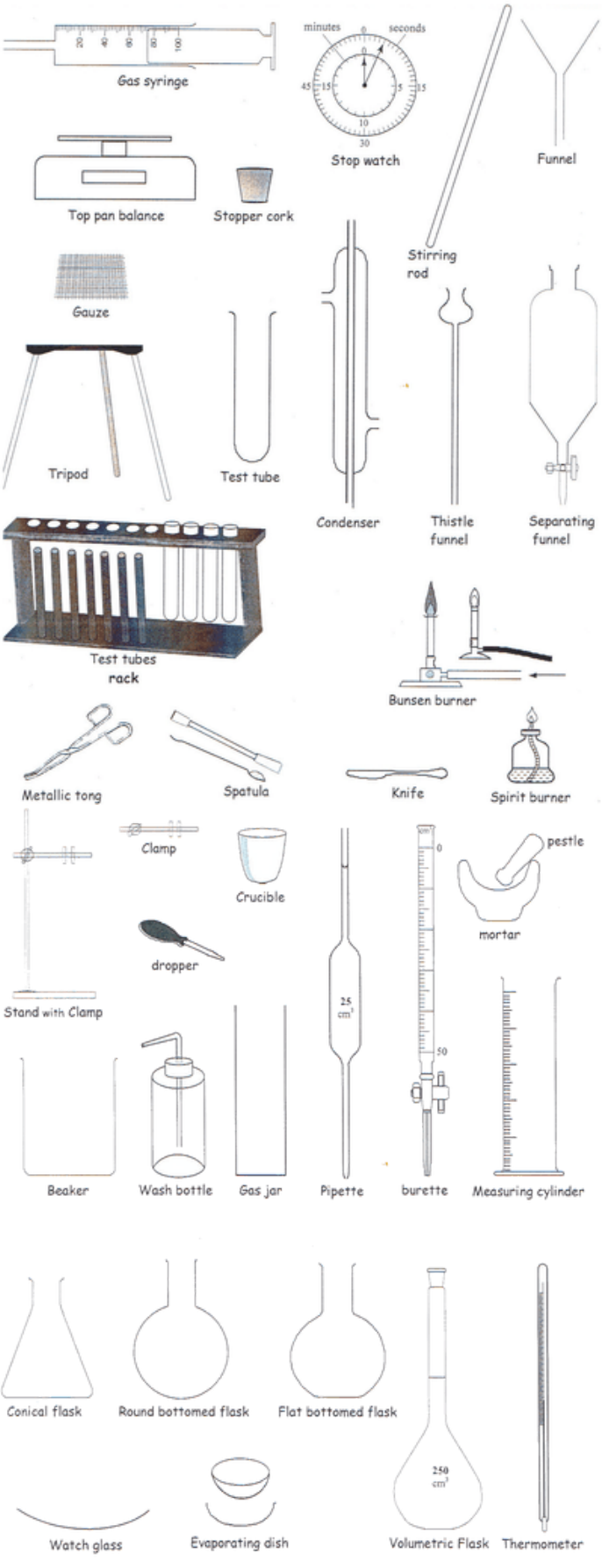
ZNOTES.ORG

UPDATED TO 2020-21 SYLLABUS

CAIE IGCSE CHEMISTRY (0620)

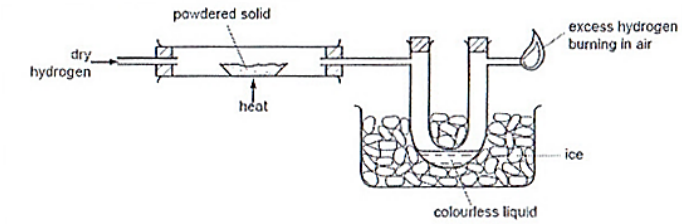
SUMMARIZED NOTES ON THE ALTERNATIVE TO PRACTICAL SYLLABUS

1. Apparatus

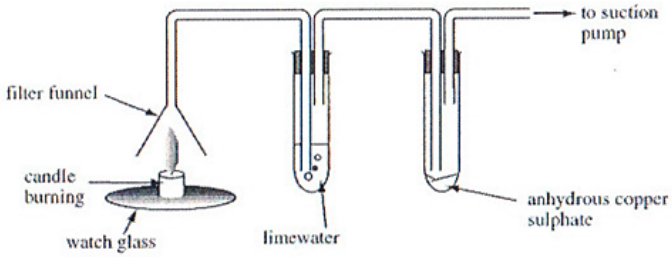


2. Experiments

- Reducing Copper(III) Oxide to Copper

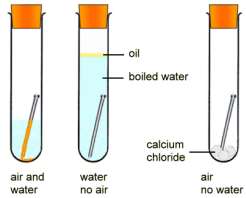


- Testing products of combustion:

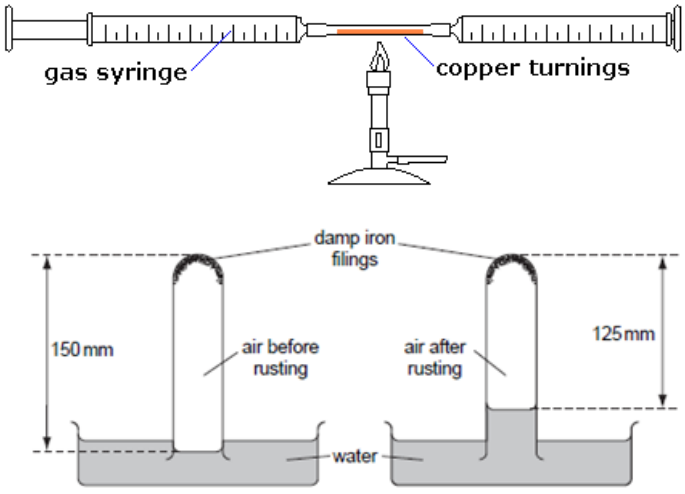


2.2. Experiments

- Showing that oxygen and water is needed for rusting iron



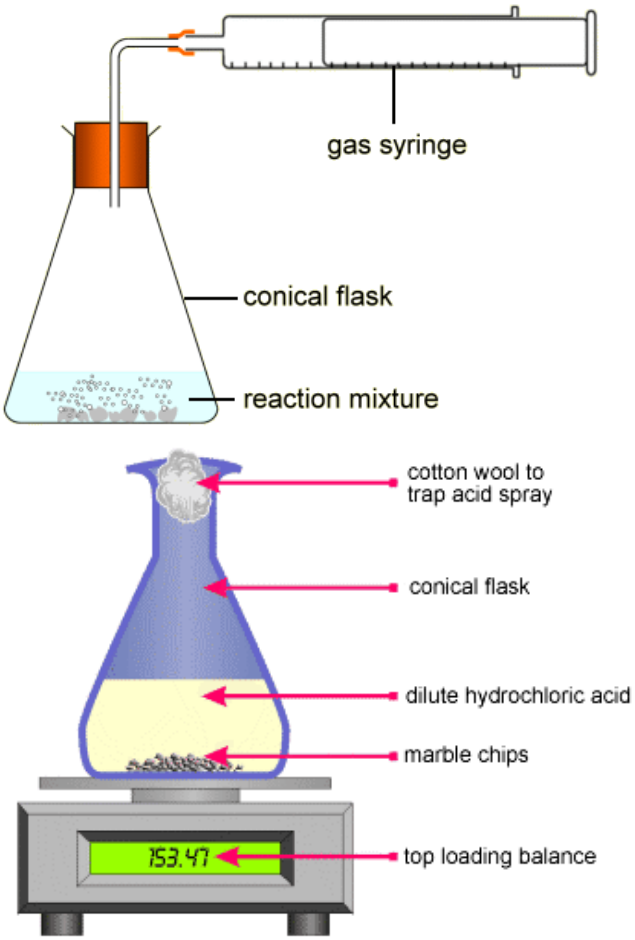
- Showing that air is 21% Oxygen



3. Rates of Reaction

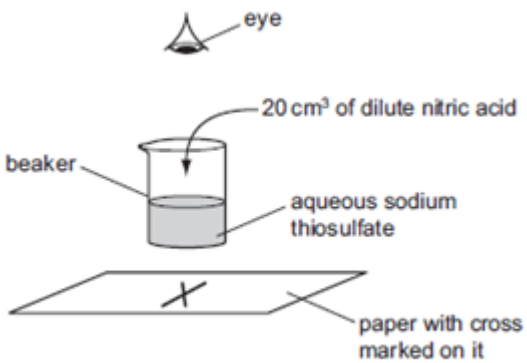
3.1. Testing factors affecting rate of reaction

- Different temperature acid
- Different size of particle/reactant
- Concentration of acid



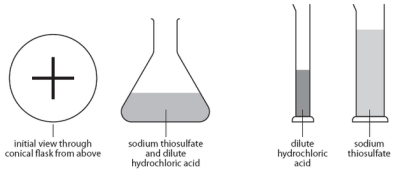
3.2. Timing

- Time how long it takes for the cross to disappear from view
- You can change the temperature and concentration of acid used



