N5: Acids

pH Scale

The pH scale runs from _____ to _____

It is a measure of the _____ in a solution. It is a logarithmic scale; pH 1 is 10 times more acidic than pH 2, pH 14 is 10 times more alkaline than pH 13.

Water exists in an equilibrium

The   arrow means that the reaction is reversible.
Only a small number of water molecules split into ions. The number of _____ and _____ ions in water is _____, therefore water is neutral, pH _____.

Acids contain _____ _____ ions than _____ ions, their pH is _____ _____ ____

Alkalis contain _____ _____ ions than _____ ions, their pH is _____ _____ _____.

Dilution of acids will _____ the concentration of _____ ions and move the pH _____ closer to _____

Dilution of alkalis will _____ the concentration of _____ ions and move the pH _____ closer to ___

Soluble _____ oxides will form _____, when they dissolve in water _____ form.

Soluble _____ oxides will form _____

? 1. An alkaline solution contains more/less/the same number of hydrogen ions than an acid

2. Adding water to an acidic solution will raise the pH/lower the pH/leave the pH unchanged

3. For each oxide what will be the effect on the pH of water:
   A. Sodium oxide

   B. Carbon monoxide

   C. Sulfur dioxide

   D. Iron (II) oxide
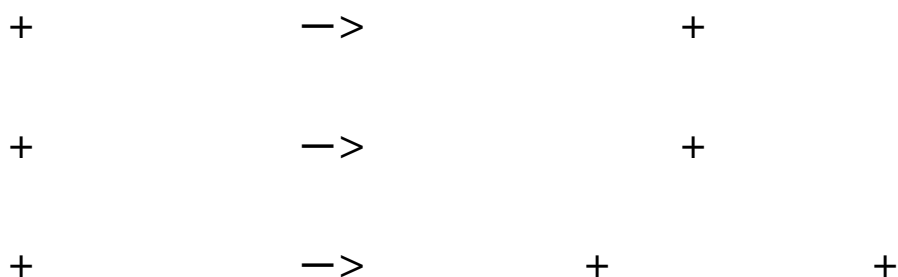
   E. Silicon dioxide

Neutralisation

Substances which neutralise acids are called _____.
_____ which dissolve in water are called _____.

Examples of _____ are _____,
_____, _____ and
_____.

When bases react with acids, water and a salt are produced.

Name of acid	End of salt name
Hydrochloric acid	
Sulfuric acid	
Nitric acid	
Phosphoric acid	
Ethanoic acid	

Basic word equations

+   —>   +

+   —>   +

+   —>   +   +

?

1. Sodium hydroxide + nitric acid —>

2. Magnesium oxide + sulfuric acid —>

3. Copper carbonate + hydrochloric acid —>

4. Lithium hydroxide + phosphoric acid —>

5. Calcium carbonate + nitric acid —>

In solution acids, alkalis and salts split into ions. Ions which do not get involved in the reaction and are present at the start and end unchanged are called _____ ions.

