

Acid-Base & Acid-Carbonate Reactions

Introduction:

Acids and bases are two groups of chemical substances. They are opposite ends on the scale of acidity (pH scale). In the middle of the scale are neutral substances and solutions. The most important neutral substance is water.

Acids contain hydrogen atoms which detach to form hydrogen ions (H^+) when the acid is dissolved.

Bases are another family of chemicals which have the opposite property to acids, they neutralize acids. When a base dissolves in water it is called an ALKALI and it releases hydroxide ions (OH^-).

Acids and bases change the colours of dyes called indicators. An indicator is a dye that changes colour and shows if solutions are acids or bases. A substance that is neither an acid nor a base is said to be neutral.

Adding a base to an acid is an example of a neutralisation reaction. In a neutralisation reaction an acid and a base react to form a salt and water.



The pH scale measures the amount of acidity of a solution. The pH scale goes from 0 - 14. The strongest acid has a pH of 0 and the strongest base has a pH of 14. Neutral is pH 7. The further away from pH 7 the more acidic or basic the solution is.

Carbonate compounds react with acids. The reaction produces a salt, water and carbon dioxide gas.



Aim:

The purpose of this experiment is to investigate the reactions between acids and bases and acids and carbonates. For this experiment you will:

- determine the pH of various acids
- determine the pH of acid base reactions
- observe acid-carbonate reactions
- observe and determine the gas produced in an acid-carbonate reaction

Materials:

- indicator solution
- hydrochloric acid (HCl)
- sulfuric acid
- nitric acid
- potassium hydroxide
- sodium hydroxide
- limewater
- test tubes
- rubber stoppers
- gas tube
- small beaker
- droppers
- calcium carbonate
- magnesium carbonate
- copper carbonate
- graduated cylinder

Method:

ACID-BASE REACTIONS -

1. Pour 5 mL of hydrochloric acid (HCl) into a test tube.
2. Determine pH by adding 2 drops of 2 indicator into the acid and observing colour.
3. Carefully pour 5 mL of sodium hydroxide (NaOH) into a small beaker.
4. Using a dropper, slowly add NaOH to the HCl and observe and record any colour changes.
5. Determine pH once all the NaOH is added to the HCl.
6. Repeat steps 1-5 using sulfuric acid (H₂SO₄) and potassium hydroxide (KOH).
7. Repeat steps 1-5 using nitric acid (HNO₃) and NaOH.

ACID-CARBONATE REACTION

1. Carefully pour 1 cm of hydrochloric acid (HCl) into 3 test tubes. Stand test tubes in a test tube rack.
2. Carefully pour about 5 cm of limewater (Ca(OH)₂) into 3 more test tubes.
3. Carefully blow bubbles into the limewater using a straw and record observations.
4. Add a small amount (about the size of a pea) of magnesium carbonate (MgCO₃), calcium carbonate (CaCO₃) and copper carbonate (CuCO₃) to each HCl filled test tube (1 carbonate per test tube!).
5. Test for carbon dioxide (CO₂): Immediately after adding carbonate, seal HCl test tube with rubber stopper connected to gas tube. Place the open end of the gas tube directly into the test tube filled with limewater.
6. Observe and record results for reaction and carbon dioxide test in table, including the rate (speed) of reaction and any colour or appearance changes.
7. Repeat steps 1 - 5 with 1 cm of sulfuric acid (H₂SO₄) in each test tube.

Observations:

ACID-BASE TABLE

ACID	COLOUR (once indicator is added)	BASE	OBSERVATIONS	COLOUR (once all base is added)
HCl		NaOH		
H ₂ SO ₄		KOH		
HNO ₃		NaOH		

ACID-CARBONATE TABLE

ACID	CARBONATE	OBSERVATIONS	CO ₂ TEST RESULTS
HCl	MgCO ₃		
HCl	CaCO ₃		
HCl	CuCO ₃		

Conclusions:

1. What is a neutralisation reaction?

2. What products were formed when acids and bases reacted?

3. Complete the acid-base reactions (don't forget to balance!):



4. What products were formed when metal carbonates reacted with acids?

5. Complete the acid-carbonate reactions:

