



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE
NAME

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CENTRE
NUMBER

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CANDIDATE
NUMBER

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* 7 0 4 9 0 8 5 5 7 2 *

CHEMISTRY

0620/02

Paper 2

May/June 2009

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	
Total	

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



- 1 (a) Choose from the list of compounds to answer questions (i) to (v).

For
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Use

calcium carbonate	carbon dioxide	hydrogen chloride	
iron(III) oxide	lead(II) bromide	methane	sodium hydroxide

Each compound can be used once, more than once or not at all.

Name the compound which

- (i) is a transition metal compound,

..... [1]

- (ii) produces brown fumes at the anode when electrolysed,

..... [1]

- (iii) is used to manufacture lime,

..... [1]

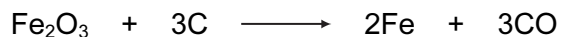
- (iv) dissolves in water to form an alkaline solution,

..... [1]

- (v) is the main constituent of natural gas.

..... [1]

(b) At a high temperature iron(III) oxide is reduced by carbon.



(i) Explain how the equation shows that iron(III) oxide is reduced by carbon.

..... [1]

(ii) Complete these sentences about the extraction of iron using words from the list.

bauxite blast converter haematite lime
limestone sand slag

Iron is extracted from by mixing the ore with
 coke and in a furnace.

The iron ore is reduced to iron and impurities in the ore react with calcium oxide
 to form [4]

[Total: 10]

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- 2 The table shows some observations about the reactivity of various metals with dilute hydrochloric acid.

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metal	observations
calcium	many bubbles produced rapidly with much spitting
copper	no bubbles formed
iron	a few bubbles produced very slowly
magnesium	many bubbles produced rapidly with no spitting

- (a) Put these metals in order of their reactivity.

most reactive $\longrightarrow$ least reactive

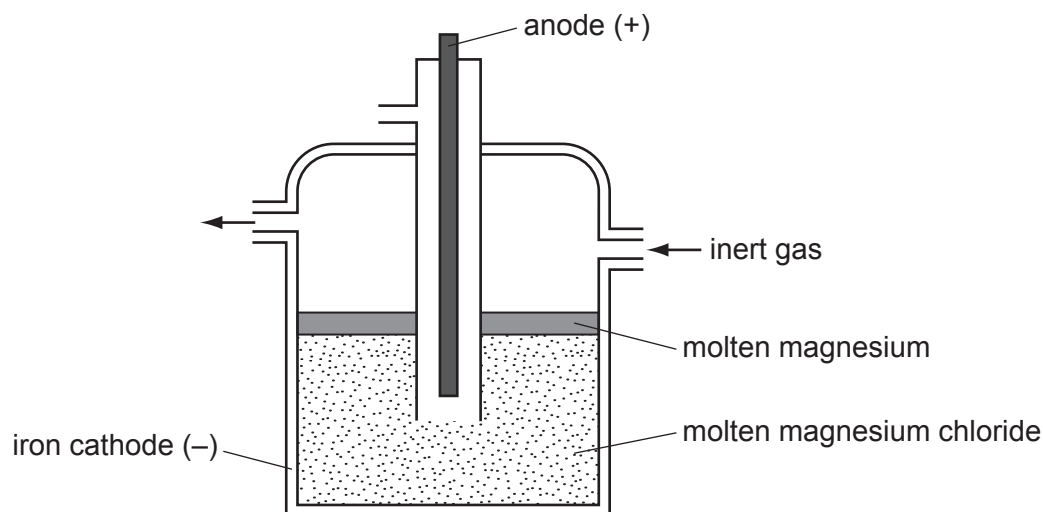
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[1]

- (b) Zinc is between iron and magnesium in its reactivity.
Suggest what observations are made about how fast the bubbles are produced when zinc reacts with dilute hydrochloric acid.

..... [1]

- (c) Magnesium is extracted by the electrolysis of molten magnesium chloride.



- (i) What information in the diagram suggests that magnesium is less dense than molten magnesium chloride?

..... [1]

- (ii) Suggest why magnesium has to be extracted by electrolysis rather than by heating its oxide with carbon.

..... [1]

- (iii) Suggest why a stream of inert gas is blown over the surface of the molten magnesium.

..... [1]

- (iv) State the name of a gaseous element which is inert.

..... [1]

- (d) In some old magnesium manufacturing plants, coal gas is blown over the surface of the magnesium.

