

Centre Number	Candidate Number	Name
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CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CHEMISTRY

0620/02

Paper 2

May/June 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 provided 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 printed on page 16.

FOR EXAMINER'S USE	
1	
2	
3	
4	
5	
6	
TOTAL	

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.

1 The diagram shows part of the Periodic Table.

I	II							III	IV	V	VI	VII	0
Li									C	N	O	F	He
Na											S	Cl	Ne
K							Fe		Cu	Zn		Br	Ar
												Kr	

(a) Answer these questions using **only** the elements shown in the diagram.

Write down the symbol for an element which

(i) is a transition metal.

(ii) forms an acidic oxide.

(iii) has six electrons in its outer shell.

(iv) has a giant covalent structure.

(v) reacts rapidly with water.

(vi) has a higher proton (atomic) number than iron.

[6]

(b) Some uses of some non-metallic elements are shown below.

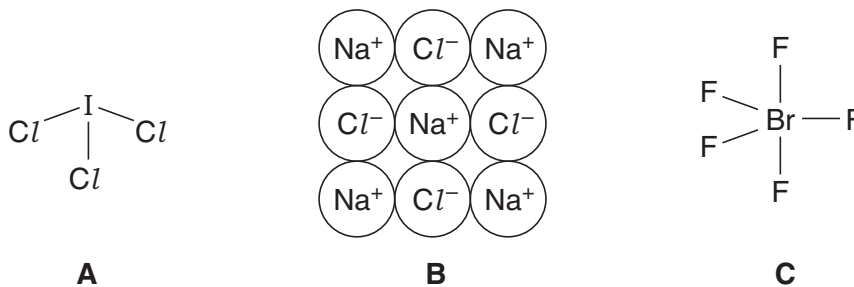
Draw lines between the boxes to link the elements to their correct uses.

The first one has been done for you.

element		use
oxygen		in light bulbs
argon		in oxygen tents in hospitals
chlorine		to kill bacteria in water purification
carbon (graphite)		in balloons
helium		as a lubricant

[4]

(c) The structures of some halogen compounds are shown below.



(i) Describe the type of bonding in compound **A**.

.....

(ii) State the simplest formula for compound **C**.

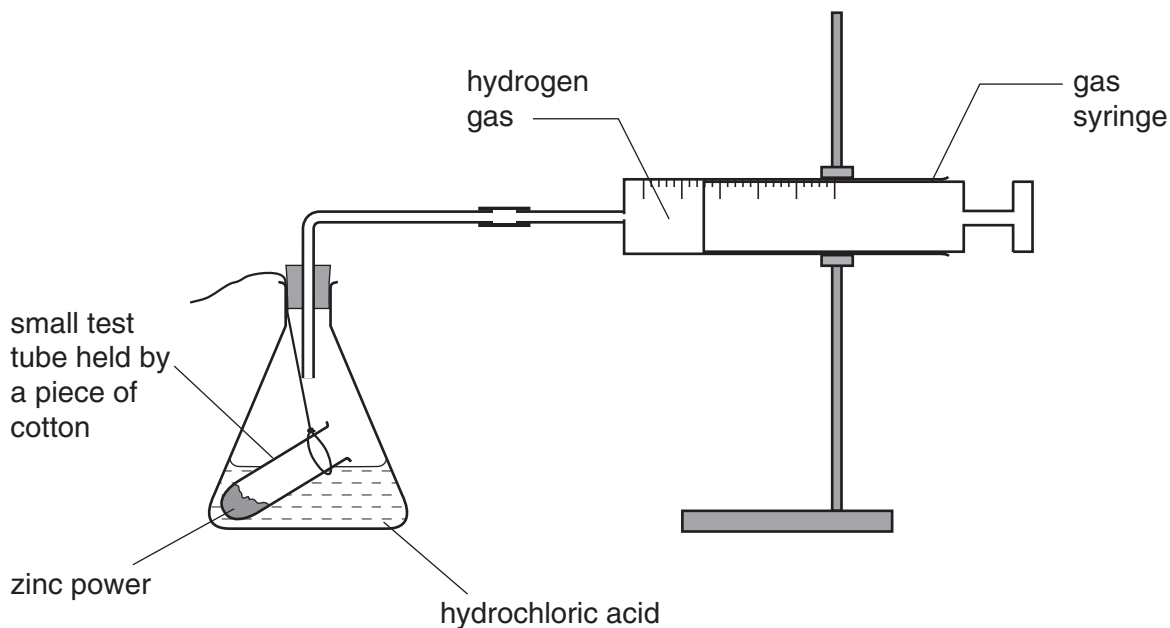
.....