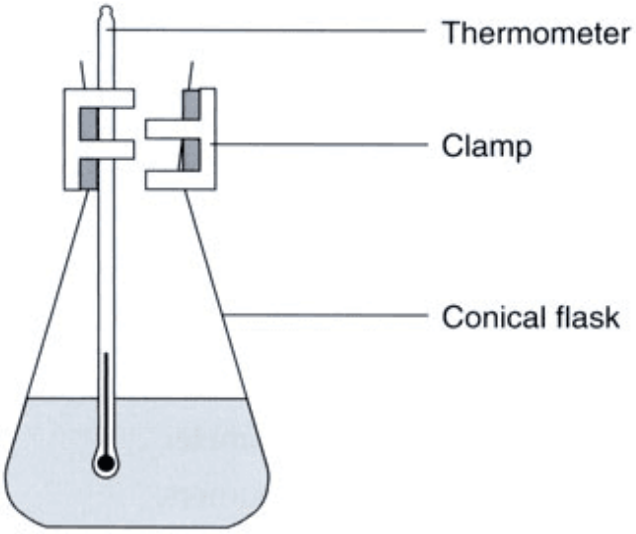
3.3. Keep constant:

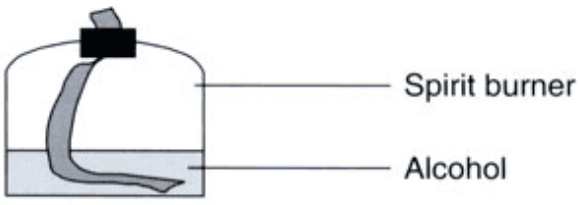
- Diameter of beaker
- The Cross
- Volume



4. Energy in Alcohol

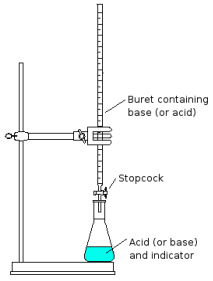
- Find the amount of energy given when an alcohol is burnt:
- You need to know:
  - Mass of water
  - Change in mass of burner containing alcohol
  - Specific heat capacity of water
  - Temperature change of water
  - The molecular mass of the alcohol
- $\frac{\text{Change in mass}}{\text{Molecular mass}} = \text{Number of moles burnt}$
- $\text{Change in temperature} \times \text{Mass of water} \times \text{SHC of water} = \textit{Energy}$
- $\frac{\text{Energy}}{\text{Moles burnt}} = \text{Amount of energy per mole (J/mol)}$





5. Finding Concentration

- Acid and base titration to find the concentration of a solution:
- Measure volume of acid then pour into conical flask
- Record initial volume of base in burette
- Slowly add base from burette, stirring each time
- When indicator neutral, record final volume of base
- Find amount of bas used: Final – Initial
- Find moles of base used by $volume \times concentration$
- Use balanced equation to find how many moles of acid are needed to neutralize the base
- $\frac{\text{Number of moles of Acid Needed}}{\text{Volume of Acid Used}} = Concentration\ of\ Acid$



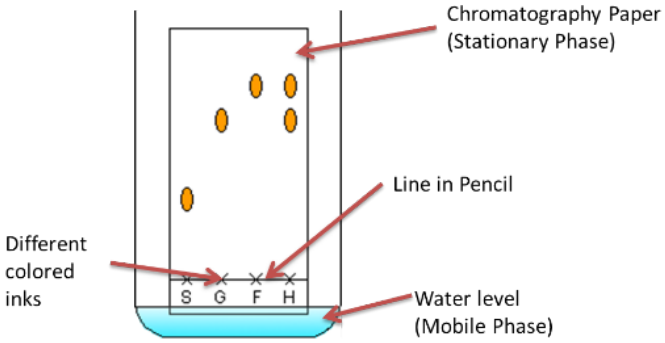
6. Flame Tests

- **Lithium** = Red
- **Sodium** = Yellow
- **Potassium** = Lilac
- **Iron** = Gold
- **Magnesium** = Bright White
- **Source of errors for flame tests:**
  - The test cannot detect low concentrations of most ions.
  - Brightness of the flames varies from one sample to another.
  - Impurities or contaminants affect the test results.
  - The test cannot differentiate between all elements or compounds