The list shows the main substances in coal gas.

carbon monoxide

ethene

hydrogen

hydrogen sulfide

methane

- (i) Draw the structure of ethene showing all atoms and bonds.

[1]

- (ii) Suggest **two** hazards of using coal gas by referring to **two** specific substances in the list.

substance

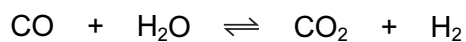
hazard

substance

hazard [2]

- (e) Carbon monoxide can be removed from coal gas by mixing it with steam and passing the mixture over a catalyst of iron(III) oxide at 400 °C.

For
Examiner's
Use



- (i) Write a word equation for this reaction.

..... [1]

- (ii) What does the symbol $\rightleftharpoons$ mean?

..... [1]

- (iii) Iron(III) oxide reacts with acids to form a solution containing iron(III) ions.
Describe a test for aqueous iron(III) ions.

test

result

..... [2]

[Total: 13]

- 3 Petroleum is a mixture of hydrocarbons which can be separated into fractions such as petrol, paraffin and diesel.

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- (a) State the name of the process used to separate these fractions.

..... [1]

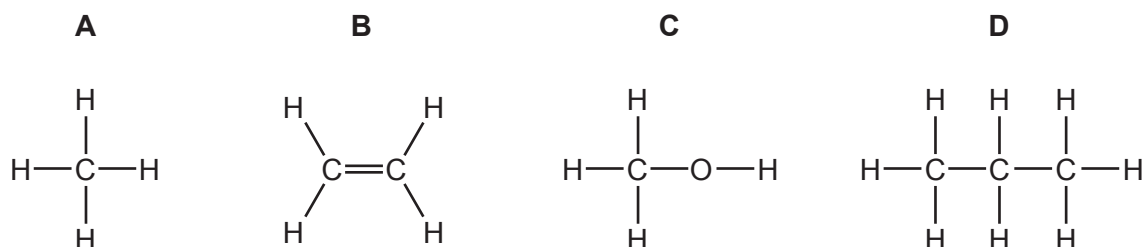
- (b) Name **two** other fractions which are obtained from petroleum .

..... and [2]

- (c) Give **one** use for the paraffin fraction.

..... [1]

- (d) Many of the compounds obtained from petroleum are alkanes.
Which **two** of the following structures are alkanes?



..... [1]

- (e) Use words from the list below to complete the following sentence.

ethane	ethene	hydrogen	nitrogen	oxygen
reactive		unreactive		water

Alkanes such as are generally but they can
be burnt in to form carbon dioxide and [4]

- (f) Alkanes are saturated hydrocarbons.
What do you understand by the terms

(i) saturated,
.....

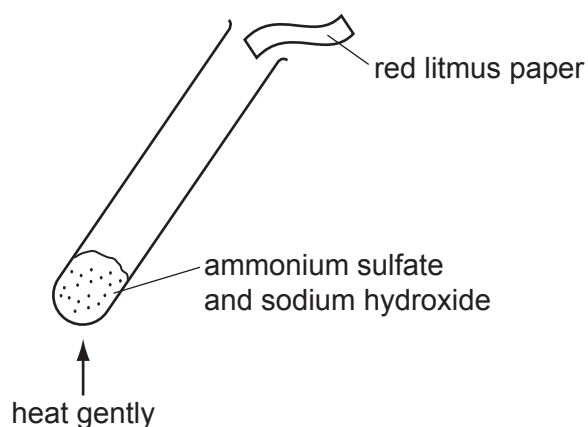
(ii) hydrocarbon?

..... [2]

[Total: 11]

- 4 This question is about some compounds of nitrogen.

A mixture of ammonium sulfate and sodium hydroxide was warmed in a test-tube. The gas was tested with moist red litmus paper.



- (a) State the name of the gas released.

..... [1]

- (b) State the colour change of the litmus paper.

..... [1]

- (c) Complete the word equation for the reaction of ammonium carbonate with hydrochloric acid.

ammonium carbonate + hydrochloric acid $\longrightarrow$ + +
 [3]

- (d) Ammonium salts such as ammonium nitrate, NH_4NO_3 and ammonium chloride NH_4Cl are used as fertilisers.

- (i) Explain why farmers need to use fertilisers.

.....
 [1]

- (ii) Explain why ammonium nitrate is a better fertiliser than ammonium chloride.

..... [1]

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- (iii) Calculate the relative formula mass of ammonium nitrate.