Metal oxides

        +   —>

Metal hydroxides

        +   —>

Soluble carbonates

        +   —>   +
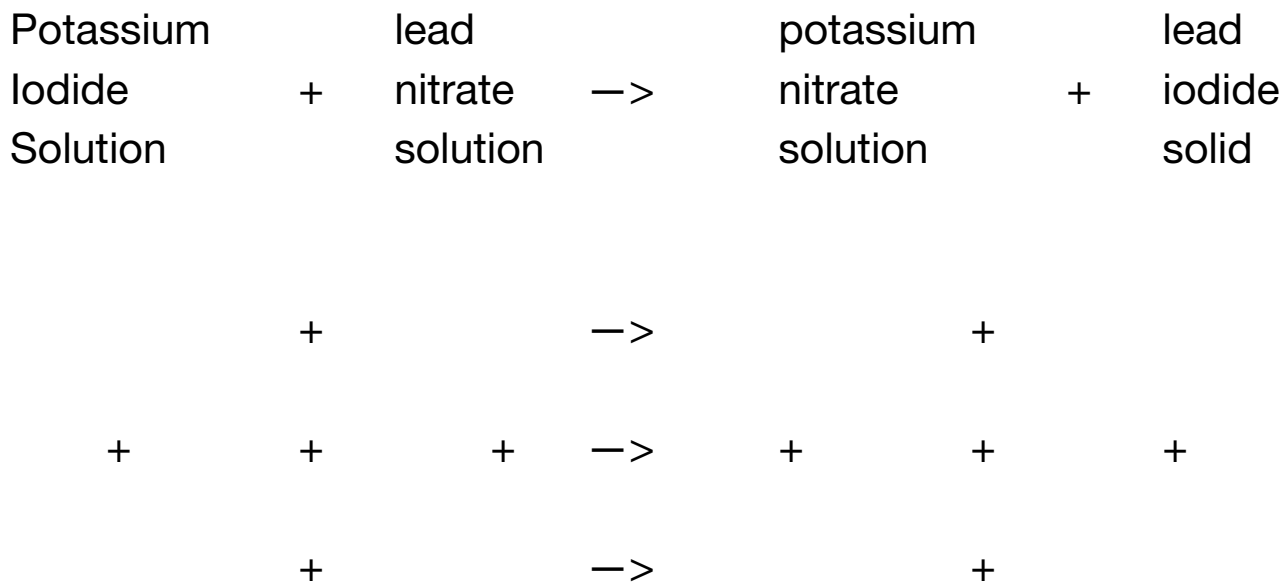
Insoluble metal carbonates

        +   —>   +
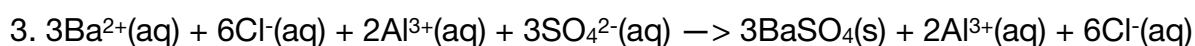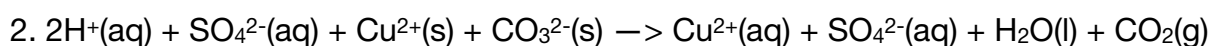
A precipitate is a _____ produced from two solutions.
Spectator ions can also be identified in these reactions.
E.g.

Potassium Iodide Solution	+	lead nitrate solution	—>	potassium nitrate solution	+	lead iodide solid

	+		—>		+	
+	+	+	—>	+	+	+
	+		—>		+	

? Identify the spectator ions and rewrite the equation without them

1. $H^+(aq) + Cl^-(aq) + Na^+(aq) + OH^-(aq) \longrightarrow Na^+(aq) + Cl^-(aq) + H_2O(l)$

2. $2H^+(aq) + SO_4^{2-}(aq) + Cu^{2+}(s) + CO_3^{2-}(s) \longrightarrow Cu^{2+}(aq) + SO_4^{2-}(aq) + H_2O(l) + CO_2(g)$

3. $3Ba^{2+}(aq) + 6Cl^-(aq) + 2Al^{3+}(aq) + 3SO_4^{2-}(aq) \longrightarrow 3BaSO_4(s) + 2Al^{3+}(aq) + 6Cl^-(aq)$
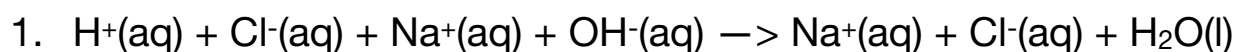
Titrations

Titration reactions involve reacting accurate volumes of solution with each other. Often an indicator is added to see the end point. This allows you to calculate either:

•

•
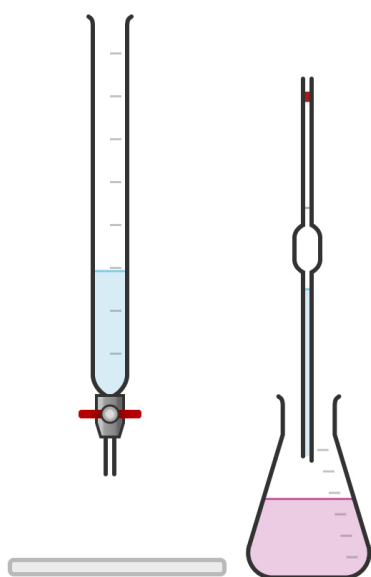
Step 1: Rinse and fill the _____ with one solution

Step 2: Rinse and fill the _____ with the other solution

Step 3: Transfer this to a _____ _____ and add some indicator

Step 4: Read and note the start value of the burette

Step 5: Place the conical flask on a white tile and add $1cm^3$ at a time from the burette with swirling.

