

7 Acids, bases and salts

7.1 The characteristic properties of acids and bases

1 Describe the characteristic properties of acids in terms of their reactions with:

(a) metals

- Acid+metal $\longrightarrow$ salt+hydrogen

(b) Bases(neutralisation)

- Acid+base $\longrightarrow$ salt+water

(c) Carbonates

- Acid+carbonate $\longrightarrow$ salt+water+carbon dioxide
- They have a pH less than 7
- They have a sour taste
- When acids are dissolved in water, they form hydrogen ions, making the solution acidic.

2 Describe acids in terms of their effect on:

(a) litmus

- Turns red when acid is added.

(b) Thymolphthalein

- When acid is added, thymolphthalein which is initially blue turns colourless.

(c) methyl orange

- It is initially orange. turns red when acid is added.

3 State that bases are oxides or hydroxides of metals and that alkalis are soluble bases

NOTE: EVERY alkali is a base but Not all bases are alkalis.

4 Describe the characteristic properties of bases in terms of their reactions with:

(a) Acids

- $\text{Acid} + \text{base} \longrightarrow \text{salt} + \text{water}$

(b) ammonium salts

- $\text{Ammonium salt} + \text{base} \longrightarrow \text{salt} + \text{water} + \text{ammonia}$

5 Describe alkalis in terms of their effect on:

(a) litmus

- Turns blue when base is added

(b) Thymolphthalein

- Turns blue when base is added.

(c) methyl orange

- Turns yellow when base is added.

6 State that aqueous solutions of acids contain H^+ ions and aqueous solutions of alkalis contain OH^- ions

7 Describe how to compare hydrogen ion concentration, neutrality, relative acidity and relative alkalinity in terms of colour and pH using universal indicator paper

- A pH greater than 7 means that a substance is more basic(has a higher relative alkalinity). The colour of universal indicator will be green-blue, blue, violet or purple if the substance is basic.
- A pH less than 7 means that a substance is more acidic(has a higher relative acidity). The colour of universal indicator will be green-yellow, red, yellow or orange if the substance is acidic.
- A pH of exactly 7 means that a substance is neutral . The colour of universal indicator will be green if the substance is neutral.

8 Describe the neutralisation reaction between an acid and an alkali to produce water, $H^+_{(aq)} + OH^-_{(aq)} \rightarrow H_2O_{(l)}$

9 Define acids as proton donors and bases as proton acceptors

10 Define a strong acid as an acid that is completely dissociated in aqueous solution and a weak acid as an acid that is partially dissociated in aqueous solution

- “partially dissociated” means that the reaction is reversible. This means that the ions can form the weak acid again.

11 State that hydrochloric acid is a strong acid, as shown by the symbol equation, $HCl_{(aq)} \rightarrow H^+_{(aq)} + Cl^-_{(aq)}$

12 State that ethanoic acid is a weak acid, as shown by the symbol equation, $CH_3COOH_{(aq)} \rightleftharpoons H^+_{(aq)} + CH_3COO^-_{(aq)}$

7.2 Oxides

1 Classify oxides as acidic, including SO_2 and CO_2 , or basic, including CuO and CaO , related to metallic and non-metallic character

- Metal oxides are basic which react with water to form basic solutions.
- Non-metal oxides are acidic EXCEPT, carbon monoxide, nitric oxide and nitrous oxide which are neutral oxides which do not form acidic solution when added to water unlike non-metal oxides.

2 Describe amphoteric oxides as oxides that react with acids and with bases to produce a salt and water AND 3 Classify Al_2O_3 and ZnO as amphoteric oxides

- These oxides can act as BOTH acids and bases.
- $\text{Al}_2\text{O}_3 + 6\text{HCl} \rightarrow 2\text{AlCl}_3 + 3\text{H}_2\text{O}$ (Al_2O_3 is a base).
- $\text{Al}_2\text{O}_3 + 2\text{NaOH} + 3\text{H}_2\text{O} \rightarrow 2\text{Na}[\text{Al}(\text{OH})_4]$ (Al_2O_3 is an acid)