For
Examiner's
Use

[1]

- (e) When ammonium nitrate is heated nitrogen(I) oxide is given off.
Nitrogen(I) oxide relights a glowing splint.
Name **one** other gas which relights a glowing splint.

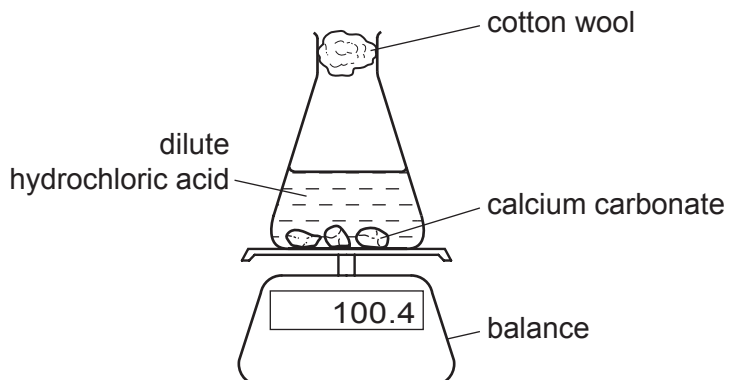
..... [1]

- (f) State **one** harmful effect of nitrogen oxides on the environment.

..... [1]

[Total: 10]

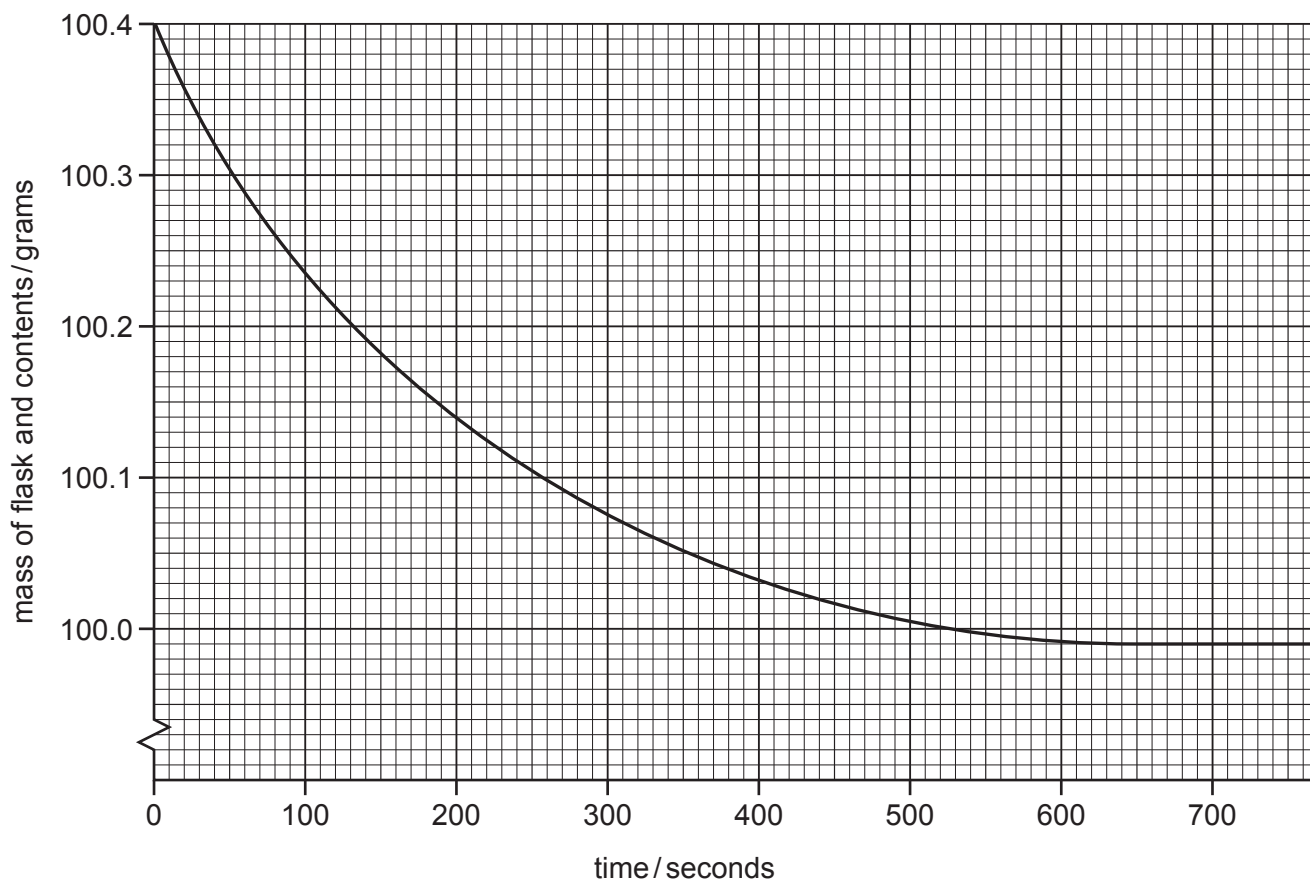
- 5 A student used the apparatus shown below to investigate the rate of reaction of calcium carbonate with dilute hydrochloric acid.



