Science 10

Unit A: Energy and matter in chemical change

Polarity and solubility

Oil and water

- After shaking, oil forms droplets in water and then separates back into a layer on top.
- Oil floats because it is less dense than water, and polarity explains why the liquids fail to mix.
- Water is polar and cooking oil is mostly non-polar, so their particle attractions favour separation.

Molecular polarity

- Water is polar because its bent molecule has a partially negative oxygen side and partially positive hydrogen sides.
- Hydrogen bonds are attractions between neighbouring polar molecules; the covalent bonds inside one water molecule are a separate, stronger link.
- Call a substance soluble only for a named solvent and conditions.
- Sodium nitrate is soluble in water under typical classroom conditions.

Key terms

polar

Having an uneven distribution of electrical charge.

hydrogen bond

Attraction involving a partially positive hydrogen and an electronegative atom on another particle.

soluble

Able to dissolve to an appreciable extent in a stated solvent and condition.

insoluble

Dissolving only to a very small extent in a stated solvent and condition.

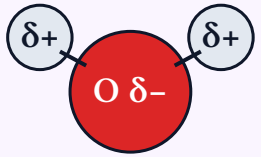
Key terms

like dissolves like

Guideline that substances with similar polarity tend to dissolve one another.

From bond polarity to water's properties

- Oxygen attracts shared electrons more strongly than hydrogen, so each O-H bond has partial charges.
- Water's bent shape keeps the bond dipoles from cancelling, making the whole molecule polar.
- Attractions between neighbouring water molecules require energy to disrupt, helping explain water's high heat capacity and evaporative cooling.



hape ⟶ polar molecule; explains cohesion and many solubility pa

Solubility charts as evidence

- Identify the cation and anion in the proposed ionic compound.
- Locate the ion combination on the approved chart and check any listed exception.
- Use the chart to assign aqueous or solid state; trust the chart over the idea that “all ionic compounds dissolve.”

Solubility chart check

1. Name cation and anion
2. Find the pair on the chart

$Ag^+ + Cl^-$

→ **insoluble (exception)**

Check listed exceptions before deciding

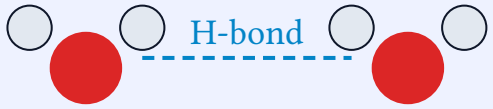
Precipitate prediction

- Mix $AgNO_3(aq)$ and $NaCl(aq)$: list Ag^+, NO_3^-, Na^+, and Cl^- before predicting new ion pairs.
- Ion exchange gives possible products $AgCl$ and $NaNO_3$; the solubility chart identifies $AgCl$ as relatively insoluble.
- Write $AgNO_3(aq) + NaCl(aq) \longrightarrow AgCl(s) + NaNO_3(aq)$, then verify atoms and charge are accounted for.



Water and energy transfer

- Equal energy input usually produces a smaller temperature change in water than in many other common substances.
- Part of the transferred energy disrupts attractions between water molecules before their average motion increases greatly.
- In lakes and organisms, this behaviour moderates temperature; evaporation can remove energy with escaping water molecules.



δ+ on H attracted to δ− on O of neighbouring molecule

Polarity and solubility retrieval check

- Explain why oil floating on water and oil staying separate from water require two different ideas.
- Use the solubility chart to predict whether AgCl forms when $AgNO_3(aq)$ and NaCl(aq) mix.
- State what else you need, besides conductivity, to identify dissolved ions or judge whether something is toxic.

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