Section Two : The Microscopic World

Unit Six : Periodic Table 元素週期表(Families of Elements)

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Investigation A

Results:

Metal	Colour	**Reaction with water**	**Colour of red litmus paper**
Potassium	grey	melts to a silvery ball; moves about quickly on water surface; produces hissing 嘶嘶聲 sound; burns spontaneously 自發地 with a lilac flame 淡紫色的火焰.	turns blue
Sodium	grey	similar to potassium; no lilac flame	turns blue
Iron	grey	no reaction; sinks to the bottom	remains red

Conclusion: _____Potassium and sodium_____have similar properties.

Investigation B

Results:

Metal	Colour	**Reaction with dilute hydrochloric acid**
Calcium	silvery / grey	rapid evolution 快速地釋放 of colourless gas (hydrogen); metal dissolves quickly to give a colourless solution
Magnesium	silvery / grey	similar to calcium
Copper	brown	metal sinks to the bottom ; no reaction

Conclusion: _____Calcium and magnesium_____have similar properties.

Investigation C

Results:

Non-metal	**Colour of solution / suspension**	**Reaction with Sodium sulphite solution**
Chlorine	pale greenish yellow	becomes a colourless solution (i.e. decolourized)
Bromine	light brown (or yellow)	
Iodine	brown	
Sulphur	yellow solid in colourless solution	no reaction

Conclusion: _____Chlorine, bromine and iodine_____have similar properties.

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Exercise

The following diagrams are taken from the Periodic Table :

1 1.0 **H** **Hydrogen**	6 12.0 **C** **Carbon**	9 19.0 **F** **Fluorine**	11 23.0 **Na** **Sodium**	17 35.5 **Cl** **Chlorine**	20 40.1 **Ca** **Calcium**	30 65.4 **Zn** **Zinc**

a) For fluorine, explain the meaning of the numbers
   i) 9 and
   ii) 19.0 respectively.

b) Give the electronic configuration and draw the electron diagram of sodium.

c) In what way are the electronic arrangement of the atoms of fluorine and chlorine
   i) similar to each other?
   ii) different from each other?

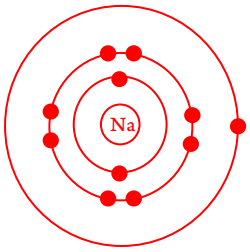
d) What is the group number and period number of calcium?

e) What is the name for the family of elements of which
   i) zinc;
   ii) calcium belongs to respectively?

f) The electronic configuration of zinc is 2, 8, 18, p.
   i) Calculate the value of p.
   ii) In which group of the Periodic Table should zinc be placed?
   iii) Draw the electron diagram of zinc, showing the outermost shell only.

a) i) atomic number / number of protons / number of electrons
   ii) relative atomic mass

b) 2,8,1

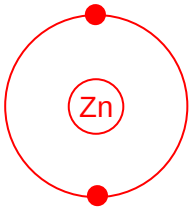


c) i) Both of them have 7 of outermost electrons.
   ii) Fluorine has 2 electron shells while chlorine has 3.

d) Group number = 2
   Period number = 4

e) i) Transition metals
   ii) Alkaline earth metals

f) i) p = 30 – 2 – 8 – 18 = 2
   ii) Transition metal
   iii)



