The content on this sheet is assessed on paper 1 only.

Acids and alkalis part 1

3.1—Acids & alkalis in solution

All acids form hydrogen (H^+) ions in solution.

All alkalis form hydroxide (OH^-) ions in solution.

3.2—pH values

All acids have a pH value of below 7.

All alkalis have a pH value of above 7.

Neutral substances have a pH value of 7.

3.3—Indicators

Indicator	Colour in acid	Colour in alkali
Phenol-phthalein	Colourless	Pink
Methyl orange	Red	Yellow
Litmus	Red	Blue

3.4—ions & pH (HT only)

The pH of an acidic substance decreases as the concentration of H^+ ions increases.

The pH of an alkaline substance increases as the concentration of OH^- ions increases.

3.5—pH and H^+ ions (HT only)

As the pH value of a solution increases by 1, the H^+ ion concentration decreases by a factor of 10.

As pH **decreases** by 1, the H^+ ion concentration increases by a factor of 10.

If a solution of pH 2 is diluted by a factor of 1000, the new pH is 5.

3.7—concentrated and dilute (HT only)

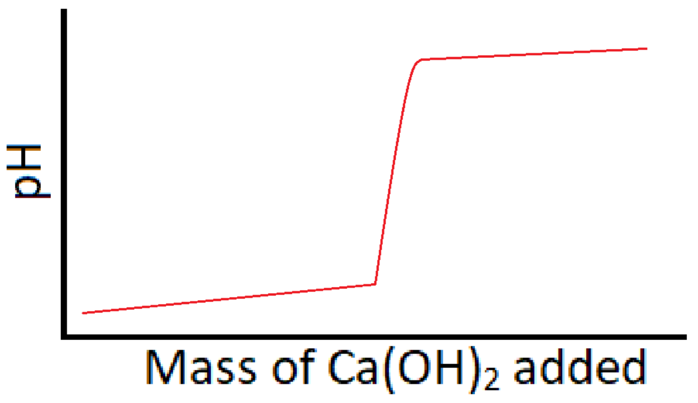
A concentrated solution contains lots of the solute dissolved in the solvent.

A dilute solution contains little of the solute dissolved in the solvent.

You can dilute a solution by adding water (or removing some solute particles).

3.6—CP 2—investigating the effect of powdered $Ca(OH)_2$ on pH

Sketch a graph (right) showing how the pH changes when $Ca(OH)_2$ is added to an acid.



Describe the safety precautions you have to take in this practical (the acid is irritant, and the calcium hydroxide corrosive to the eyes).

Wear safety glasses to protect eyes.

Wash skin if it comes into contact.

Explain why using a pH meter/probe to measure the pH is preferable to universal indicator.

pH meter gives a more precise reading, and a numerical value, rather than a colour.

3.8—strong & weak (HT only)

A strong acid/alkali fully dissociates (splits up to form ions) when dissolved in water.

A weak acid/alkali only partially dissociates (splits up to form ions) when dissolved in water.

This means that a strong acid would have a lower pH value than a weak acid of equal concentration.

3.7 & 3.8: deeper thinking (HT)

Explain how you could have a strong acid and a weak acid with the same pH.

pH is a measure of H^+ ion concentration.

If this is equal, then pH is equal.

You would need a concentrated solution of a weak acid, and a dilute solution of a strong acid.

As long as both have the same H^+ concentration, pH is equal.

3.9—Bases

A base is a substance which neutralises an acid to produce water and a salt only.

3.10—Alkalis

An alkali is a soluble base.

3.11—Reactions of acids

Complete the general formulae

Acid + metal → salt + hydrogen (gas)

Acid + metal oxide → salt + water

Acid + metal hydroxide → salt + water

Acid + metal carbonate → salt + water + carbon dioxide

3.12—Testing for gases

The positive test for hydrogen is hold a lit splint to the gas; squeaky pop.

The positive test for carbon dioxide is limewater turning cloudy.

3.13—Neutralisation reactions: in words

A neutralisation reaction is one in which an acid and a base react to form salt + water only.

3.14—Neutralisation reactions: in ions

$H^+ + OH^- \longrightarrow H_2O$

Common acids & alkalis

Name	Formula	Salt formed by acid	Name	Formula
Hydrochloric acid	HCl	Chloride	Sodium hydroxide	$NaOH$
Sulfuric acid	H_2SO_4	sulfate	Potassium hydroxide	KOH
Nitric acid	HNO_3	Nitrate	Lithium hydroxide	$LiOH$

3.15—Soluble salt from an insoluble reactant

3.15a—Adding a excess of the insoluble reactant

Explain why we add an excess of insoluble solid in this type of reaction.

To ensure all of the acid reacts.

3.15b—Removing the unreacted excess

Name the separating technique we use to remove the unreacted solid, and explain why this step is necessary.

Filtration

To remove the unreacted base and ensure a pure product.

3.15c—Salt & water solution

Explain why only the salt and water are left in the solution, and name the separating technique we use to collect a sample of salt crystals.

All of the unreacted solid has been removed & the acid is fully reacted; we use crystallisation.

3.16—Soluble salt from a soluble reactant (e.g. alkali)

3.16a—Titration

Explain why we must use titration, referring to what would happen if we added an excess of one of the reactants.

We must use titration to work out the correct amount of acid to add. All of the chemicals are colourless solutions, so we can't tell when the reaction is complete.

3.16b—The volume of each reactant

Explain why it is important to know the *exact* volumes of the two reactants that are reacted together.

To ensure that the product is pure.

3.16c—Salt & water solution

Explain why only the salt and water are left in the solution, and name the separating technique we use to collect a sample of salt crystals.

We have exactly neutralised the acid & alkali; crystallisation.