(iii) Explain why compound **B** does not conduct electricity when solid but does conduct when molten.

.....

.....[4]

- 2 A student investigates the reaction between zinc and hydrochloric acid. The hydrochloric acid is in excess. The student uses the apparatus shown in the diagram.



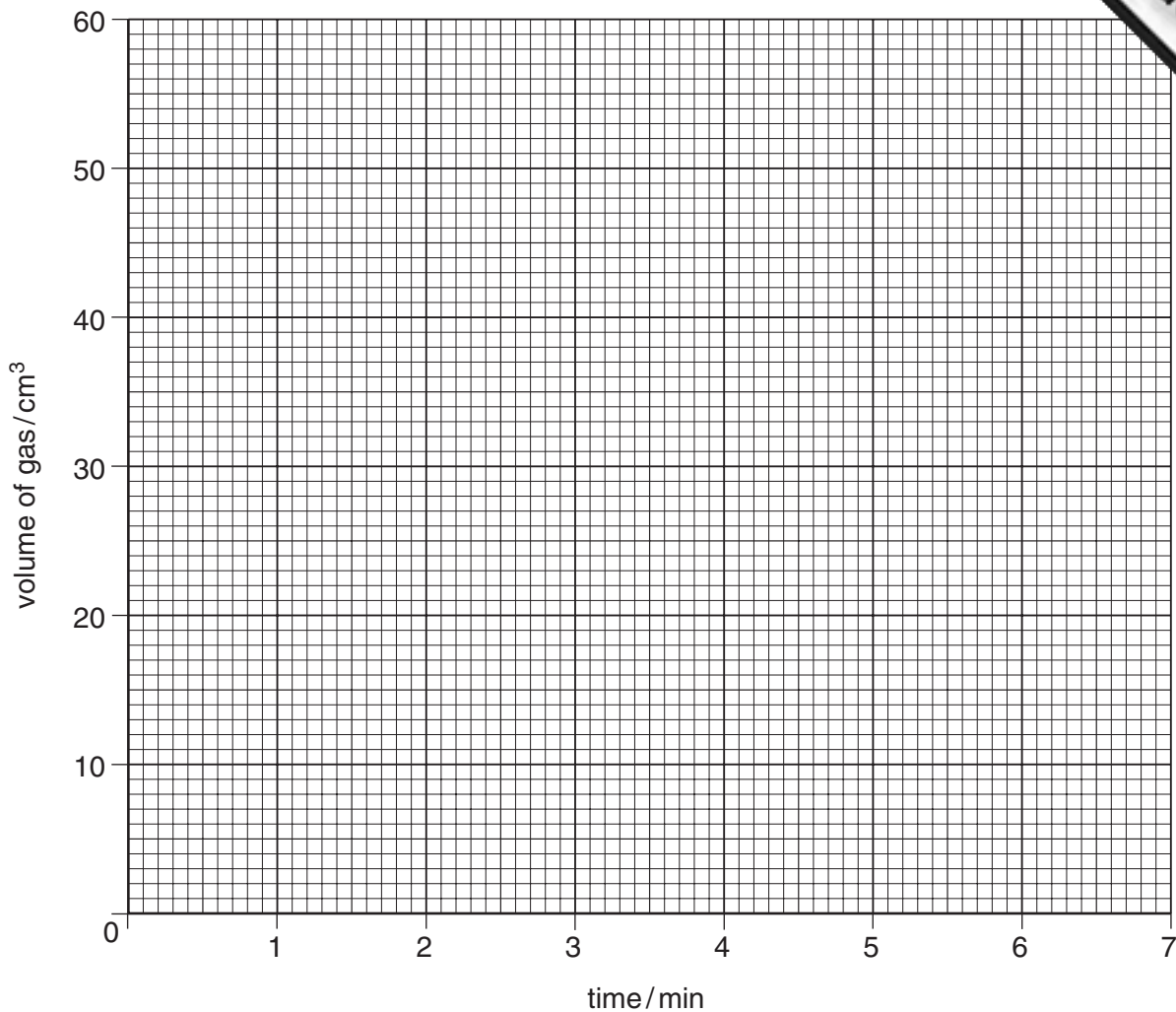
- (a) What should the student do to start the reaction?

