



華中國際學校

Hwa Chong INTERNATIONAL SCHOOL

NAME _____ SUBJECT _____ MARKS _____

INDEX NO. _____ CLASS _____ DATE _____

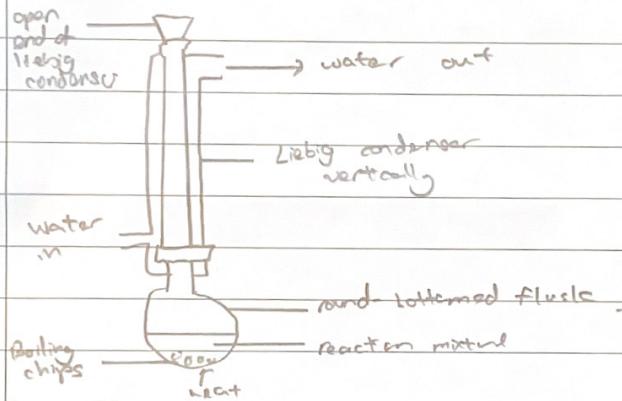
Electrochemistry

- Temperature is important.
- Use water bath and thermometer to ensure $T = 298\text{K}$
- Use crocodile clip to connect wires.
- Salt bridge through filter paper soaked in saturated KNO_3 solution.

Organic Synthesis

- Mixing of reagents may cause exothermic side reactions (cool reaction mixture in ice bath)
- Reflux set-up.

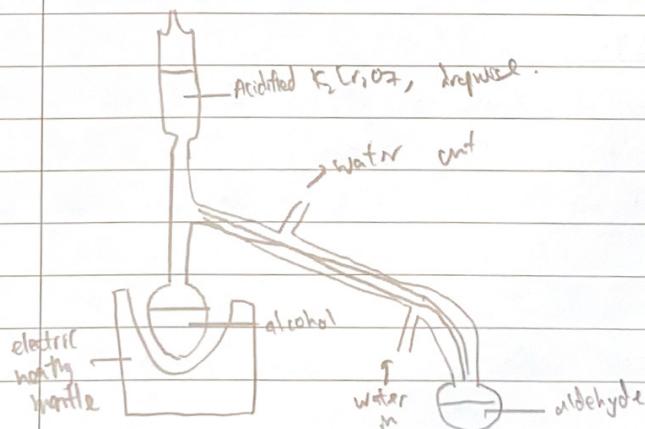
Use dropping funnel to add reagents dropwise.



Advantages

- ↳ Reaction can be conducted at/near boiling point of reactants without loss of reactants/products
- ↳ Immiscible reagents constantly agitated and brought into intimate contact (splash + dripping from above)

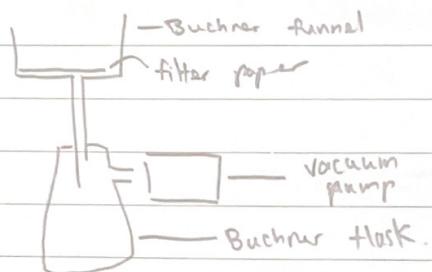
Distillation



* Do not use bunsen flames

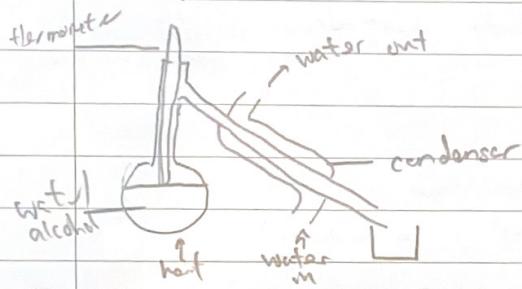
as organic compounds highly flammable.
(water bath + heating plate
or - heating mantle)

Vacuum Filtration.

