Using a Balance & Collecting Gases

Using a balance

TARE Balance Technique

1. TARE balance with crucible.
2. Transfer exact mas of solute into crucible.

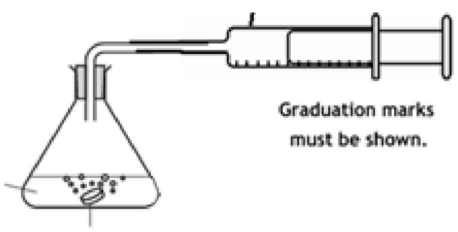
Weigh by difference

1. Weigh solute and weighing boat and record the mass.
2. Transfer solute into crucible
3. Reweigh empty weigh boat and calculate the difference

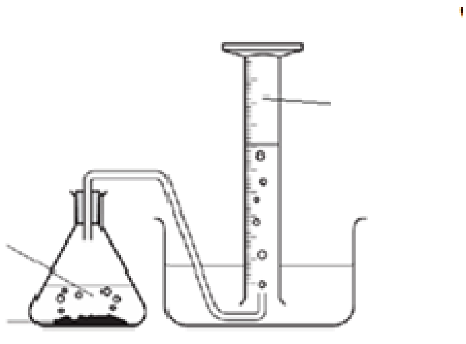
Collecting a gas

Two different techniques can be used to collect a gas. A syringe can be used whether the gas is soluble/insoluble in water whereas over water with a measuring cylinder requires the gas to be insoluble.

1. Syringe



2. Over water



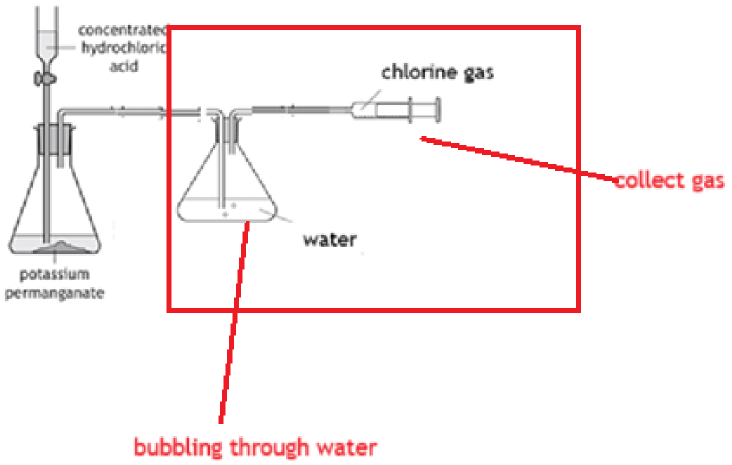
Gas must be insoluble in water

Separating/drying gases

Mixtures of gases

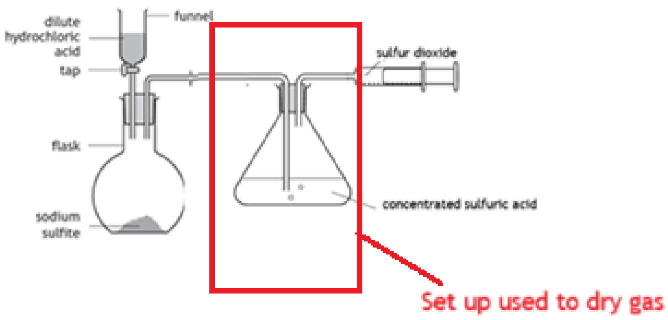
Gases can be separated by bubbling through water if only 1 gas is insoluble.

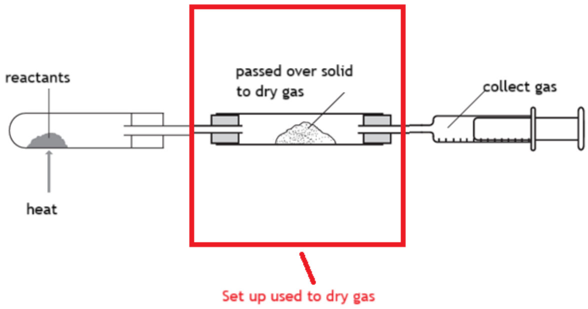
The soluble gas/gases dissolves in the water leaving the insoluble gas to be collected in the syringe.