.....[1]

- (b) The student reads the volume of gas in the syringe every minute. The results are shown in the table.

time in minutes	0	1	2	3	4	5	6	7
volume of gas in cm ³	0	23	35	45	50	53	55	55

- (i) Plot the results on the grid on page 5.



(ii) Draw the best curve through the points.

(iii) Explain why the volume of gas stays the same after six minutes.

.....
.....[5]

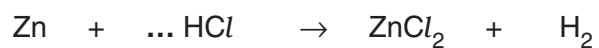
(c) The student does the experiment again.

The only difference is that the student uses warm, rather than cold, hydrochloric acid.

On the grid, draw the shape of the graph you would expect for the experiment with the warm hydrochloric acid.

[2]

- (d) (i) Balance the equation for the reaction between zinc and hydrochloric acid.



- (ii) Name the compound which has the formula ZnCl_2 .

.....

- (iii) Calculate the relative formula mass of ZnCl_2 .

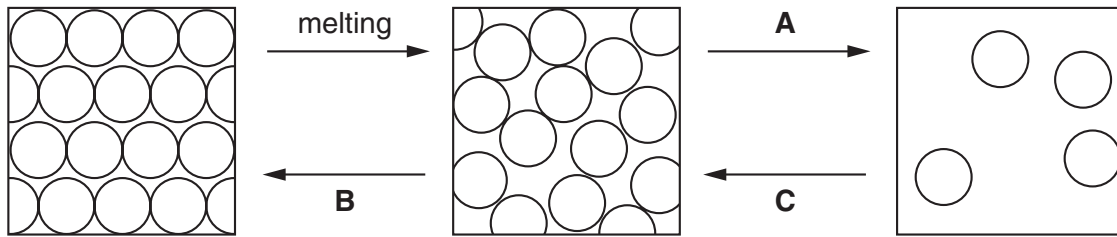
[3]

- (e) Zinc is an element.
State the meaning of the term *element*.

.....

.....[1]

- 3 The states of matter are solid, liquid and gas.
The diagram below shows how the molecules are arranged in these three states.



(a) State the name given to the change of state labelled

(i) **A**

(ii) **B**

(iii) **C**

[3]

(b) Which one of the following best describes the movement of molecules in the liquid state?

Tick **one** box.

The molecules are not moving from place to place.

The molecules are sliding over each other.

The molecules are moving freely.

[1]

(c) Which of the changes **A**, **B** or **C**, is endothermic?
Explain your answer.

.....

..... [2]

(d) Choose from the following list of substances to answer the questions below.

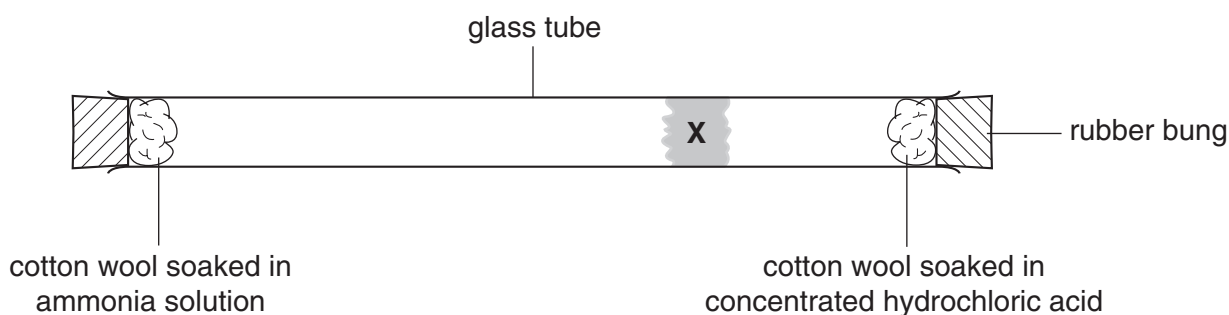
bromine
chlorine
iron
mercury
sodium chloride
sulphur

Name a substance which is

- (i) a gas at room temperature.
- (ii) a non-metallic liquid at room temperature.
- (iii) a compound which is a solid at room temperature.

[3]

(e) A student set up the apparatus shown in the diagram below.



