

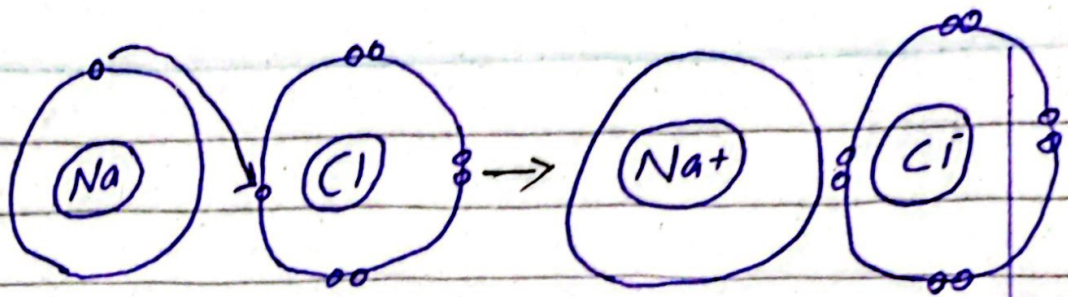
Why do atoms form bonds? Name three major types of chemical bonds.

The reason atoms form bonds:

Atoms form bonds to reach the most stable (lowest-energy) state. They achieve this by filling their outer electron shell, often following the octet rule (8 electrons, except <sup>for</sup> hydrogen and helium, which need 2). They do this by gaining, losing or sharing electrons.

Example:

For example, sodium (Na) has one electron in its outer shell and loses it to achieve stable configuration, becoming a positively charged ion ( $\text{Na}^+$ ). Chlorine (Cl) has seven electrons and gains one to become a negatively charged ion ( $\text{Cl}^-$ ). The opposite charges of  $\text{Na}^+$  and  $\text{Cl}^-$  attract each other, forming an ionic bond and resulting in sodium chloride ( $\text{NaCl}$ ). Thus, atoms bond to achieve a stable electron arrangement, as in the ionic bonding of sodium and chlorine.



Three major types of chemical bonds:

i) Ionic bonds:

These form when one atom transfer an electron to another atom. For example, the bond between sodium and chlorine to form NaCl.

ii) Covalent bonds:

These form when atom shares electrons instead of transferring them completely. For example, the bond between hydrogen and oxygen atoms to form a water molecule (H<sub>2</sub>O).

iii) Metallic bonds: Metallic bonds form in metals where valence electrons move freely through the structure. For example, in copper (Cu), the free moving electrons keep the copper ions bonded in a solid structure.

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What are longitudinal waves, electromagnetic radiations and Gamma radiations? Discuss them.

### 1) Longitudinal waves:

Longitudinal waves are waves where particle displacement is parallel to the direction of wave propagation.

Characteristics:

- i) Longitudinal waves have regions of compression (particle close together) and rarefaction (particles spread apart).
- ii) These waves need a medium (solid, liquid or gas) to travel.
- iii) Sound waves and seismic P-waves are common examples of longitudinal waves.

### 2) Electromagnetic radiations:

Electromagnetic radiation consist of waves of the electromagnetic field that can travel through a vacuum at the speed of light.

Characteristics:

- i) Electromagnetic radiations exhibit

both wave like properties, such as wavelength and frequency, and particle-like properties, like photons.

ii) The electromagnetic spectrum includes radio waves, microwaves, infrared, visible light, ultraviolet, x-rays and gamma rays.

iii) In a vacuum, these waves travel at approximately  $3 \times 10^8$  meters per second.

### 3) Gamma Radiations:

Gamma radiation is a type of electromagnetic radiation with the highest energy and shortest wavelength in the electromagnetic spectrum.

characteristics:

i) Gamma rays are produced by the decay of radioactive nuclei and other high-energy processes in the universe.

ii) These rays have very high penetrating

power and require heavy shielding, such as lead or concrete, to be stopped.

iii) They are used in medical treatments like cancer therapy, industrial inspection and research.

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