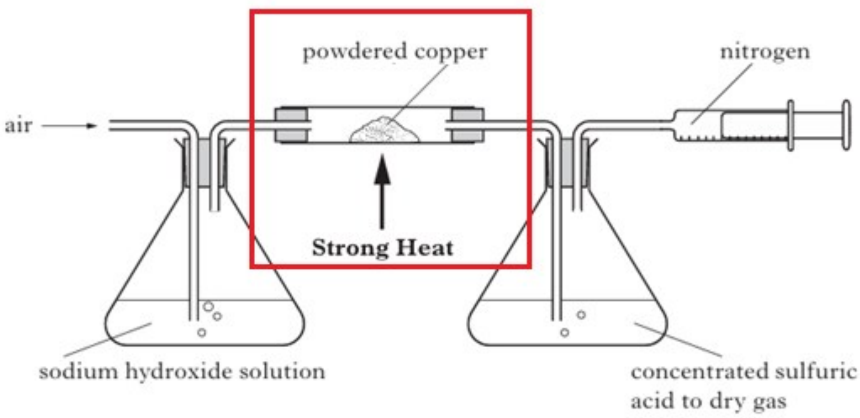
Drying Gases

1. Drying gas with liquid e.g. conc sulfuric acid
2. Drying gas with solid e.g. calcium oxide





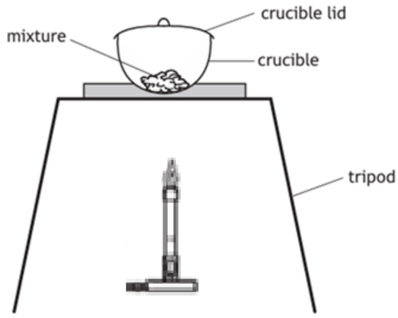
Gases can be passed over heated copper/aluminium foil to cause the generation of another reaction as follows



Heating

Bunsen burners

Provide rapid heat. OK to use if reactants are non flammable.



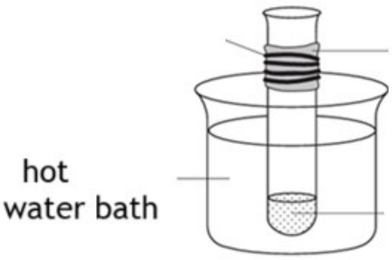
Problems

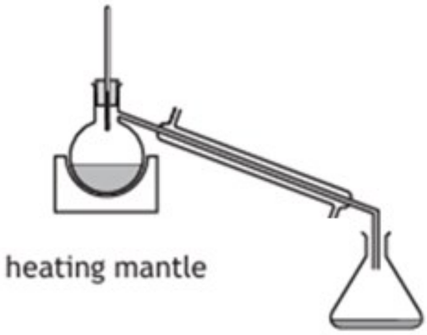
1. Not safe to heat flammable liquids e.g. alcohols
2. Heat can not be controlled & may be delivered too rapidly.

Heating mantle/Hot water bath/Hot plates

More accurate control of temperature

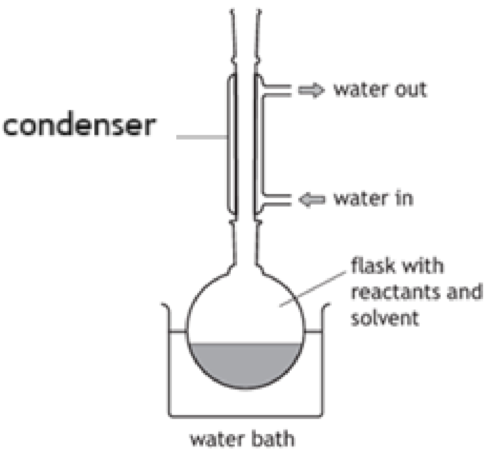
Can be used to safely heat flammable liquids

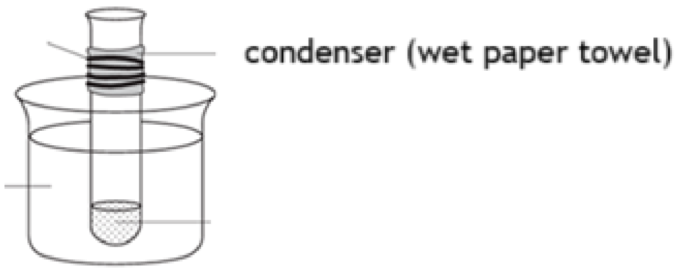




Condensers

Turns gas back into a liquid which can be collected which prevents loss of reactants/ products).





Separating Substances

Distillation

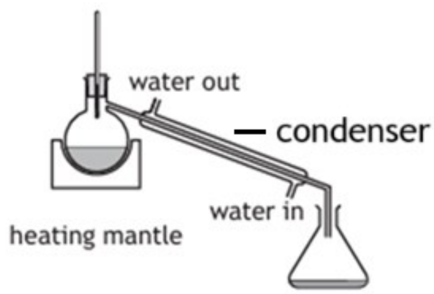
Used to separate liquids based on their different boiling points.

1. The mixture is heated in a round bottom flask until the boiling point of the lowest boiling liquid is reached.

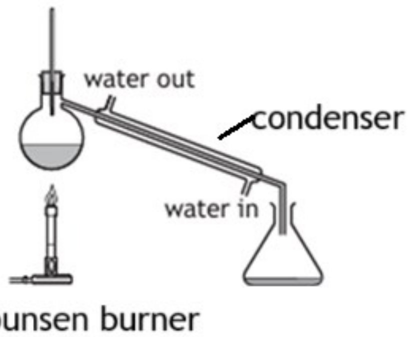
2. The vapour is then cooled as it pass through a condenser where it turns back into a liquid which can be collected.

A round bottomed flask is used to spread the heat over a larger surface area.

Flammable liquid

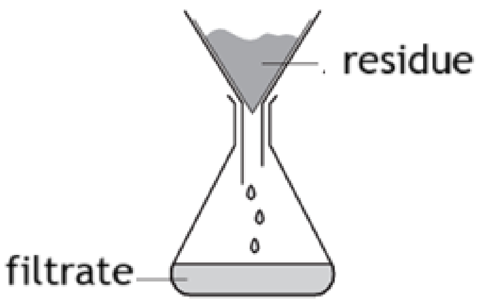


Non Flammable liquid



Filtration

Can be used to separate a solid (precipitate) from a liquid.



Drying/weighing precipitate

1. Weigh the filter paper
2. Filter the precipitate
3. Wash the precipitate with water to remove any impurities
4. Dry the precipitate in an oven
5. Weigh the precipitate and the filter paper

Residue

Insoluble substance that cannot be filtered and left behind in filter paper.

Filtrate

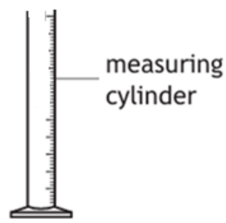
Substances that pass through filter paper into flask beneath

Care must be taken not to overfill filter funnel as this can lead to mixture not going through funnel resulting in it entering flask unfiltered.

Measuring Volumes of Solution

Approximate measurements

Adding in approximate measurements of volumes of solutions with measuring cylinders/beakers/syringes.



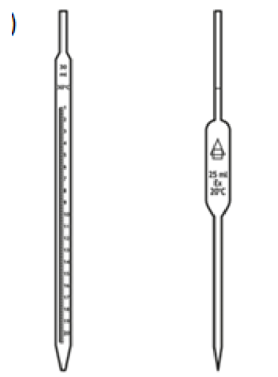
Accurate measurements

Pipettes or burettes provide higher degree of accuracy of measurement of volume.