The white solid is formed because the molecules of hydrogen chloride gas and ammonia gas move at random throughout the tube and eventually react with each other.

- (i) State the name given to this random movement of molecules.

.....

- (ii) State the name of the white solid formed at X.

.....

- (iii) Suggest why the white solid is formed towards one end of the tube and not in the middle.

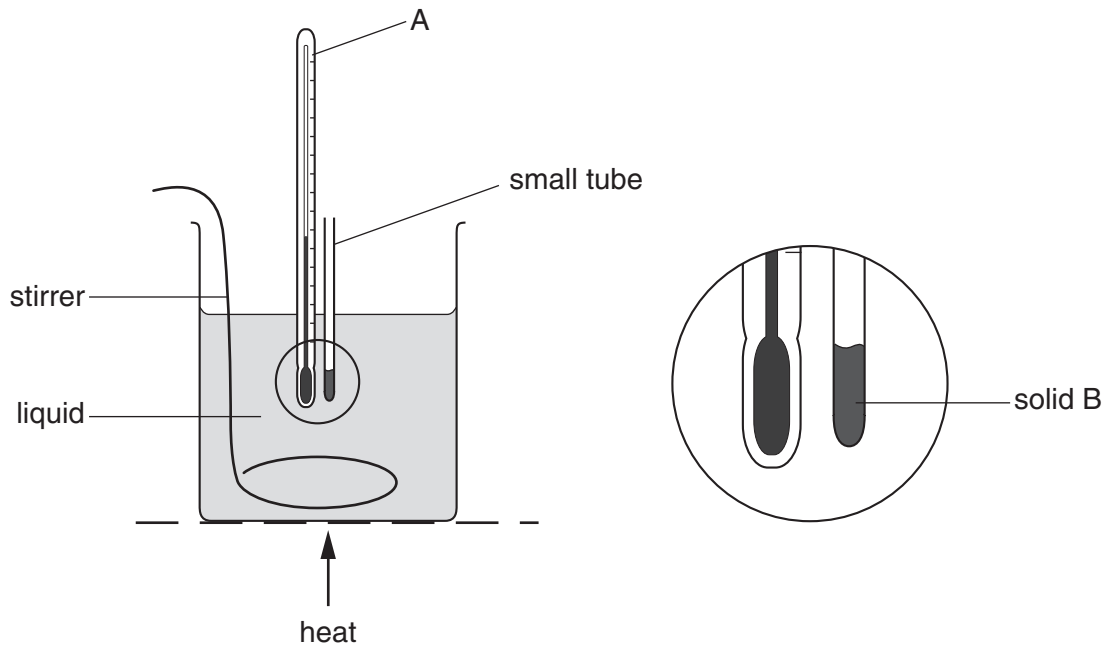
.....

.....[3]

- (f) What type of chemical reaction takes place when ammonia reacts with hydrochloric acid?

.....[1]

- (g) The diagram below shows a simple apparatus that can be used for measuring the melting point of a solid. The liquid in the beaker is heated slowly and the temperature at which the solid B melts is recorded.



- (i) State the name of the piece of apparatus labelled **A**.

.....

- (ii) Solid **B** melted at 155°C .
Why would water **not** be a suitable liquid to put in the beaker when using this apparatus to find the melting point of solid **B**?

.....

.....

- (iii) Suggest why the liquid needs to be kept stirred.

.....

.....[3]

- 4 Catalytic cracking is carried out by oil companies to produce high grade petrol. The process is carried out using an aluminium oxide catalyst. The reaction is a type of thermal decomposition.

(a) Explain the meaning of

(i) *thermal decomposition*.

.....

(ii) *catalyst*.

.....
[2]

(b) A typical 'cracking' reaction is



State the name of the unsaturated compound in this equation.

.....[1]

(c) The table shows some of the products obtained by cracking 100g of different 'fractions' under the same conditions.

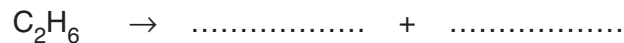
'fraction' cracked	products obtained / g per 100g of 'fraction' cracked			
	hydrogen	methane	ethene	petrol
ethane	10	5	75	2
paraffin	1	15	30	23
diesel	0	6	20	17

(i) Which 'fraction' is the best source of fuel for cars?

.....

(ii) Calculate the amount of paraffin 'fraction' needed to make 600g of methane.

