4.2 - Covalent bonding

A covalent bond forms by atoms sharing electrons

The octet rule states that when atoms make a bond, they bond to achieve an octet shell with eight electrons.

\[ H^+ + \text{ion} \rightarrow H_2^+ \]

How does this diagram relate to a covalent bond?

- **Covalent bond**

Atoms can share more than one pair of electrons to form multiple bonds:

- **Double bond**
- **Triple bond**

**Short bonds are strong bonds**

- **Bond length** is the distance between the nuclei of the bonded atoms.
- **Bond strength** is the amount of energy required to break the bond.

We can now see that there is a continuum between ionic bonding and pure covalent bonding instead of a clear-cut midpoint. This can be used to explain the unusual properties of some substances.

**Lowest energy point = favoured distance between atom = length of the "covalent bond"**

**Polar bonds result from unequal sharing of electrons**

We can represent polarity with arrows showing the direction of electron pull.

**Exercises**

10. Which substance contains only ionic bonds?
   - A. NaHCO₃
   - B. H₂PO₄
   - C. NH₄Cl
   - D. CaCO₃

11. Which of the following molecules contains the strongest bond between carbon and oxygen?
   - A. CO₂
   - B. H₂CO₄
   - C. CO₃
   - D. CH₃COOH

12. For each of these molecules, identify any polar bonds and label them using L₁ and L₂ appropriately.
   - (a) H₂O
   - (b) H₂O₂
   - (c) CF₃
   - (d) CO₂

13. Use the electronegativity values in Section B of the B data booklet to predict which bond is in each of the following pairs is more polar.
   - (a) H₂O or H₂O₂
   - (b) SnI₄ or SnCl₄
   - (c) H₂O or H₂Mg₂