Step 5: Stop adding when the colour change occurs, read and note the end value of the burette.

Step 6: Calculate the titre (added volume)

Step 7: Rinse the conical flask and add another aliquot of solution using the pipette. Add indicator.

Step 8: Read and note the start value of the burette, refilling if necessary. Calculate the previous added volume minus 1. Add this volume quickly to the conical flask with swirling.
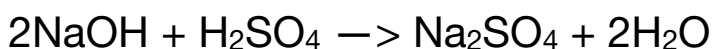
Step 9: Add dropwise with swirling until the colour change and note the final volume. Calculate the titre.

Repeat steps 7 to 9 until you achieve concordant titres, within 0.2 of each other.

Titration calculations

sulfuric
acid

1M sodium
hydroxide,
20ml
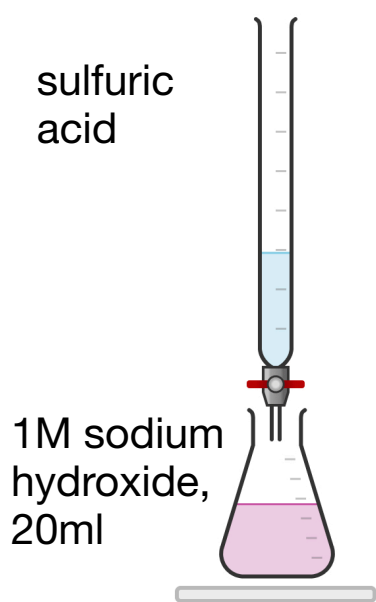
Titration	Start reading (ml)	End reading (ml)	Titre (ml)
1	0	11.5	11.5
2	11.5	22.3	10.8
3	22.3	32.9	10.6

$$2NaOH + H_2SO_4 \longrightarrow Na_2SO_4 + 2H_2O$$

Calculate the concentration of sulfuric acid.

Step 1: Calculate the average titre

Step 2: Calculate the moles of sodium hydroxide (two pieces of information)
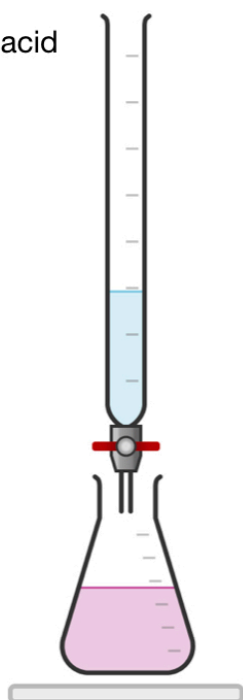
Step 3: Use the mole ratio to find the moles of sulfuric acid

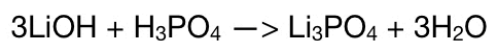Step 4: Calculate the concentration of sulfuric acid (now two pieces of information)

?

Phosphoric acid

1M lithium hydroxide 25 ml

Titrations

Titration	Start reading (ml)	End reading (ml)	Titre (ml)
1	0	18.4	18.4
2	18.4	36.2	17.8
3	0	17.6	17.6

$3LiOH + H_3PO_4 \longrightarrow Li_3PO_4 + 3H_2O$

Calculate the concentration of phosphoric acid

Making salts

Soluble salts can be made in multiple ways.

By carrying out a titration to find the required volumes of acid and alkali, you can repeat it without indicator to make a salt solution. This can then be heated to evaporation to produce a dry salt.

The following process can be used with insoluble bases.