

# Elements

## 1 Arrangement - periodic table

number of outermost shell  $e^-$

GROUP

number of occupied shells

PERIOD

Transition metals

does not belong to any group

Alkali metals

Alkaline earth metals

Halogens

Noble gases

Metals

Semi-metals

Non-metals

all naturally occurring isotopes

weight = relative abundance

weighted average  $\rightarrow$  R.A.M.

R.A.M. =  $M_A \cdot a\% + M_B \cdot b\% + M_C \cdot c\% \dots$

## 2 Main group elements

### GRP I - ALKALI METALS

- silvery solids
- soft metals ( $\checkmark$  cut by knife)
- low density (Li, Na, K floats on water)
- reactive
  - $4M + O_2 \rightarrow 2M_2O \Rightarrow$  stored in paraffin oil
  - $2M + 2H_2O \rightarrow 2MOH + H_2 \Rightarrow$  gives out hydrogen  $\Rightarrow$  alkaline solution
- reactivity increases down the group

### GRP II - ALKALINE EARTH METALS

- silvery solids
- low density (but denser than Grp I)
- less reactive than Grp I (harder to lose outermost  $e^-$ )
  - $M + 2H_2O \rightarrow M(OH)_2 + H_2 \Rightarrow$  less vigorous than Grp I  $\Rightarrow$  base, insol. in water
- reactivity increases down a group

### GRP VII - HALOGENS

- toxic
- $\rightarrow$  Fluorine, Chlorine, Bromine, Iodine, Astatine
  - gas  $\rightarrow$  liquid  $\rightarrow$  solid  $\rightarrow$  mp./bp.  $\uparrow$  (size  $\uparrow \Rightarrow$  vdw  $\uparrow$ )
  - pale yellow  $\rightarrow$  yellowish green  $\rightarrow$  reddish brown  $\rightarrow$  black  $\rightarrow$  colour light  $\rightarrow$  dark
- reactivity decreases down a group

### GRP O - NOBLE GASES

- colourless gases
- very unreactive (duplet/octet electronic structure  $\rightarrow$  very stable)

### WHY DOES REACTIVITY DIFFER DOWN A GROUP?

- atomic size  $\uparrow$
- attraction  $\%$  nucleus & outermost shell  $e^- \downarrow$
- easier to lose / harder to gain  $e^-$
- reactivity increases / decreases

Grp I-III  
Grp IV-VII

## 3 Isotopes

### DEFINITION

- different atoms of the same element
- w/ same no. of p &  $e^-$  but different no. of n
- same chem. prop. ( $\because$  same electronic arrangement)
- different phy. prop. ( $\because$  different mass)

### RELATIVE ABUNDANCE

- proportion of a particular isotope of element in nature
- eg.  $^{16}O$  99.76%  
 $^{17}O$  0.04%  
 $^{18}O$  0.20%

### RELATIVE ISOTOPIC MASS

- mass of isotope compared w/ referencing standard  $\rightarrow ^{12}C = 12.00$
- $\approx$  mass number  $\rightarrow p/n \pm 1, e^- \pm 0$
- no unit (relative value)

## 4 Relative atomic mass (R.A.M.)

### DEFINITION & CALCULATION

- Element
  - Isotope A - Relative isotopic mass A
  - Isotope B - Relative isotopic mass B
  - Isotope C - Relative isotopic mass C
- all naturally occurring isotopes
- weight = relative abundance
- weighted average  $\rightarrow$  R.A.M.
- R.A.M. =  $M_A \cdot a\% + M_B \cdot b\% + M_C \cdot c\% \dots$

For more metal reactions see topic 3: Metals