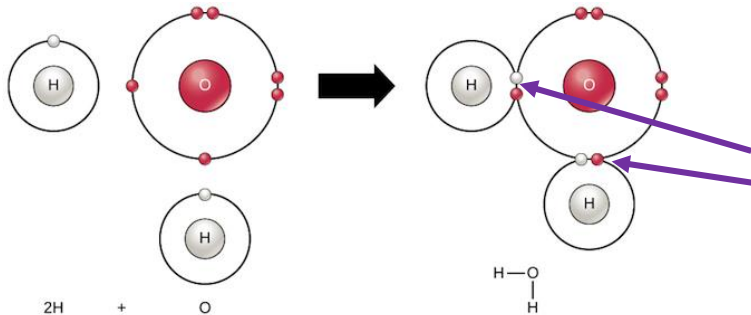


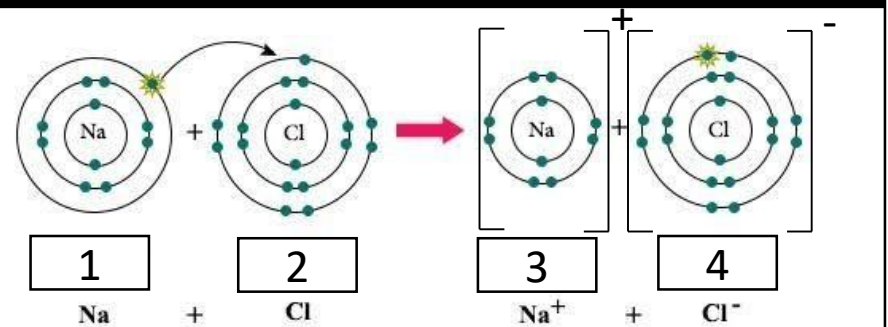
# Chemistry Topic 2: Bonding, Structure, and the properties of matter

## 1. Keywords

Ionic bond	When a metal donates electrons to a non-metal forming opposite charged ions that are attracted to each other
Covalent bond	A shared pair of electrons between two non-metals
Metallic bond	Positive metal ions in a 'sea' of delocalised electrons
Ions	Charged atoms which have either gained or lost electrons
Electrons	Negative particles found in the shells of atoms
Group 0	The unreactive 'noble gases' all elements aim to get to group 0 electron configuration when they react
Dot and cross diagrams	The simplest way we show the bonding in atoms
Polymer	A long chain molecule made up of repeating monomers
Monomer	The small molecules that join together to make polymers
Delocalised	Electrons which are free to move anywhere
Alloy	A mixture of a metal and another element to change its properties



## 2. The process of ionic bonding



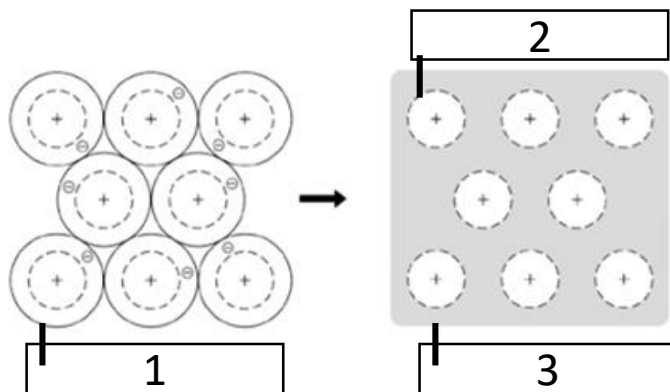
No	Name	Electron movement	Charge	Electron configuration	Does it have a full outer shell?
1	Sodium atom	0	0	2,8,1	No
2	Chlorine atom	0	0	2,8,7	No
3	Sodium ion	Lost 1	+1	2,8	Yes
4	Chloride ion	Gained 1	-1	2,8,8	Yes

## 3. The process of covalent bonding

1	Non metals share their outer unpaired electrons
2	Now all outer shell spaces appear full
3	There is no change in charge. They remain uncharged