Pipettes

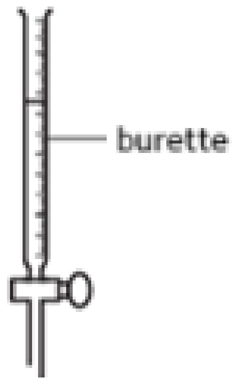
Measure **fixed volumes** of liquid

e.g. $10cm^3$, $15cm^3$, $20cm^3$ or $25cm^3$



Burettes

Can be used to measure **non standard volumes** of liquid e.g. $28cm^3$



Standard Flasks/Standard solutions

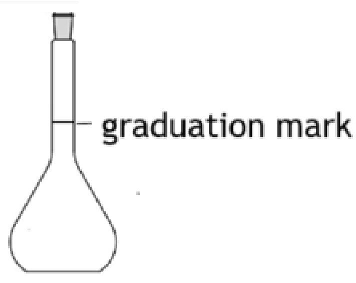
Standard Solution

A solution of **accurately** known concentration.

Standard/Volumetric Flask

Used to make up a standard solution by

1. Dissolving a known mass of solute in small volume of relevant solvent (water/hexane)
2. Transfer to standard flask with rinsings
3. Made up to graduation mark with solvent



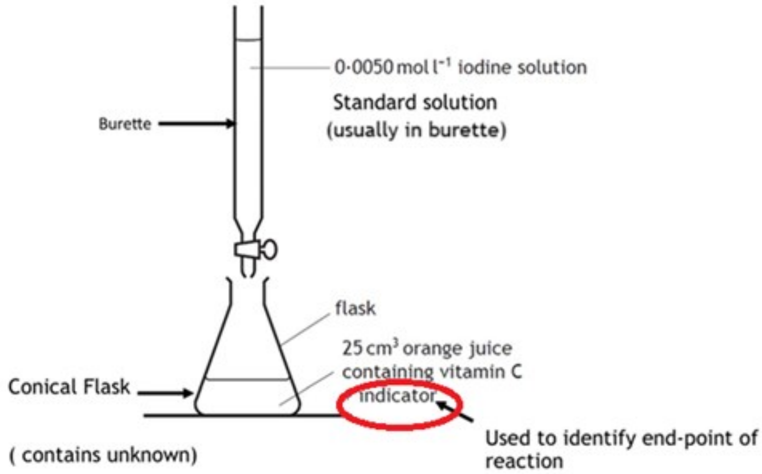
Redox Titration

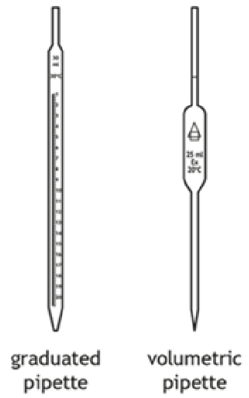
Redox equations can be used in titration reactions to determine the concentration of a solution.

In all redox titrations a **Standard solution** is used.

Standard Solution:
A solution of **accurately** known concentration.

Pipette
Used to accurately measure solution of unknown concentration into flask.





During the titration, the standard solution is added to the conical flask until there is a colour change observed. This is described as the end-point of the reaction.

Filling a burette

- Rinse burette with solution
- Fill burette above scale with thiosulfate solution
- Filter funnel used should be removed
- Tap opened to drain some solution to ensure no air bubbles
- Solution run into scale.
- Reading should be made from bottom of meniscus

Why use deionised/distilled water.

Tap water may contains other metal ions that could interfere with the reaction.

Tap water may contain ions of the **standard solutions** altering the concentrations used in the titration.

