CHEMISTRY ONLINE
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CHEMISTRY

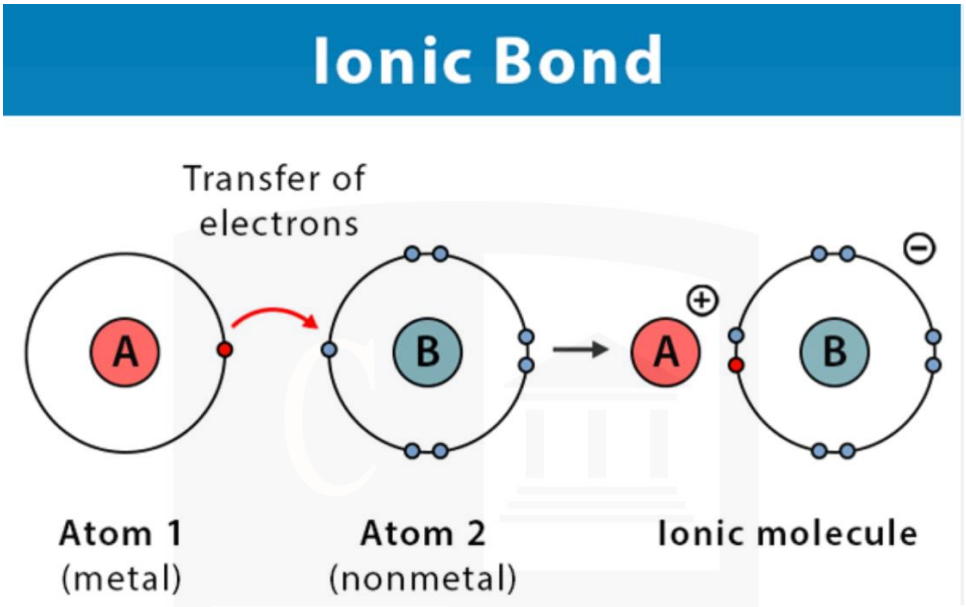
REVISION NOTES

CHEMICAL BONDING -1

Chemical Bonding

Ionic bonding

is a chemical bond formed by the electrostatic attraction between positively and negatively charged ions due to the transferring of one or more electrons from the metal to the non-metal.



Note: Metal atoms lose electrons to form cations. Non-metal atoms gain electrons to form anions.

Exam point

Question: Why do different ionic compounds have different boiling points?

Answer: It is essential to understand why different ionic compounds have different boiling points. Ionic bonds are stronger and have higher melting points when the ions involved are smaller and/or have higher charges. In the case of MgO and NaCl, MgO has a higher melting point because the ions involved (Mg^{2+} and O^{2-}) are smaller and have higher charges than those in NaCl (Na+ and Cl-). This means the ionic bond between Mg^{2+} and O^{2-} in MgO is stronger and requires more energy to break, resulting in a higher melting point.

Exam point

Students should be able to write down the atom's electronic configuration and the same atom in ion form.

Exam Question

The nitrates of lithium, rubidium and strontium are all white solids. The compounds are held together by ionic bonds.

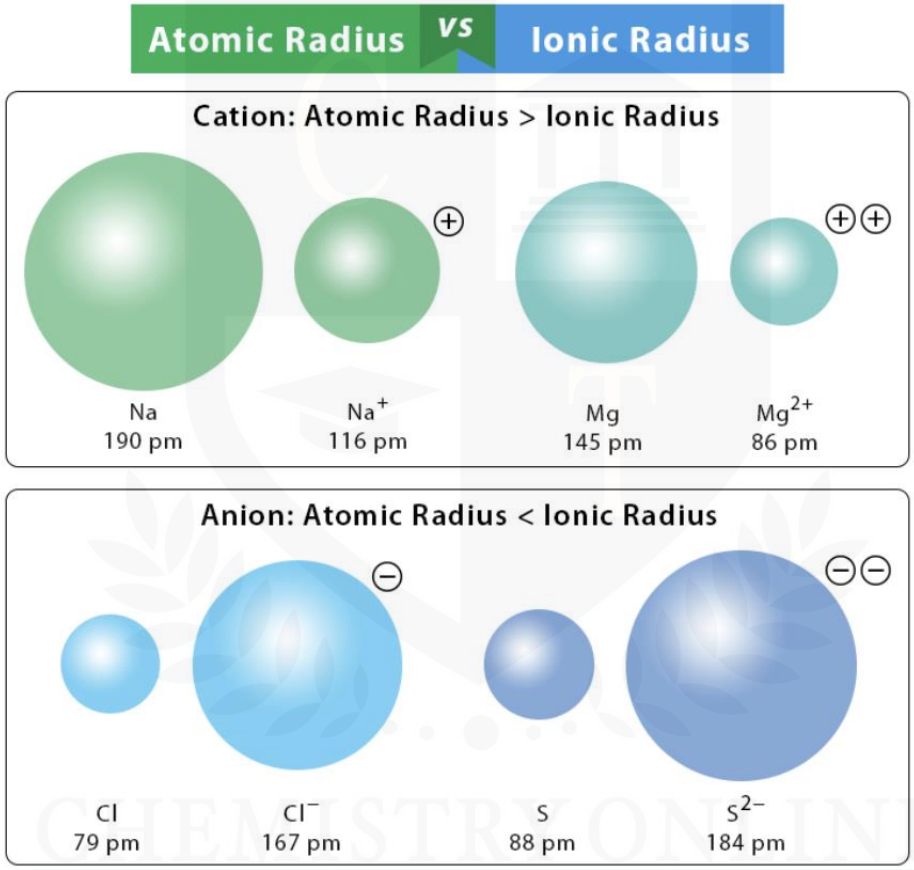
State the meaning of the term 'ionic bond'.

(Please note that if you're looking for more exam-style questions, you can visit the resources page on Chemistryonlinetuition.com)

Ionic Radius

Positive ions are smaller than their corresponding atoms because they have one less electron shell, resulting in a greater net force that holds the remaining electrons more closely.

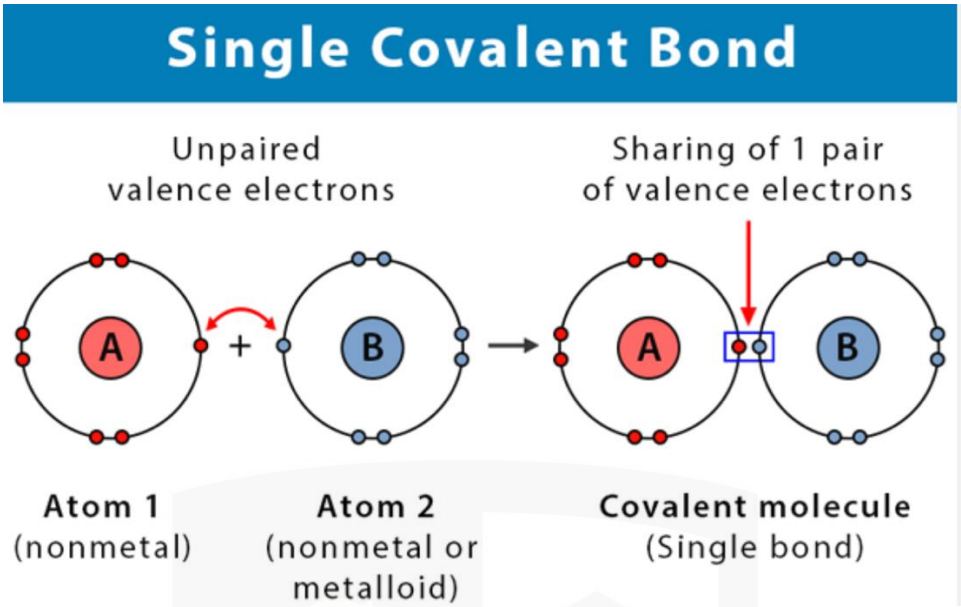
Negative ions formed from groups five to seven are larger than their corresponding atoms. This is because negative ions have more electrons than their corresponding atoms but the same number of protons. As the pull of the nucleus is distributed over more electrons, the attraction per electron is less, resulting in a larger ion.



Covalent bonding

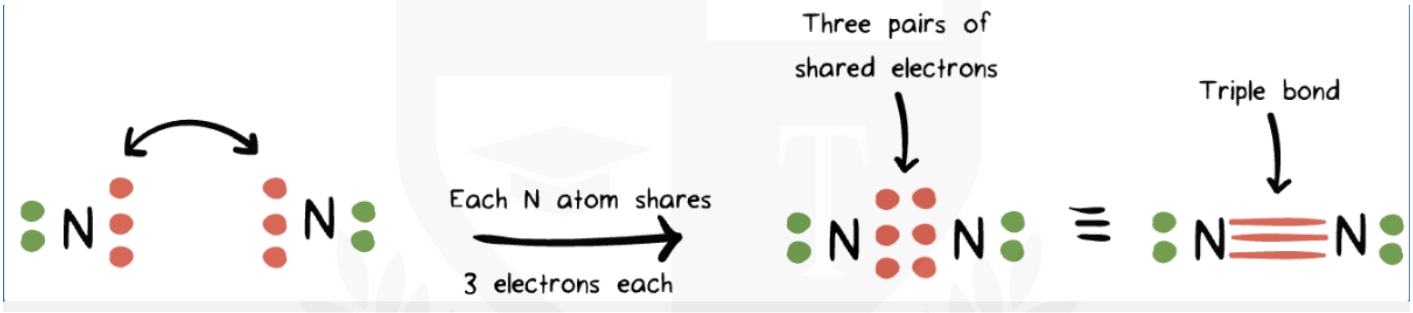
A covalent bond is formed when two atoms share a pair of electrons. It is a chemical bond involving the sharing of valence electrons between atoms.