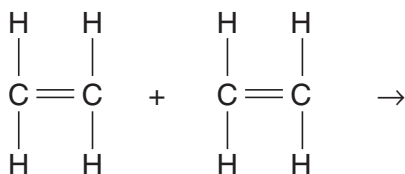
(iii) Complete the equation for the cracking of ethane to produce hydrogen and



[4]

(d) Ethene can be polymerised to form poly(ethene).

(i) Complete the equation below to show the structure of **two** units in the poly(ethene) molecule.



(ii) State the name given to this type of polymerisation.

.....[2]

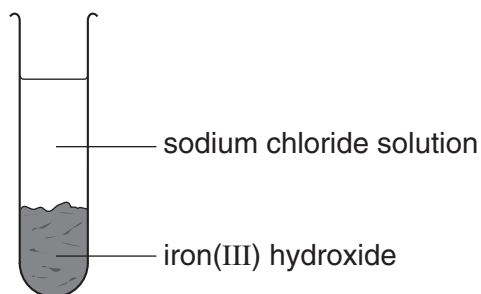
5 A precipitate may be formed when two aqueous solutions are mixed. The colour of these precipitates may be used to identify particular aqueous ions.

(a) Complete the following table.

ion under test	solution to be added to test for the ion	colour of precipitate
iron(II)		
iodide		
chloride		
sulphate		

[8]

- (b) When a solution of iron(III) chloride is added to a solution of sodium hydroxide, a precipitate of iron(III) hydroxide is formed and sodium chloride remains in solution.



Explain how you would obtain a pure dry sample of sodium chloride from this mixture. You may use diagrams to help with your explanation.

[3]

- (c) Sodium chloride and iron(III) hydroxide are both compounds. Explain the meaning of the term *compound*.

.....

..... [2]

- (d) Molten sodium chloride can be electrolysed using graphite electrodes.

Predict the products of this electrolysis

(i) at the anode

(ii) at the cathode

[2]

6 This question is about different metals.

The list below shows part of the metal reactivity series .

- | | |
|-----------|---------------|
| potassium | more reactive |
| magnesium | |
| aluminium | |
| zinc | |
| iron | |
| copper | less reactive |

(a) From this list, choose a metal which is extracted using electrolysis.

.....[1]

(b) Two thousand years ago, people were able to extract iron and copper from their ores. They were not able to extract aluminium.

Suggest why they were not able to extract aluminium from its ore.

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

(c) Uranium is between magnesium and zinc in the reactivity series.

Equal sized strips of magnesium, uranium and zinc were placed in hydrochloric acid. The hydrochloric acid was the same concentration. The results are shown in the table.

(i) Complete the result for uranium and hydrochloric acid.

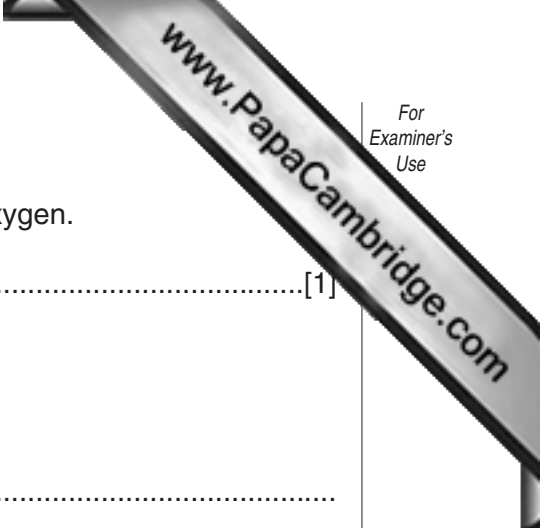
<i>metal</i>	<i>observations on adding to hydrochloric acid</i>
magnesium	many bubbles of gas produced very rapidly and magnesium dissolves quickly
uranium	
zinc	a few bubbles produced at a steady rate and zinc dissolves slowly

(ii) Uranium has several isotopes which are radioactive. One of these isotopes is uranium – 235 (²³⁵U).

What do you understand by the term *isotopes*?

.....
.....

(iii) State **one** use of uranium –235.



- (d) Metals high in the reactivity series react readily with oxygen.
Name the compound formed when magnesium reacts with oxygen.

.....[1]

- (e) Copper is alloyed with tin to make bronze.