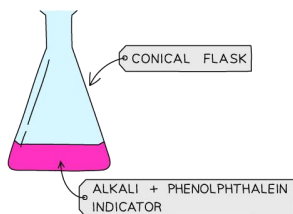
7.3 Preparation of salts

1 Describe the preparation, separation and purification of soluble salts by reaction of an acid with:

(a) an alkali by titration

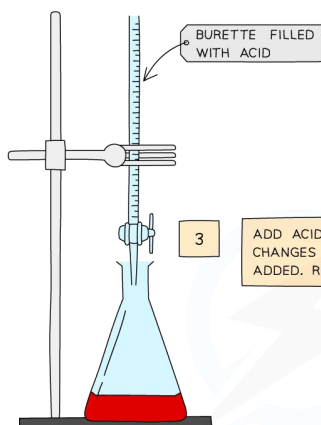
1

ADD ALKALI + INDICATOR TO CONICAL FLASK USING A PIPETTE



2

ADD ACID TO BURETTE, NOTING THE STARTING VOLUME

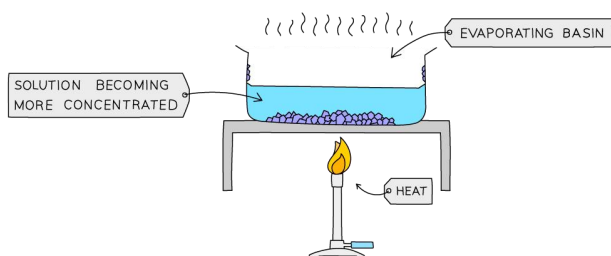


3

ADD ACID TO ALKALI SLOWLY UNTIL INDICATOR CHANGES COLOUR. CALCULATE VOLUME OF ACID ADDED. REPEAT STEPS 1-3 WITHOUT INDICATOR

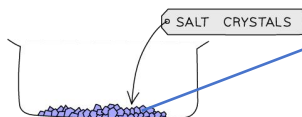
4

TRANSFER SOLUTION TO AN EVAPORATING BASIN, HEAT TO PARTIALLY EVAPORATE WATER.



5

REMOVE EVAPORATING BASIN FROM HEAT AND ALLOW FILTRATE TO DRY AND CRYSTALLIZE



These crystals are dried with filter paper as well

(b) excess metal



(c) excess insoluble base

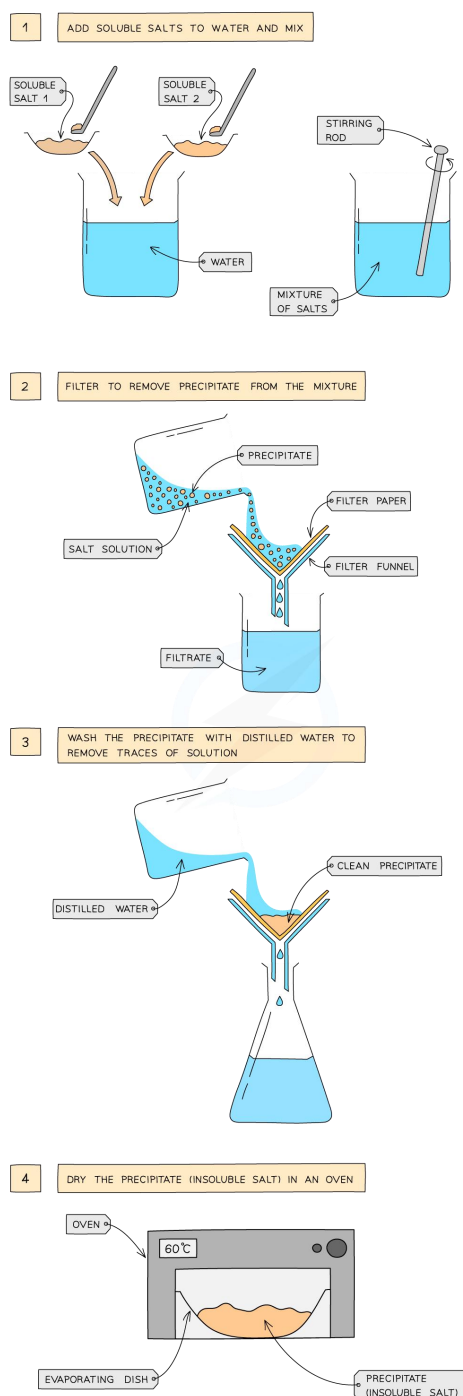


(d) excess insoluble carbonate**2 Describe the general solubility rules for salts:**

- (a) sodium, potassium and ammonium salts are soluble
- (b) nitrates are soluble
- (c) chlorides are soluble, except lead and silver
- (d) sulfates are soluble, except barium, calcium and lead
- (e) carbonates are insoluble, except sodium, potassium and ammonium
- (f) hydroxides are insoluble, except sodium, potassium, ammonium and calcium (partially)

3 Define a hydrated substance as a substance that is chemically combined with water and an anhydrous substance as a substance containing no water

4 Describe the preparation of insoluble salts by precipitation



5 Define the term water of crystallisation as the water molecules present in hydrated crystals, including $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ and $\text{CoCl}_2 \cdot 6\text{H}_2\text{O}$

END OF CHAPTER