Pei Hwa Secondary School
4N Science (Chemistry) Revision 1
Chp 4 & 5: Chemical Bonding & Structure and Properties of Materials

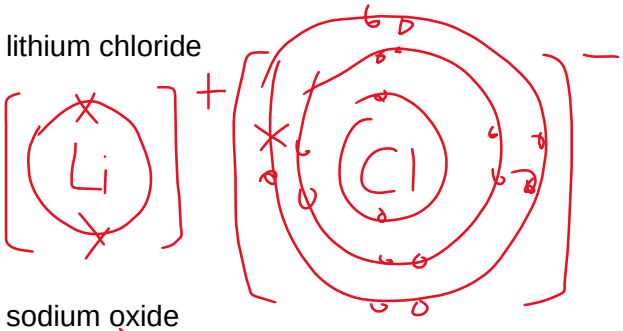
Name: _____ **Class / TG:** _____ **Date:** _____

Ionic Bonding:

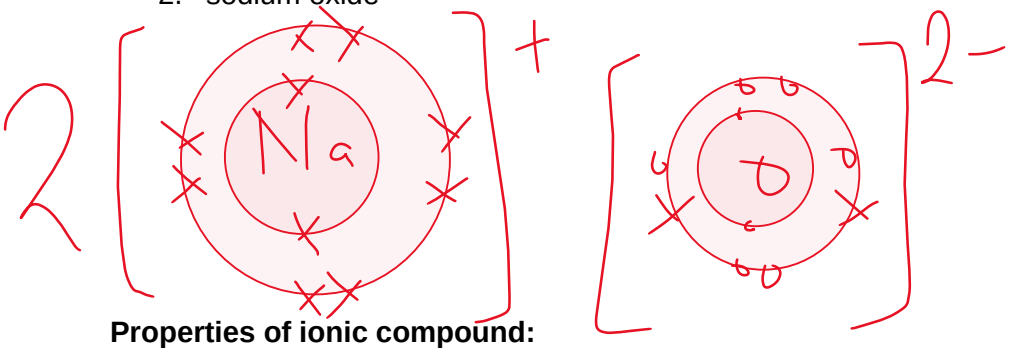
- **Transfer of electron(s)** from **metal atom(s) to non-metal atom(s).**
- **Structure: giant ionic lattice structure**

"Dot and cross" diagram of ionic compounds

1. lithium chloride



2. sodium oxide



Properties of ionic compound:

Properties	Explanation
1. **High** melting and boiling point	Large amount of **e**nergy is needed to overcome **Strong electrostatic forces of attraction between oppositely charged ions** Held in a giant lattice **s**tructure
2. **Poor** conductor of electricity in solid state **Good** conductor of electricity in aqueous or liquid (molten) state	Ions are held in fixed positions and are not mobile. Giant lattice structure has broken down and ions are mobile to act as charge carriers

3. **Hard** but **brittle**

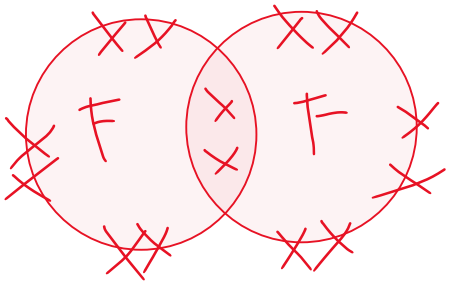
4. Usually **soluble in water.** Usually **insoluble in organic solvent**

Covalent Bonding:

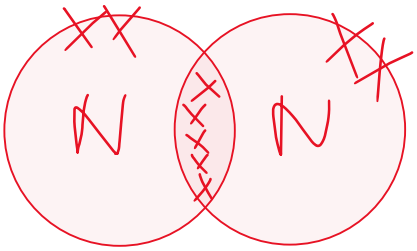
- **<u>sharing</u> of electrons between <u>non-metal atoms</u>.**
- Structure: **simple covalent molecule**

Drawing of covalent molecules using "dot and cross":