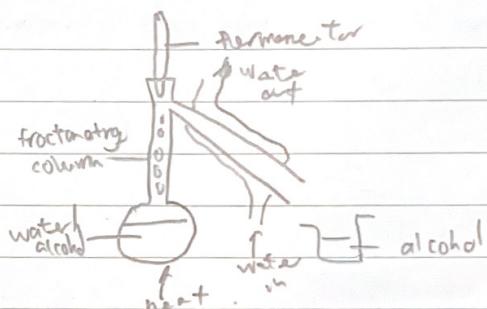


Simple vs fractional distillation (boiling points $< 10^{\circ}\text{C}$ apart)

Simple



Fractional



Extraction (immiscible liquids)

Separating funnel

Purification

	Hot	Cold
Solid product	Yes	No
Impurities	Yes	Yes

1. Transfer mixture into 50cm^3 conical flask with a few baking chips.

2. Add 5cm^3 of water and place on heating plate.

3. When mixture is boiling and mixture does not dissolve, add water slowly until mixture just dissolves.

4. Remove flask from heating plate.

5. Filter cooled mixture and wash residue with cold deionized water to remove impurities.

b. Dry residue.



華中國際學校

Hwa Chong INTERNATIONAL SCHOOL

NAME _____ SUBJECT _____ MARKS _____

INDEX NO. _____ CLASS _____ DATE _____

Identification

Purity → melting/boling point used to ascertain purity. Pure compound should melt/bol/ over a narrow range of temperature (about $\pm 10^\circ\text{C}$)

Volumetric

→ Need to prepare standard solution with graduated flask?

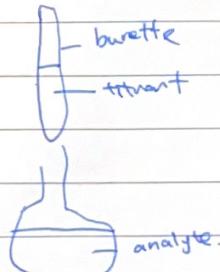
→ Titration of A (conical flask) against B (burette)

→ State clearly volume to be pipetted.

→ Target for titre volume between 20.00cm^3 and 25.00cm^3

→ Too low, high percentage error

→ Too high, more time consuming and may have higher percentage error as need to refill burette during titration.



Indicators

Acid endpoint

Alkali

Methyl orange

3.2 - 4.4

A

O

Y

Sealed MO

3.2 - 4.4

Violet grey

Green

Thymol blue

8.0 - 9.6

Y

G

B

Thymolphthalein

9.4 - 10.6

colourless

light blue
(acid)
colourless
(alkaline)
(acid
titrant).

B

→ Choice — X is suitable indicator as pH range coincides with region of rapid pH change.

KMnO₄

KMnO₄ in burette

KMnO₄ and H₂SO₄

(colourless
(H₂SO₄) → pink
(dilute KMnO₄)

KMnO₄ in flask

pale pink
(dilute
KMnO₄) → colourless
(H₂O₂)

Fe²⁺ (aq)

Yellow Fe²⁺ → pink (orange)

pale orange → yellow

mixture of
yellow
Fe²⁺ and pink
KMnO₄.

KMnO₄ + Fe²⁺

Use H₂SO₄ to oxidise as Cl⁻ ion can be easily oxidised into Cl₂(g).

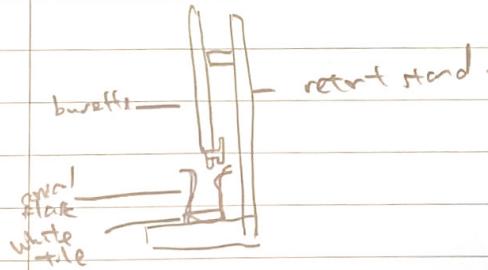
Microfiltration

1. Using dropping pipette, add 10 drops of FA2 into baby tube
2. Add my suitable indicator (acid)
3. wash dropping pipette with deionized water and FA1. (contaminated dropper)
4. Using some dropping pipette add FA1 drop by drop into baby tube. Shake baby tube to ensure good mixing until colour change observed. Record dropper & FA1 used.
→ Different dropping pipettes have different drop size.

Safety

- In redox reaction, use HgSO_4 to oxidise instead of HCl as Cl^- may be oxidised into toxic $\text{Cl}_2(\text{g})$.
- Fill burette with acid & funnel and below eye-level to prevent accidental spillage of corrosive acid solution into eyes which would cause irritation/hurt.
- Wear safety goggles and safety gloves when diluting high conc acid to avoid direct contact.
- Pipette using pipette tip (rather than mouth) to prevent accidental contact/smearing of corrosive or toxic chemicals.

If soluble acid



→ Using electronic balance, weigh out accurately about x grams of sample into clean & dry weighing bottle.