A single covalent bond contains a shared pair of electrons.



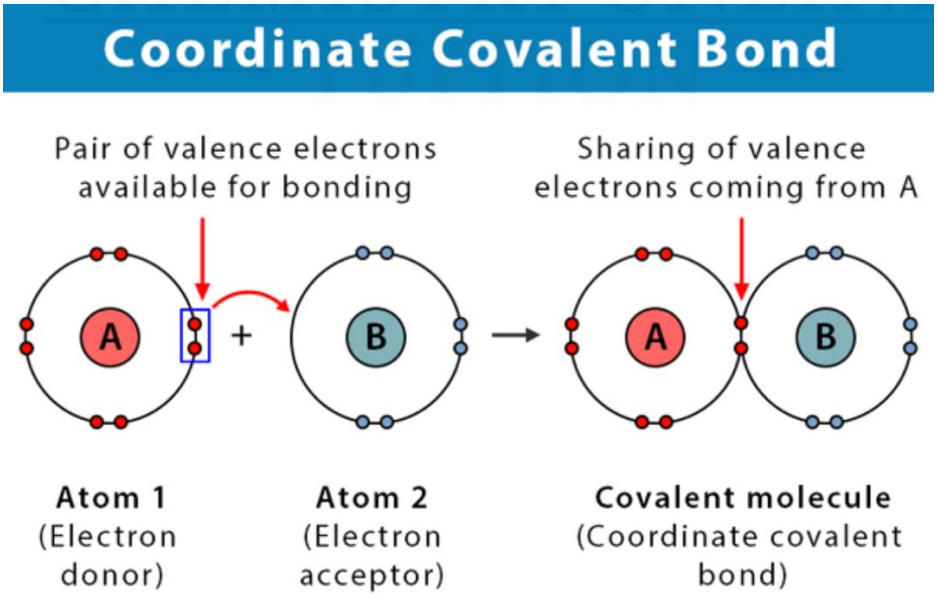
Examples: H_2, Cl_2, Br_2, I_2, HCl, NH_3, CH_4, and C_2H_6

Multiple bonds contain multiple pairs of electrons.



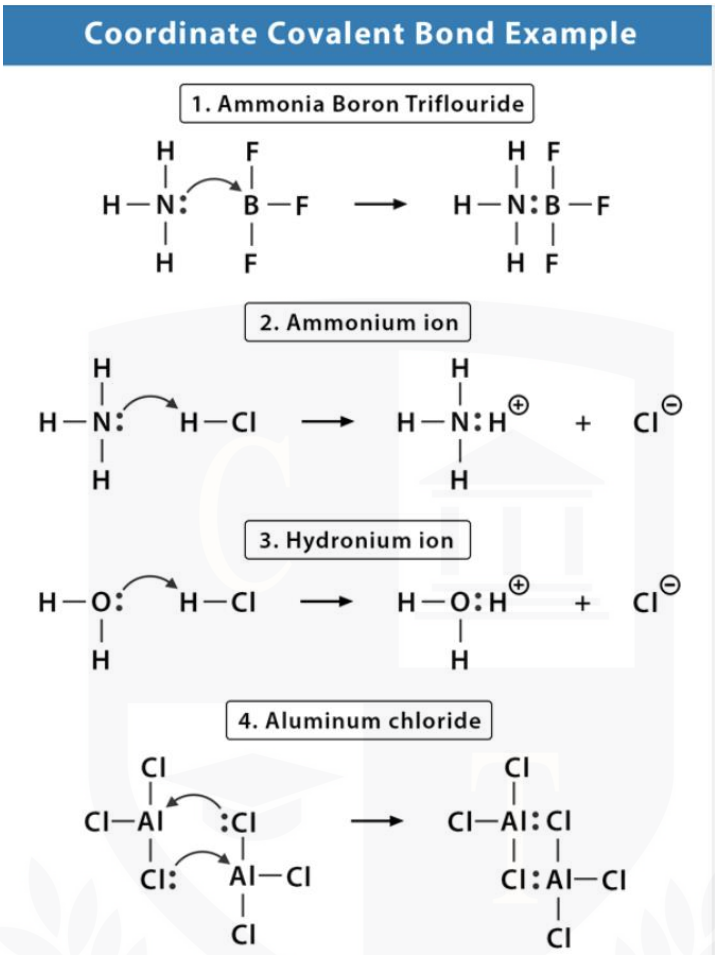
Examples: O_2, CO_2, SO_2,N_2

A coordinate (dative covalent) bond contains a shared pair of electrons, with both electrons supplied by one atom.