7. Chromatography

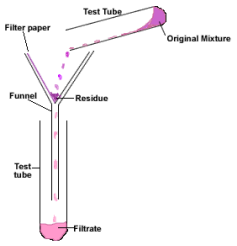
- **Principle: Difference in solubility separates different pigments**
  - Drop substance to center of filter paper and allow it to dry
  - Drop water on substance, one drop at a time
  - Paper + rings = chromatogram.
- **Stationary phase:** material on which the separation takes place
- **Mobile phase:** mixture you want to separate, dissolved in a solvent.
- **Interpreting simple chromatograms:**
  - Number of rings/dots = number of substances
  - If two dots travel the same distance up the paper they are the same substance.
- You can calculate the Rf value to identify a substance, given by the formula:
- $Rf\ Value = \frac{\text{Distance moved by solute}}{\text{Distance moved by solvent}}$

- To make colorless substances visible
  - Dry chromatogram in an oven
  - Spray it with a locating agent
  - Heat it for 10 minutes in the oven

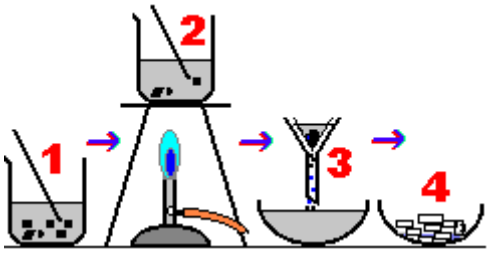


8. Separation Methods

- **Filtration**
  - Mixture goes in a funnel with filter paper, into a flask.
  - Residue is insoluble and filtrate goes through

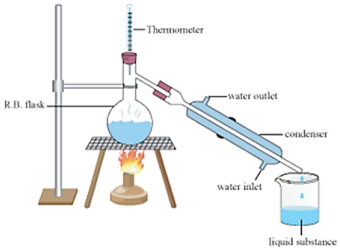


- **Crystallization**
  - Some water in the solution is evaporated so solution becomes more concentrated.
  - Solution is left to cool and crystallise.
  - Crystals are filtered to remove solvent.



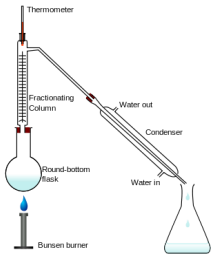
8.2. Simple distillation:

- Impure liquid is heated
- It boils, and steam rises into the condenser
- Impurities are left behind
- Condenser is cold so steam condenses to the pure liquid and it drops into the beaker



8.3. Fractional distillation:

- Removes a liquid from a mixture of liquids, because liquids have different b.p.s
- Mixture is heated to evaporate substance with lowest b.p.
- some of the other liquid(s) will evaporate too.
- Beads are heated to boiling point of lowest substance, so that substance being removed cannot condense on beads.
- Other substances continue to condense and will drip back into the flask
- The beaker can be changed after every fraction.



8.4. Separating mixture of two solids:

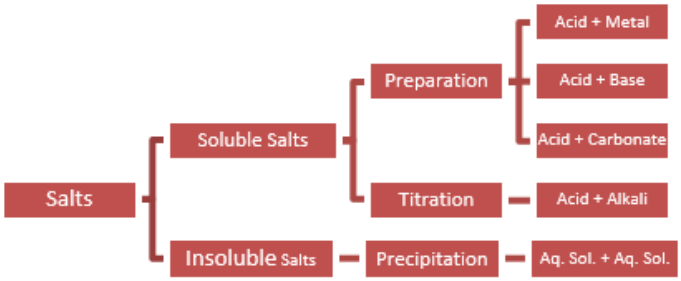
- Can be done by dissolving one in an appropriate solvent
- Then filter one and extract other from solution by evaporation
- If one solid is magnetic, can use a magnet e.g. sand and iron

Solvent	It dissolves...
Water	Some salts, sugar
White spirit	Gloss paint
Propanone	Grease, nail polish
Ethanol	Glues, printing inks, scented substances, chlorophyll

8.5. Choosing a suitable method:

Method of separation	Used to separate
Filtration	A solid from a liquid
Evaporation	A solid from a solution
Crystallization	A solid from a solution
Simple Distillation	A solvent from a solution
Fractional Distillation	Liquids from each other
Chromatography	Different substances from a solution

9. Making Salts



9.1. Starting with a metal:

- Add excess metal to an acid
- When bubbling (hydrogen) stops the reaction is done
- Filter off excess metal

Starting with an insoluble base:

- Add insoluble base to acid and heat gently, it will dissolve
- Keep adding until no more dissolves (reaction is done)
- Filter out the insoluble (excess) base

9.2. Titration:

- Put a certain amount alkali in a flask and add phenolphthalein
- Add acid from a burette, stirring, until it goes colourless
- Find out how much acid you used and repeat, to be more accurate
- Evaporate water from neutral solution

Precipitation:

- Mix the two soluble salts, so they react together
- Filter the mixture to separate the products produced (soluble and insoluble salt produced)
- Wash the insoluble salt on the filter paper
- Dry the insoluble salt in a warm oven