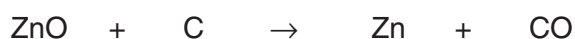
- (i) State what is meant by the term *alloy*.

.....
.....

- (ii) Suggest why metals are often used in the form of alloys.

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

- (f) Zinc can be extracted by heating zinc oxide with carbon.



Explain why carbon is a reducing agent (reductant) in this reaction.

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

- (g) Iron is used as a catalyst in the Haber Process for making ammonia.



- (i) What does the sign \rightleftharpoons mean?

.....

- (ii) What is the approximate percentage of nitrogen in the air?

.....[2]

(h) Magnesium is in group II of the Periodic Table.

(i) Draw a diagram to show the electronic structure of magnesium.

(ii) Explain what happens to the magnesium atom when it reacts and forms a magnesium ion.

.....[3]

DATA SHEET
The Periodic Table of the Elements

		Group													
I	II	III	IV	V	VI	VII	O								
7 Li Lithium	9 Be Beryllium	<table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <tr> <td>1 H Hydrogen</td> <td>4 He Helium</td> </tr> </table>										1 H Hydrogen	4 He Helium	20 Ne Neon	
1 H Hydrogen	4 He Helium														
23 Na Sodium	24 Mg Magnesium	11 B Boron	12 C Carbon	14 N Nitrogen	16 O Oxygen	19 F Fluorine	10								
39 K Potassium	40 Ca Calcium	27 Al Aluminium	28 Si Silicon	31 P Phosphorus	32 S Sulphur	35.5 Cl Chlorine	40 Ar Argon								
85 Rb Rubidium	88 Sr Strontium	70 Ga Gallium	73 Ge Germanium	75 As Arsenic	79 Se Selenium	80 Br Bromine	84 Kr Krypton								
133 Cs Caesium	137 Ba Barium	115 In Indium	119 Sn Tin	122 Sb Antimony	128 Te Tellurium	127 I Iodine	131 Xe Xenon								
87 Fr Francium	88 Ra Radium	204 Tl Thallium	207 Pb Lead	209 Bi Bismuth	210 Po Polonium	210 At Astatine	210 Rn Radon								
		65 Zn Zinc	64 Cu Copper	59 Ni Nickel	59 Co Cobalt	59 Fe Iron	56 Mn Manganese	55 Cr Chromium	51 V Vanadium	48 Ti Titanium	45 Sc Scandium	45 Y Yttrium	89 La Lanthanum	89 Ac Actinium	
		112 Cd Cadmium	108 Ag Silver	106 Pd Palladium	103 Rh Rhodium	101 Ru Ruthenium	101 Tc Technetium	96 Mo Molybdenum	93 Nb Niobium	91 Zr Zirconium	89 Y Yttrium	88 Sr Strontium	87 Rb Rubidium	86 Kr Krypton	
		201 Hg Mercury	197 Au Gold	195 Pt Platinum	192 Ir Iridium	190 Os Osmium	186 Re Rhenium	184 W Tungsten	181 Ta Tantalum	178 Hf Hafnium	139 La Lanthanum	137 Ba Barium	135 Cs Caesium	134 Xe Xenon	
		159 Tb Terbium	157 Gd Gadolinium	152 Eu Europium	150 Sm Samarium	144 Pm Promethium	144 Nd Neodymium	141 Pr Praseodymium	140 Ce Cerium	140 Ce Cerium	141 Pr Praseodymium	144 Nd Neodymium	150 Sm Samarium	152 Eu Europium	159 Tb Terbium
		101 Md Mendelevium	101 Md Mendelevium	100 Fm Fermium	100 Fm Fermium	99 Es Einsteinium	99 Es Einsteinium	98 Cf Californium	98 Cf Californium	98 Cf Californium	101 Md Mendelevium	102 No Nobelium	102 No Nobelium	102 No Nobelium	102 No Nobelium
		175 Lu Lutetium	175 Lu Lutetium	173 Yb Ytterbium	173 Yb Ytterbium	173 Yb Ytterbium	173 Yb Ytterbium	173 Yb Ytterbium	173 Yb Ytterbium	173 Yb Ytterbium	173 Yb Ytterbium	173 Yb Ytterbium	173 Yb Ytterbium	173 Yb Ytterbium	173 Yb Ytterbium

3-71 Lanthanoid series
0-103 Actinoid series

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.).