→ Dissolve sample in deionized water in 100cm^3 beaker. Transfer sample quantitatively from weighing bottle into beaker by rinsing weighing bottle a few times with deionized water and transfer all washings into beaker.

→ Stopper graduated flask and shake thoroughly to ensure it is homogeneous. Label as FA1.

→ Transfer solution in beaker quantitatively into a 250cm^3 graduated flask with the aid of a funnel and

glass rod. Rinse beaker a few times with deionized water → transfer all washings into graduated flask.

→ Fill graduated flask up to 250cm^3 mark with deionized water, using a dropping pipette, when over mark for drop by drop.



華中國際學校

Hwa Chong INTERNATIONAL SCHOOL

NAME _____ SUBJECT _____ MARKS _____

INDEX NO. _____ CLASS _____ DATE _____

Titration procedure.

FAl

1. Fill burette with $0.100 \text{ mol dm}^{-3}$ propanoic acid (known concentration).
2. Pipette 25cm^3 of FAl into 250cm^3 conical flask. Add 2 drops of methyl orange indicator. Titrate solution in conical flask against standard FAl placed in burette.
3. Stop the titration when endpoint is reached — 1 drop of FAl added from burette changes colour of solution in flask from yellow to orange.
4. Record results with appropriate table
5. Repeat titration until at least 2 consistent results are obtained (2 titre volumes within 0.1cm^3 of each other)

Titration Number

1 2 3

Anomaly

Final burette reading / cm^3

→ As titration A and B are only 0.1cm^3 apart, they are consistent.

Initial burette reading / cm^3

too high → Not added dropwise

Volume of FAl used / cm^3

conical flask not rinsed sufficiently.

Value used (V) ✓ ✓

proper pipetting and titring techniques used (ie dropper added & titrant to ensure endpoint not exceeded)

Uncertainty — when using burette, must multiply by 2 because initial / final reading.

burette — $\pm 0.05\text{cm}^3$

→ total of $\pm 0.10\text{cm}^3$ as initial and

Pipette — $\pm 0.1\text{cm}^3$

final volumes (can arise when initial

graduated flask — $\pm 0.15\text{cm}^3$.

is ± 0.05 and final ~ 0.05)

Gravimetry

— Repeat procedure of reheating, cooling and weighing solid until constant mass (2 consecutive readings within 0.05g of each other) is achieved to ensure sample completely decomposed.

Why not? Hot objects generate convection currents, resulting in unstable buoyancy offset from electronic mass balance surface and under-readings & mass.

Gravimetry

Mass of empty container
Mass of container + solid
Mass of container + contents after heating

Weigh out accurately & ...

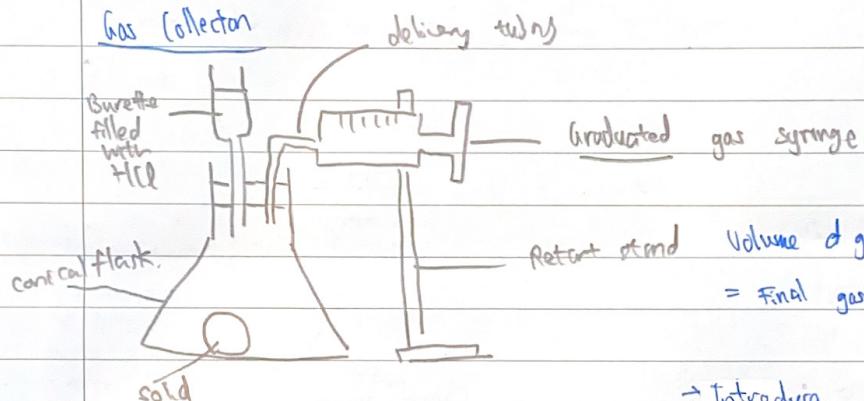
A
B
C
D
D

Heat gently, then steadily

||
2 consistent readings (within 0.05g)

Crucible without lid — allows water vapour to be lost more easily and not condense on surface of boiling tube.

Gas collector



Volume of gas

$$= \text{final gas syringe} - \text{initial gas syringe} \\ - \text{volume of aq added.}$$

→ Introduce gaseous reagent without loss of gas as no need to re-stopper.

