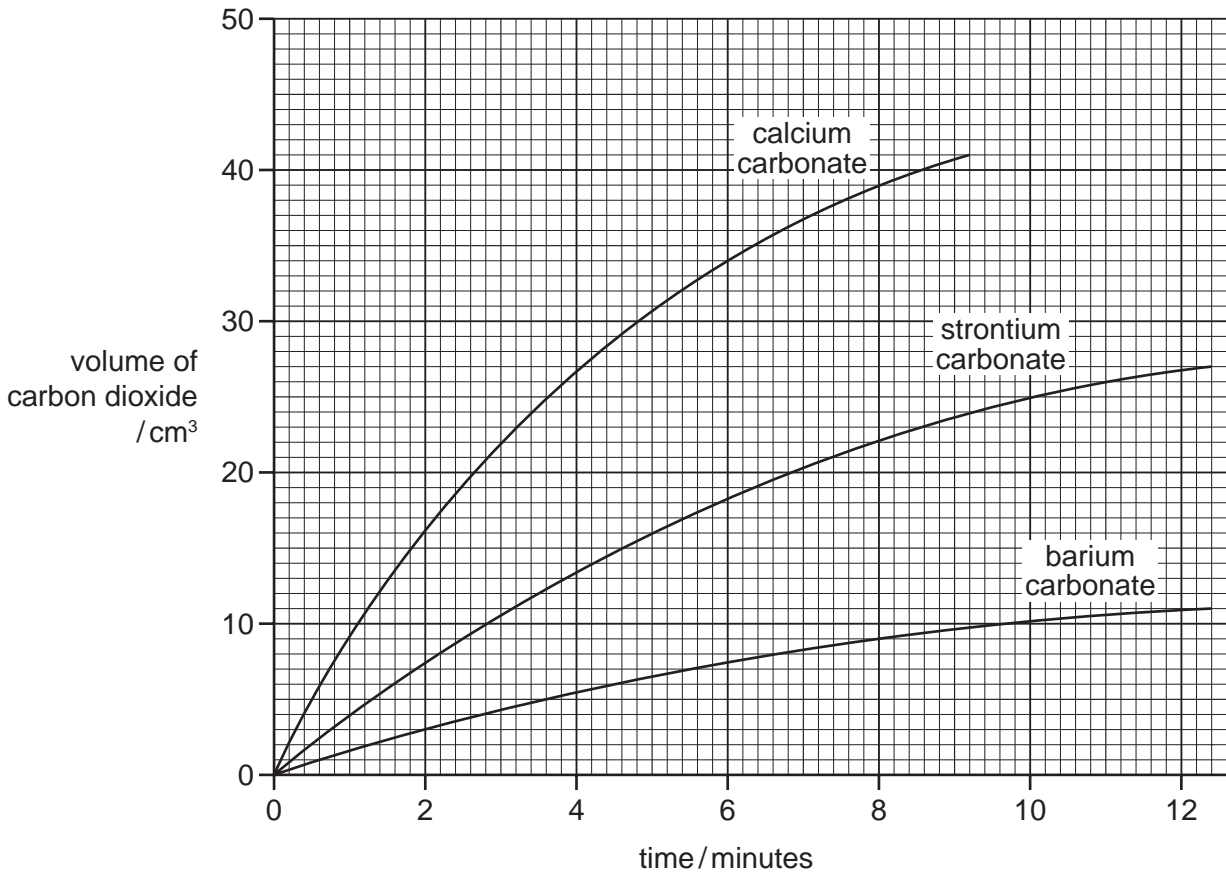


- (a) What is the chemical name for lime?  
 ..... [1]
- (b) State the name of the type of chemical reaction that takes place in the rotary lime kiln.  
 ..... [1]
- (c) Suggest why the air coming out of the rotary kiln has a greater percentage of carbon dioxide than the air entering the kiln.  
 ..... [1]
- (d) State **one** use for lime.  
 ..... [1]
- (e) A student compared the speed of reaction of three metal carbonates. She measured the volume of gas released using the apparatus shown.



State **one** thing that must be kept constant if the speeds of these reactions are to be compared in a fair way.  
 ..... [1]

(f) The graph shows the volume of carbon dioxide released when the three metal carbonates are heated.



(i) Which carbonate produced carbon dioxide the fastest?

..... [1]

(ii) What volume of carbon dioxide was produced by strontium carbonate in ten minutes?