#### 4. Metallic bonding

1	Metal atoms
2	Positive metal ions
3	'Sea' of delocalised electrons

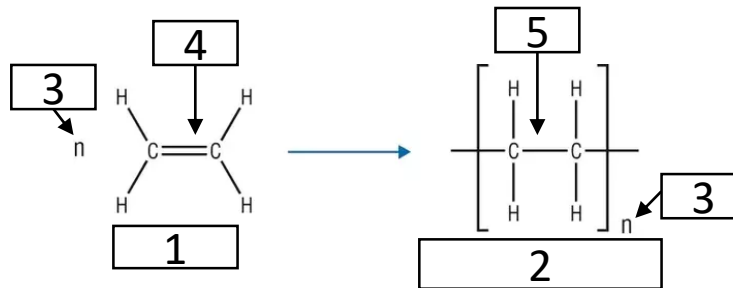


#### 5. State symbols

Symbol	Meaning	Example
(s)	Solid	Gold
(l)	Liquid	Water
(g)	Gas	Hydrogen
(aq)	Aqueous (dissolved in water)	Salt solution

#### 6. Polymers

1	Ethene
2	Poly(ethene) "polythene"
3	A very large number
4	A double bond
5	A single bond

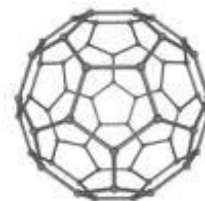


#### 7. General properties of different substances

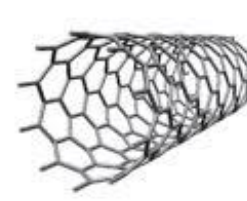
Property	Ionic compounds	Small covalent molecules	Giant covalent structures	Metals and alloys
Density	High	Low	High	High
Melting and boiling point	High	Low	High	High
Conduct electricity	Only melted or dissolved in water	No	No (apart from graphite)	Yes
Conduct heat	No	No	No (apart from diamond)	Yes
Brittle or malleable	Brittle	N/A	Brittle	Malleable
Examples	<ul style="list-style-type: none"> <li>Salt (sodium chloride)</li> <li>Magnesium Sulfate</li> </ul>	<ul style="list-style-type: none"> <li>Chlorine</li> <li>Oxygen</li> </ul>	<ul style="list-style-type: none"> <li>Diamond</li> <li>Graphite</li> <li>Sand</li> </ul>	<ul style="list-style-type: none"> <li>Iron</li> <li>Steel</li> </ul>

## 9. The structure and bonding of carbon

Name of structure	Diamond	Graphite	Graphene + Fullerene
Number of bonds	4	3	3
Any delocalised electrons?	no	yes	Yes
Hardness	Very hard	soft	Flexible and strong
Conduct electricity	No	yes	Yes
Melting point	Very high	High	High
Uses	<ul style="list-style-type: none"> <li>Gems</li> <li>Drill bits</li> </ul>	<ul style="list-style-type: none"> <li>Electrodes</li> <li>Pencils</li> </ul>	<ul style="list-style-type: none"> <li>Electronics</li> <li>Nanotubes</li> </ul>



fullerene



nanotube



graphene

## 10. Bulk and surface properties of nanoparticles (TRIPLE ONLY)

Name	Size in nanometres	Size in standard form
Nanoparticles	1-100 nm	$1 \times 10^{-9}$ m to $1 \times 10^{-7}$ m
Fine particles	100-2500 nm	$1 \times 10^{-7}$ m to $2.5 \times 10^{-6}$ m
Coarse particles ("dust")	2500nm – 10000nm	$2.5 \times 10^{-6}$ m to $1 \times 10^{-5}$ m
Uses of nanoparticles	Example	
<ol style="list-style-type: none"> <li>Medicine</li> <li>Electronics</li> <li>Cosmetics</li> <li>Sunscreen</li> <li>Deodorants</li> <li>Catalysts</li> </ol>	<ol style="list-style-type: none"> <li>Delivering drugs directly to cells</li> <li>Wearable electronics</li> <li>Anti-aging creams</li> <li>Sunscreen without white marks</li> <li>Antibacterial action</li> <li>Fullerene</li> </ol>	

Diamond



Graphite