10. Salts and Indicators

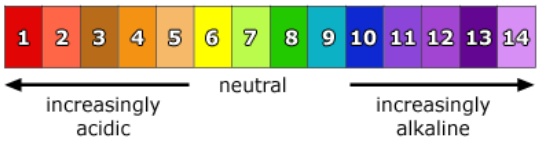
10.1. Solubility of salts

Soluble Salts	Insoluble Salts
All sodium, potassium and ammonium salts	The rest
All nitrates	N/A
Chlorides	Except silver and lead
Sulphates	Except barium, lead and calcium
Potassium, sodium and ammonium carbonates	All other carbonates

10.2. Indicators:

Indicator	Color in acid	Color in alkaline
Phenolphthalein	Colorless	Pink
Methyl orange	Red	Yellow
Methyl red	Red	Yellow
Red litmus	Red	Blue
Blue litmus	Red	Blue

10.3. pH Scale:



11. Test for Anions and Cations

Cation	Sodium Hydroxide	Ammonia
Aluminum (Al^{3+})	Soluble white ppt.	White ppt.
Ammonium (NH_4^+)	Ammonium gas - damp red litmus turns blue	N/A
Calcium (Ca^{2+})	White ppt.	No ppt.
Copper (Cu^{2+})	Light blue ppt.	Light blue soluble ppt.
Iron(II) (Fe^{2+})	Green ppt.	Green ppt.
Iron(III) (Fe^{3+})	Red-brown ppt.	Red-brown ppt.
Zinc (Zn^{2+})	White soluble ppt.	White soluble ppt.

Anion	Test	Test result
Carbonate (CO_3^{2-})	Add dilute nitric acid	Limewater goes cloudy
Chloride (Cl^-)	Add nitric acid, then aqueous silver nitrate	White ppt.
Bromide (Br^-)		Cream ppt.
Iodide (I^-)		Yellow ppt.
Nitrate (NO_3^-)	Add aqueous sodium hydroxide then add aluminum	Gas produced turns damp red litmus paper blue
Sulphate (SO_4^{2-})	Add nitric acid, then add aqueous barium nitrate	White ppt.

12. Other Tests

Gas	Test and test result
Ammonia (NH_3)	Damp red litmus paper turns blue
Carbon dioxide (CO_2)	Bubble gas through limewater - from colorless to cloudy
Chlorine (Cl_2)	Bleaches red/blue litmus paper
Hydrogen (H_2)	Place lighted splint, squeaky pop
Oxygen (O_2)	Place glowing splint, splint relights

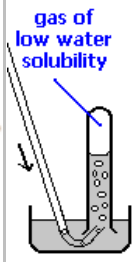
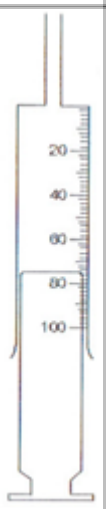
Substance	Test and test result
Water	White anhydrous copper (II) sulphate crystals turns blue
	Blue cobalt chloride paper turns pink
Alkene	Add to bromine water; from orange to colourless
Alkane	Add to bromine water; remains orange
Acid	Blue litmus paper turns red
	Add a metal carbonate; bubbles of CO_2
Base	Red litmus paper turns blue

13. Preparing Gases in the Lab

To make....	Place in flask:	Add....	Reaction
CO_2	$CaCO_3$ (marble chips)	Dilute HCl	$CaCO_3(s) + HCl(aq) \rightarrow CaCl_2(aq) + H_2O(l) + CO_2(g)$
Cl_2	Manganese (IV) oxide (as an oxidising agent)	Conc. HCl	$2HCL(aq) + [O] \rightarrow H_2O(l) + Cl_2(g)$
H_2	Pieces of zinc	Dilute HCl	$Zn(s) + HCL(aq) \rightarrow ZnCl_2(aq) + H_2(g)$
O_2	Manganese (IV) oxide (as a catalyst)	Hydrogen peroxide	$2H_2O_2(aq) \rightarrow 2H_2O(l) + O_2(g)$

14. Collecting Gases

Method	Downward displacement of air	Upward displacement of air	Over water	Gas syringe
Use when...	Gas more dense than air	Gas less dense than air	Gas is sparingly soluble in water	To measure the volume

Method	Downward displacement of air	Upward displacement of air	Over water	Gas syringe
Apparatus				
Examples	Carbon-dioxide, chlorine, sulphur dioxide, hydrogen chloride	Ammonia, hydrogen	Carbon dioxide, hydrogen, oxygen	Any gas

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