

Invisible Ink

Key stage 3

Scheme of work unit	7E	Learn about acids and alkalis as classes of chemicals with distinct properties and uses. The use indicators to classify solutions as acidic, alkaline or neutral. Use the pH scale to compare the acidity and alkalinity of different solutions. Begin to explore neutralisation. (Can be applied to unit 7F – Simple Chemical Reactions).
Intended learning	7E	Investigate acids and bases, and their uses in revealing invisible inks. Can look at the neutralisation reaction. Also look at natural indicators and the colour changes that occur with acids and bases.

Introduction notes

- Commonly acids and bases are used as invisible ink, and these are subsequently revealed by indicators.
- Indicators are chemical compounds which are different colours when in contact with either acids or bases.
- Indicators are also used in chemistry to show when chemical reactions are finished.
- An acid is traditionally considered any chemical compound that, when dissolved in water, gives a solution with a pH less than 7.0, with the generic formula $HA[H^+A^-]$.
- Common examples include acetic acid (in vinegar) and sulphuric acid (in car batteries).
- Generally acids have the following properties:
 - Taste: Acids generally have a sour taste.
 - Touch: Strong or concentrated acids often produce a stinging feeling.
 - Reactivity: Strong acids react aggressively with or corrode many metals.
 - Electrical Conductivity: Acids, while not usually ionic compounds are electrolytes.
 - Turn litmus paper (an indicator) red.
- Most commonly, acids are thought of as a substance that can donate protons.
- Common examples are sodium hydroxide and ammonia.
- Bases can be thought of as the chemical opposite of acids.
- This is because the effect of an acid is to increase the hydronium ion concentration in water, and the effect of a base is to reduce it.
- A reaction between an acid and base is called neutralization.
- Bases react with acids to produce water and salts (or their solutions).
- Generally bases have the following properties:
 - Taste: Bitter taste
 - Touch: Slimy or soapy feel on fingers
 - Reactivity: Caustic on organic matter, react violently with acidic substances.
 - Electrical conductivity: Aqueous solutions or molten bases dissociate into ions and conduct electricity.
 - Turn litmus paper (an indicator) blue.

Resources required

- Diced red cabbage
- Lemon
- Bicarbonate of soda
- Warm water
- Pestle and Mortar
- Paper
- Plastic cups or containers
- Paint brushes

Practical notes

Care needs to be taken to ensure the water is not too warm as to scald the pupils. Acids and bases are irritants, and if eye contact occurs the eye must be rinsed thoroughly.

Further Work

Investigate the use of other readily available materials as invisible inks. Explore which are acids and which are bases.

Use indicators to classify solutions as acidic, alkaline or neutral.

Answers:

1. Indicators are chemical compounds that are different colours when in contact with either acids or bases.
2. Acidic.
3. Bases react with acids to produce water and salts (or their solutions). A neutralisation reaction.
4. $\text{HCl}_{(\text{aq})} + \text{NaOH}_{(\text{aq})} \rightarrow \text{H}_2\text{O}_{(\text{l})} + \text{NaCl}_{(\text{aq})}$
5. Vinegar – Acidic
Coca Cola – Acidic
Water – Neutral
Soap – Basic
Lemon – Acidic
Lime Water – Basic
Bleach – Basic
6. Use an indicator, e.g., Methyl Orange, or use Litmus paper.