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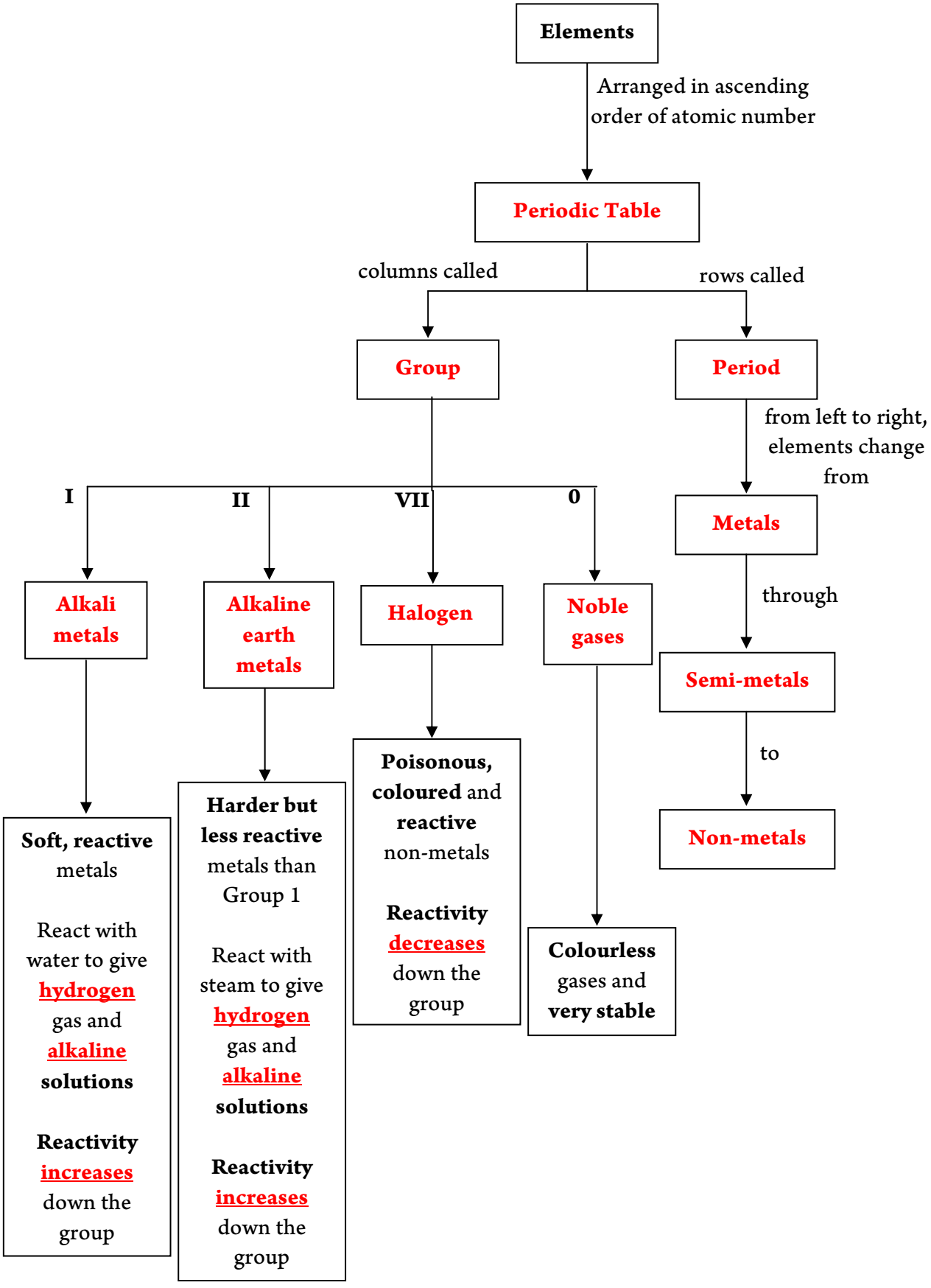
Concept Map



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Supplementary Exercise

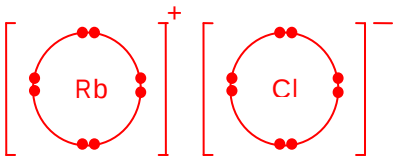
1. (a) (i) 32 (ii) 15
(iii) 15 (iv) magnesium / Mg
(v) 12 (vi) 12
(vii) 12 (viii) chlorine
(ix) 17 (x) 17
(xi) 18

(b) Group no. for P is 5, it is a non-metal.
Group no. for (iv) is 2, it is a metal.
Group no. for (viii) is 7, it is a non-metal.

(c) Their boiling point are : Magnesium (iv) > P > Chlorine (viii)

2. (a) Alkaline earth metal
(b) boiling point : Be > Mg > Ca > Sr > Ba
(c) Yes , because they have the same no. of outermost shell electrons
(d) two electrons
(e) Metallic bond
(f) 5 electron shells
(g) Barium, since it has the largest atomic size than the other four metals, it has the greatest tendency to release the electron and start the reaction among five.
(h) Yes, since all group 2 elements possess 2 free electrons.
(i) $Mg(OH)_2$. It is slightly soluble in water since all compounds of Group 2 elements are slightly soluble in water.

3. (a) 37 electrons
(b) 1 electron
(c) Rubidium reacts faster than potassium.
(d) They form ionic compound



(e) Bubbles of hydrogen will be evolved.

$$2Rb(s) + 2H_2O(l) \longrightarrow 2RbOH(aq) + H_2(g)$$

(f) Alkaline
(g) Rb_2CO_3

4. (a) Non-metal -- carbon, silicon
Semi-metal -- germanium
Metal -- tin, lead
(b) The bond type for carbon is covalent while that of lead is metallic.
(c) Graphite and diamond
(d) Boiling point of $GeH_4 > SiH_4 > CH_4$