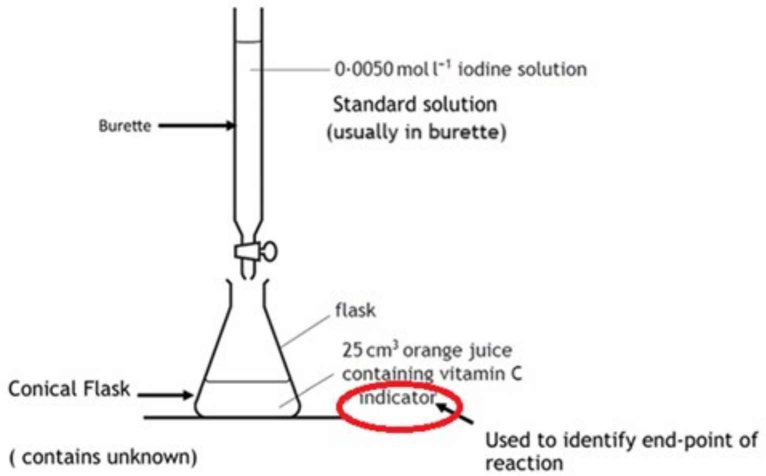
Redox Titration Calculation

The equation for the reaction is

$$C_6H_8O_6(aq) + I_2(aq) \longrightarrow C_6H_6O_6(aq) + 2HI(aq)$$

vitamin C

Calculate the concentration, in mol l^{-1}, of vitamin C in the orange juice.



The results of the titration are given in the table.

Titration	*Initial burette reading* (cm³)	*Final burette reading* (cm³)	*Titre* (cm³)
1	1·2	18·0	16·8
2	18·0	33·9	15·9
3	0·5	16·6	16·1

rough titre - ignore inaccurate

Average Volume required = $\frac{15.9 + 16.1}{2}$ = 16.0 cm^3

Always identify in the equation which reactant is the **standard solution** and which is the **un-known**.

$$\underset{\text{Unknown}}{C_6H_8O_6(aq)} + \underset{\text{Standard solution}}{I_2(aq)} \longrightarrow C_6H_6O_6(aq) + 2HI(aq)$$

vitamin C

The question should always provide the data to calculate the number of moles of the standard solution, I_2 reacting:

$n = c \times V$

$= 0.005 \times 0.016$

$= 0.00008$ moles of I_2 reacting with Vit C

As the mole: mole ratio is 1: 1

Moles of Vit C must be 0.00008 moles

Concentration of Vit C in the orange juice = Moles/ Volume

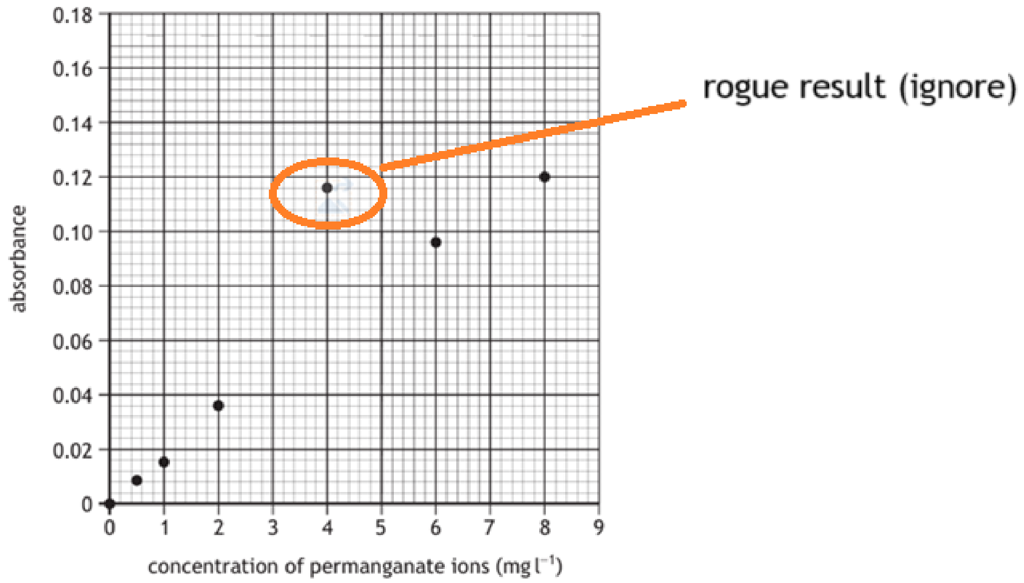
= 0.00008/ 0.025

= **0.0032 moll^{-1}**

Rogue Data/Lines of Best Fit

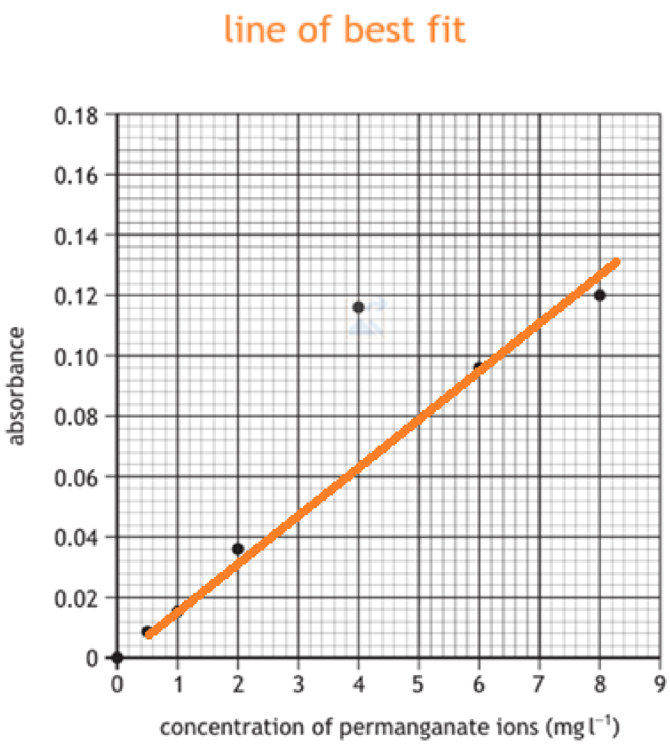
Rogue Data

Data that does not match the general trend is called a rogue results and should be discounted when drawing a line of best fit



Line of Best Fit

Line/curve should go through as many points as possible. Some points should be above & below line. Ignore rogue points.



Reproducibility/Uncertainty

Reproducible Experiments

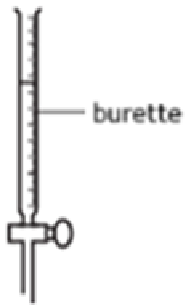
The reproducible result is the one which has repeats which are closest. C is the answer

	Experiment 1 (mg/100 cm^3)	*Experiment 2* (mg/100 cm^3)	*Experiment 3* (mg/100 cm^3)
Student A	30·0	29·0	28·0
Student B	26·4	26·6	26·8
Student C	26·9	27·0	26·9
Student D	26·9	26·5	26·9

Uncertainty measurements

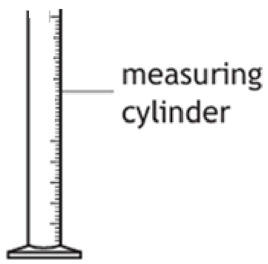
Allow you to assess the accuracy of data/equipment.

The lower the uncertainty of measurement , the more accurate the equipment.



Uncertainty = $\pm$ 0.05 cm^3

More accurate



Uncertainty = $\pm$ 0.5 cm^3

Less accurate

Apparatus & Techniques

To be successful in the exam you need to be familiar with the techniques of

1. Distillation
2. Filtration
3. Methods for collecting a gas (over water/syringe)
4. Safe heating methods using water bath/heating mantle OR Bunsen burner
5. Titration
6. Use of a balance (measuring by difference)
7. Determining enthalpy changes (unit 3)

Common Laboratory Apparatus

You should also be aware of the following apparatus and when to use these appropriately.

1. Beaker
2. Boiling tube
3. Burette
4. Conical flask
5. Delivery tubes
6. Dropper
7. Evaporating basin
8. Funnel
9. Measuring cylinder
10. Pipette & pipette filler
11. Round bottomed distillation flask
12. Thermometer
13. Standard/Volumetric flask
14. Condenser