- (a) Use the information in the equation to suggest why the mass of the flask and contents decreases with time.

.....
 [1]

- (b) The graph shows how the mass of the flask and its contents changes with time.



- (i) At what time was the reaction just complete?

..... [1]

- (ii) On the graph, mark with an **X** the point where the speed (rate) of reaction was fastest. [1]

- (iii) The student repeated the experiment but altered the concentration of the hydrochloric acid so that it was half the original value. In both experiments calcium carbonate was in excess and all other conditions were kept the same.

On the graph on page 10, draw a curve to show how the mass of the flask and contents changes with time when hydrochloric acid of half the concentration was used. [2]

- (c) How does the speed (rate) of this reaction change when

(i) the temperature is increased, [1]

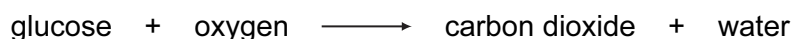
(ii) smaller pieces of calcium carbonate are used? [1]

- (d) Complete the following sentence using words from the list.

combustion expansion large rapid slow small

In flour mills there is often the risk of an explosion due to the rapid
of the very particles which have a very
..... surface area to react. [3]

- (e) Cells in plants and animals break down glucose to carbon dioxide and water.



- (i) State the name of this process.

..... [1]

- (ii) In this process enzymes act as catalysts.
What do you understand by the term *catalyst*?

..... [1]

[Total: 12]

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

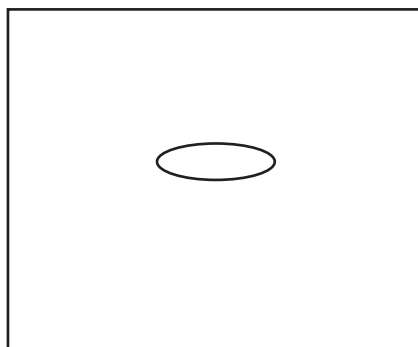
For
Examiner's
Use

(a) Write the formula for a molecule of bromine.

..... [1]

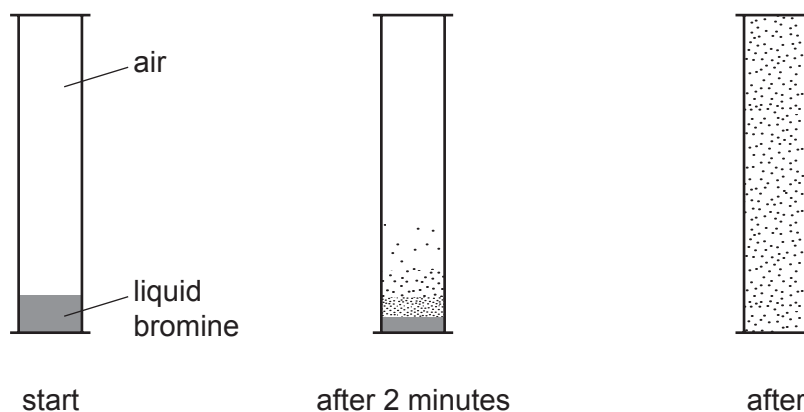
(b) Complete the diagram below to show the arrangement of the molecules in liquid bromine.

 represents a bromine molecule



[2]

(c) A teacher placed a small amount of liquid bromine in the bottom of a sealed gas jar of air. After two minutes brown fumes were seen just above the liquid surface. After one hour the brown colour had spread completely throughout the gas jar.



Use the kinetic particle theory to explain these observations.

.....

 [3]

- (d) Magnesium salts are colourless but Group VII elements are coloured.
An aqueous solution of magnesium bromide reacts with an aqueous solution of chlorine.