Exam point

You should be able to draw the dative covalent bond for NH_4^+, H_3O+, NH_3BF_3, Dimer Al_2Cl_6



Exam Question

Draw a dot-and-cross diagram for hydrazine, showing the outer electrons only.

Use crosses (×) to represent the electrons from nitrogen and dots (•) to represent the electrons from hydrogen.

Draw a diagram to show how two $AlCl_3$ molecules are joined together in the dimer.

State what is meant by the term covalent bond.

Graphite

Structure and bonding:
Graphite has a giant covalent structure in which:

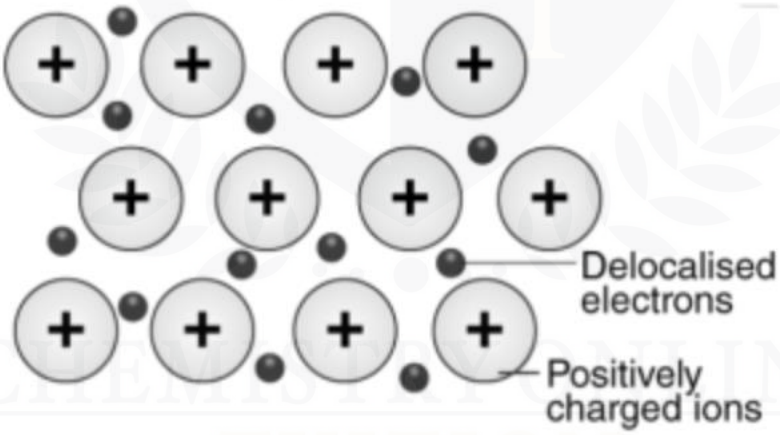
- each carbon atom is joined to three other carbon atoms by covalent bonds
- the carbon atoms form layers with a hexagonal arrangement of atoms
- the layers have weak forces between them

Properties and uses

- The delocalized electrons can freely move through the structure, so graphite can *conduct* electricity. This makes graphite useful for *electrodes* in batteries and for electrolysis.
- The layers in graphite can slide over each other because the forces between them are weak. This makes graphite slippery, so it is useful as a *lubricant.*

Metallic bonding

The metallic bond is the electrostatic attraction between positive metal ions and delocalized electrons.



The strength of metallic bonding is influenced by three primary factors:

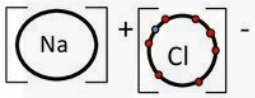
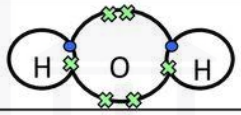
1. The number of protons in an atom determines the strength of its nuclear attraction. In other words, the more protons an atom has, the stronger its bond will be.

2. Number of delocalized electrons available per atom. The valence electrons contribute to the delocalized electron sea in a metallic bond.

3. Size of ion.
The smaller the ion, the stronger the bond.

Example

Mg has a stronger metallic bond than Na, which results in a higher melting point. This is because there are more electrons in the outer shell of Mg that are released into the sea of electrons, making the metallic bond stronger. Additionally, the Mg ion is smaller and has one more proton, resulting in a stronger electrostatic attraction between the positive metal ions and the delocalized electrons. Therefore, more energy is needed to break these bonds.

Property \ Bonding Type	Ionic	Covalent (simple)	Metallic
Which types of atoms does it involve?	Metal and Non-metal atoms	Non-metal atoms only	Metal atoms only
How are they structured?	Form giant lattices that are brittle so are easy to crush	Form molecules with weak forces of attraction so are mainly gases and liquids	Forms a strong lattice structure
An example of the bonding type is			
What is the melting point or boiling point like?	High melting point and boiling point	Low melting point and boiling point	High melting point and boiling point
Are they magnetic?	Not magnetic	Not magnetic	Some are magnetic
Are they soluble in water?	Many are soluble in water	Are not soluble in water	Are not soluble in water
Do they conduct electricity when solid liquid, gas or dissolved?	Will conduct electricity when molten or dissolved in water	Will not conduct electricity	Will conduct electricity when solid or molten
Give an example substance with a use	Sodium chloride Used to flavour food	Water Needed for life	Copper Used for wiring electrical appliances

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Exam Question

Describe the bonding in the element chromium and use your answer to justify why it has such a high melting temperature.

I am Sorry !!!!

State all the conditions under which magnesium bromide conducts electricity.

Draw a dot-and-cross diagram to show the bonding in magnesium bromide.

Only outer shell electrons are required.

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