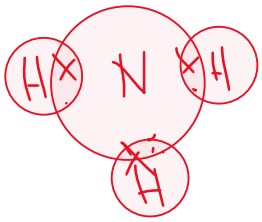
1. A molecule of fluorine, F_2



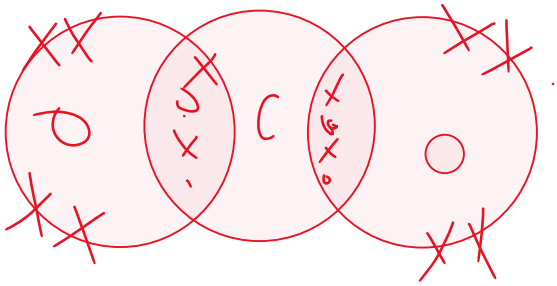
2. A molecule of nitrogen, N_2



3. A molecule of ammonia, NH_3



4. A molecule of carbon dioxide,CO_2



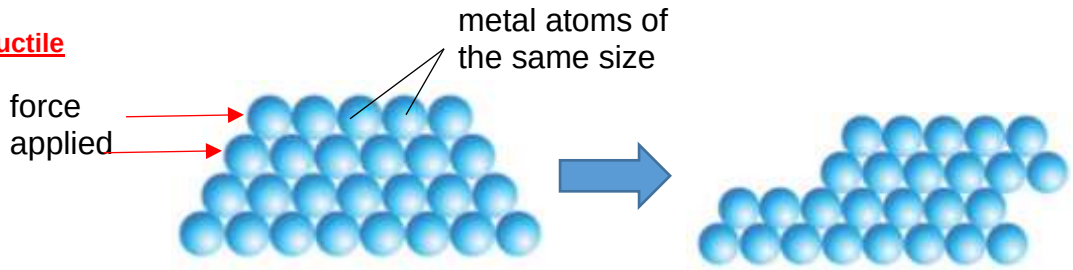
Properties of covalent molecules

Properties	**Explanation**
low melting and boiling point	A <u>small amount of energy</u> is needed to overcome <u>Weak intermolecular forces of attraction</u> between molecules held In <u>simple molecular structure</u>
Poor conductor of electricity in **all** states	<u>No mobile ions or electrons to act as charge carriers</u>
Usually **insoluble in water** Usually **soluble in organic solvent**	

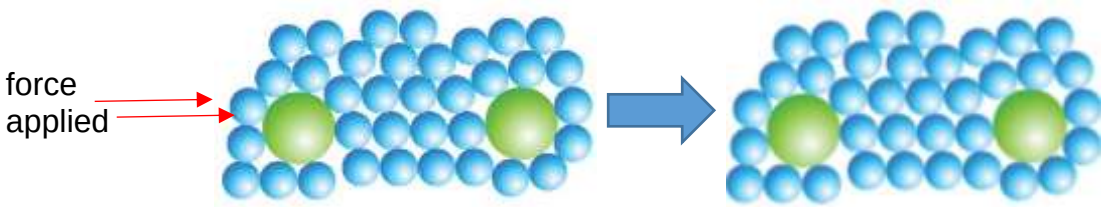
Metals and Alloys:

- **High melting point and boiling point. Alloys, being a mixture, melt over a range of temperatures.**
- **Good conductor of heat**
- **Good conductor of electricity due to sea of delocalised electrons that are mobile throughout the giant metallic lattice structure.**
- **Alloys are harder and stronger than the pure metals.**

In a pure metal, atoms are of the **same** size and packed regularly in neat rows. Layers of atoms **slide** over one another easily when a force is applied. Hence, pure metals are too **malleable / ductile**



In an alloy, atoms are of **different** sizes, hence the regular arrangement of atoms is **disrupted**. Layers of atoms cannot **slide** easily over each other when a force is applied, and so an alloy is **harder** and stronger.



Practice Questions

1 Which two elements combine to form an ionic compound?

A calcium and fluorine
B hydrogen and carbon
C hydrogen and chlorine
D sulfur and oxygen

2 **(a)** When atoms combine with other atoms, they either gain, lose or share a number of electrons. Showing only valence electrons, draw 'dot and cross' diagrams to show the electronic structure of

(ii) oxygen gas; [2]

(ii) magnesium chloride. [2]

(b) Magnesium ribbon burned in oxygen to form a white solid, magnesium oxide. Write a balanced chemical equation, including state symbols for the reaction. [2]

$2\ Mg\ (s) + O_2\ (g) \rightarrow 2MgO\ (s)$

(c) The physical properties of different compounds are shown in the table below.

name of substance	boiling point (°C)
magnesium oxide	3600
oxygen gas	–183

Explain, in terms of bonding, the difference in boiling points between magnesium oxide and oxygen gas.

MgO has a higher melting point than oxygen gas.

Larger amount of energy is needed to overcome strong electrostatic forces of attraction between oppositely charged ions in giant lattice structure of MgO. [1]

Less energy is needed to overcome weak intermolecular forces of attraction between simple molecules in O_2 gas. [1]

[2]