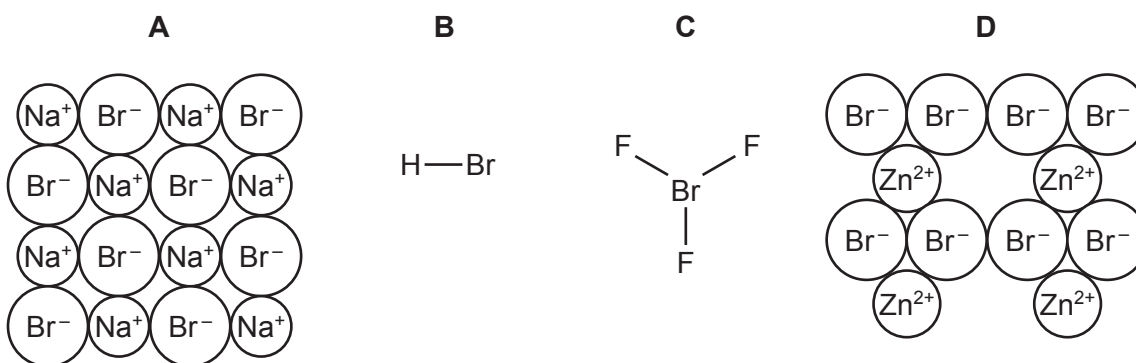
State the colour change in this reaction.

..... [2]

- (e) A solution of magnesium bromide will not react with iodine.
Explain why there is no reaction.

..... [1]

- (f) The structures of some compounds containing bromine are shown below.



- (i) Write the simplest formula for the substance with structure **A**.

..... [1]

- (ii) State the name of the substance with structure **D**.

..... [1]

- (iii) State the type of bonding within a molecule of structure **C**.

..... [1]

- (iv) Which **two** structures are giant structures?

..... and [1]

- (v) Why does structure **A** conduct electricity when it is molten?

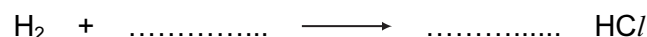
..... [1]

[Total: 14]

7 Hydrogen chloride can be made by burning hydrogen in chlorine.

For
Examiner's
Use

(a) Complete the equation for this reaction.



[2]

(b) Draw a dot and cross diagram for a molecule of hydrogen chloride.
Show all the electrons.

use **o** for an electron from a hydrogen atom
use **x** for an electron from a chlorine atom

[2]

(c) Hydrochloric acid is formed when hydrogen chloride gas dissolves in water.
Suggest the pH of hydrochloric acid.
Put a ring around the correct answer.

pH 1

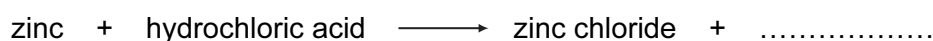
pH7

pH9

pH 13

[1]

(d) Complete the equation for the reaction of hydrochloric acid with zinc.



[1]

(e) Describe how dry crystals of zinc chloride can be obtained from a solution of zinc chloride.

.....
.....
.....

[2]

(f) A student electrolysed molten zinc chloride.
State the name of the product formed at

(i) the anode,

[1]

(ii) the cathode.

[1]

[Total: 10]

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DATA SHEET
The Periodic Table of the Elements