..... [1]

(iii) How does the speed of the reaction of these three metal carbonates relate to the position of calcium, strontium and barium in the Periodic Table?

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

(g) Describe how hydrochloric acid and limewater can be used to show that carbonate ions are present in calcium carbonate.

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

[Total: 12]

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

		Group																																																																		
I	II	III	IV	V	VI	VII	0																																																													
7 <b>Li</b> Lithium 3	9 <b>Be</b> Beryllium 4	1 <b>H</b> Hydrogen 1	11 <b>B</b> Boron 5	12 <b>C</b> Carbon 6	13 <b>Al</b> Aluminium 13	14 <b>N</b> Nitrogen 7	15 <b>O</b> Oxygen 8	16 <b>F</b> Fluorine 9	17 <b>Ne</b> Neon 10	18 <b>Ar</b> Argon 18	19 <b>K</b> Potassium 19	20 <b>Ca</b> Calcium 20	21 <b>Sc</b> Scandium 21	22 <b>Ti</b> Titanium 22	23 <b>V</b> Vanadium 23	24 <b>Cr</b> Chromium 24	25 <b>Mn</b> Manganese 25	26 <b>Fe</b> Iron 26	27 <b>Co</b> Cobalt 27	28 <b>Ni</b> Nickel 28	29 <b>Cu</b> Copper 29	30 <b>Zn</b> Zinc 30	31 <b>Ga</b> Gallium 31	32 <b>Ge</b> Germanium 32	33 <b>As</b> Arsenic 33	34 <b>Se</b> Selenium 34	35 <b>Br</b> Bromine 35	36 <b>Kr</b> Krypton 36	37 <b>Rb</b> Rubidium 37	38 <b>Sr</b> Strontium 38	39 <b>Y</b> Yttrium 39	40 <b>Zr</b> Zirconium 40	41 <b>Nb</b> Niobium 41	42 <b>Mo</b> Molybdenum 42	43 <b>Tc</b> Technetium 43	44 <b>Ru</b> Ruthenium 44	45 <b>Rh</b> Rhodium 45	46 <b>Pd</b> Palladium 46	47 <b>Ag</b> Silver 47	48 <b>Cd</b> Cadmium 48	49 <b>In</b> Indium 49	50 <b>Sn</b> Tin 50	51 <b>Sb</b> Antimony 51	52 <b>Te</b> Tellurium 52	53 <b>I</b> Iodine 53	54 <b>Xe</b> Xenon 54	55 <b>Cs</b> Caesium 55	56 <b>Ba</b> Barium 56	57 <b>La</b> Lanthanum 57	72 <b>Hf</b> Hafnium 72	73 <b>Ta</b> Tantalum 73	74 <b>W</b> Tungsten 74	75 <b>Re</b> Rhenium 75	76 <b>Os</b> Osmium 76	77 <b>Ir</b> Iridium 77	78 <b>Pt</b> Platinum 78	79 <b>Au</b> Gold 79	80 <b>Hg</b> Mercury 80	81 <b>Tl</b> Thallium 81	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	†
133 <b>Cs</b> Caesium 55	137 <b>Ba</b> Barium 56	139 <b>La</b> Lanthanum 57	140 <b>Ce</b> Cerium 58	141 <b>Pr</b> Praseodymium 59	144 <b>Nd</b> Neodymium 60	150 <b>Sm</b> Samarium 62	152 <b>Eu</b> Europium 63	157 <b>Gd</b> Gadolinium 64	162 <b>Dy</b> Dysprosium 66	165 <b>Ho</b> Holmium 67	167 <b>Er</b> Erbium 68	169 <b>Tm</b> Thulium 69	175 <b>Lu</b> Lutetium 71	140 <b>Ce</b> Cerium 58	141 <b>Pr</b> Praseodymium 59	144 <b>Nd</b> Neodymium 60	150 <b>Sm</b> Samarium 62	152 <b>Eu</b> Europium 63	157 <b>Gd</b> Gadolinium 64	162 <b>Dy</b> Dysprosium 66	165 <b>Ho</b> Holmium 67	167 <b>Er</b> Erbium 68	169 <b>Tm</b> Thulium 69	175 <b>Lu</b> Lutetium 71	232 <b>Th</b> Thorium 90	238 <b>U</b> Uranium 92	238 <b>Pa</b> Protactinium 91	238 <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																													

\*58-71 Lanthanoid series  
†90-103 Actinoid series

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.).

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