Group																		
I	II	III										IV	V	VI	VII	0		
		<div>1 H Hydrogen</div>																<div>4 He Helium</div> <div>2</div>
<div>7 Li Lithium</div> <div>3</div>	<div>9 Be Beryllium</div> <div>4</div>											<div>12 C Carbon</div> <div>6</div>	<div>14 N Nitrogen</div> <div>7</div>	<div>16 O Oxygen</div> <div>8</div>	<div>19 F Fluorine</div> <div>9</div>	<div>20 Ne Neon</div> <div>10</div>		
<div>23 Na Sodium</div> <div>11</div>	<div>24 Mg Magnesium</div> <div>12</div>											<div>27 Al Aluminium</div> <div>13</div>	<div>28 Si Silicon</div> <div>14</div>	<div>31 P Phosphorus</div> <div>15</div>	<div>32 S Sulfur</div> <div>16</div>	<div>35.5 Cl Chlorine</div> <div>17</div>	<div>40 Ar Argon</div> <div>18</div>	
<div>39 K Potassium</div> <div>19</div>	<div>40 Ca Calcium</div> <div>20</div>	<div>51 V Vanadium</div> <div>23</div>	<div>48 Ti Titanium</div> <div>22</div>	<div>55 Mn Manganese</div> <div>25</div>	<div>56 Fe Iron</div> <div>26</div>	<div>59 Co Cobalt</div> <div>27</div>	<div>59 Ni Nickel</div> <div>28</div>	<div>64 Cu Copper</div> <div>29</div>	<div>65 Zn Zinc</div> <div>30</div>	<div>70 Ga Gallium</div> <div>31</div>	<div>73 Ge Germanium</div> <div>32</div>	<div>75 As Arsenic</div> <div>33</div>	<div>79 Se Selenium</div> <div>34</div>	<div>80 Br Bromine</div> <div>35</div>	<div>84 Kr Krypton</div> <div>36</div>			
<div>85 Rb Rubidium</div> <div>37</div>	<div>88 Sr Strontium</div> <div>38</div>	<div>93 Nb Niobium</div> <div>41</div>	<div>91 Zr Zirconium</div> <div>40</div>	<div>96 Mo Molybdenum</div> <div>42</div>	<div>101 Ru Ruthenium</div> <div>44</div>	<div>103 Rh Rhodium</div> <div>45</div>	<div>106 Pd Palladium</div> <div>46</div>	<div>108 Ag Silver</div> <div>47</div>	<div>112 Cd Cadmium</div> <div>48</div>	<div>115 In Indium</div> <div>49</div>	<div>119 Sn Tin</div> <div>50</div>	<div>122 Sb Antimony</div> <div>51</div>	<div>128 Te Tellurium</div> <div>52</div>	<div>127 I Iodine</div> <div>53</div>	<div>131 Xe Xenon</div> <div>54</div>			
<div>133 Cs Caesium</div> <div>55</div>	<div>137 Ba Barium</div> <div>56</div>	<div>181 Ta Tantalum</div> <div>73</div>	<div>178 Hf Hafnium</div> <div>72</div>	<div>184 W Tungsten</div> <div>74</div>	<div>186 Re Rhenium</div> <div>75</div>	<div>192 Ir Iridium</div> <div>77</div>	<div>195 Pt Platinum</div> <div>78</div>	<div>197 Au Gold</div> <div>79</div>	<div>201 Hg Mercury</div> <div>80</div>	<div>204 Tl Thallium</div> <div>81</div>	<div>207 Pb Lead</div> <div>82</div>	<div>209 Bi Bismuth</div> <div>83</div>	<div>210 Po Polonium</div> <div>84</div>	<div>210 At Astatine</div> <div>85</div>	<div>222 Rn Radon</div> <div>86</div>			
<div>87 Fr Francium</div>	<div>226 Ra Radium</div> <div>88</div>	<div>227 Ac Actinium</div> <div>89</div>																

58-71 Lanthanoid series

90-103 Actinoid series

<div>140 Ce Cerium</div> <div>58</div>	<div>141 Pr Praseodymium</div> <div>59</div>	<div>144 Nd Neodymium</div> <div>60</div>	<div>150 Sm Samarium</div> <div>62</div>	<div>152 Eu Europium</div> <div>63</div>	<div>157 Gd Gadolinium</div> <div>64</div>	<div>159 Tb Terbium</div> <div>65</div>	<div>162 Dy Dysprosium</div> <div>66</div>	<div>165 Ho Holmium</div> <div>67</div>	<div>167 Er Erbium</div> <div>68</div>	<div>169 Tm Thulium</div> <div>69</div>	<div>173 Yb Ytterbium</div> <div>70</div>	<div>175 Lu Lutetium</div> <div>71</div>
<div>232 Th Thorium</div> <div>90</div>	<div>232 Pa Protactinium</div> <div>91</div>	<div>238 U Uranium</div> <div>92</div>	<div>238 Np Neptunium</div> <div>93</div>	<div>238 Pu Plutonium</div> <div>94</div>	<div>238 Am Americium</div> <div>95</div>	<div>238 Cm Curium</div> <div>96</div>	<div>238 Bk Berkelium</div> <div>97</div>	<div>238 Es Einsteinium</div> <div>99</div>	<div>238 Fm Fermium</div> <div>100</div>	<div>238 Md Mendelevium</div> <div>101</div>	<div>238 No Nobelium</div> <div>102</div>	<div>238 Lr Lawrencium</div> <div>103</div>

Key

a

X

b

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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