Limitations — Gas dissolve

Heat at reaction may cause fluctuations in gas volume.
Assumes ideal gas behavior of gas.

Volume of gas should be between 50% and 90%



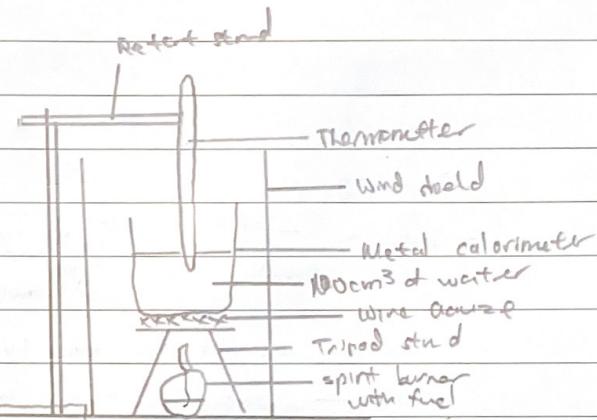
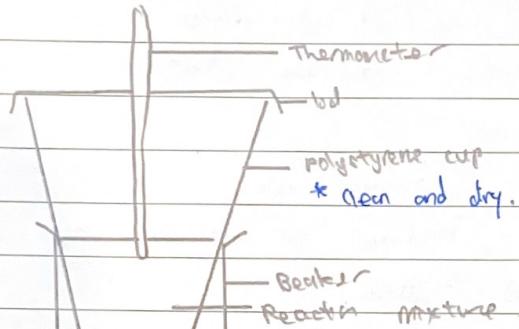
華中國際學校

Hwa Chong INTERNATIONAL SCHOOL

NAME _____ SUBJECT _____ MARKS _____
INDEX NO. _____ CLASS _____ DATE _____

Energetics

Enthalpy change of reaction



* If 2 reactants, have to use $\frac{V_a T_a + V_b T_b}{V_a + V_b}$ to determine initial T.

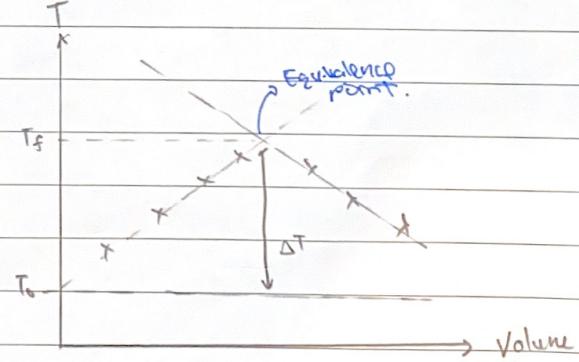
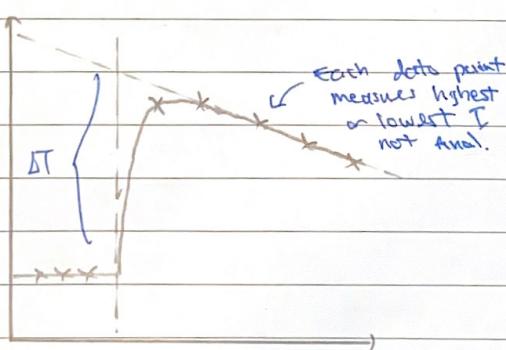
[Mass init, Mass final, T_{init} , T_{final}].

cause a 5-10°C rise in T.

Graphs

Graph against time.

Graph against \sqrt{v} reagent



Errors

Incomplete combustion → ↑ oxygen content by placing H₂O₂ with small amount of H₂O₂ next to setup.
Thermometer inaccuracy—use thermometer at high pressure, or use datalogger with temperature probe.
Heat loss from flame due to wind—use windscreen.

Kinetics

clock

Time taken for change to occur

continues

Concentration of reactant/product over time.

- Sampling and titration -
- Colormetry -
- Gas collection.

→ Identify clock.

→ rate $\propto \frac{\text{Velocity}}{t}$, or $\frac{1}{t}$ if clock is a product.
(and constant)

→ Draw sample -

→ Quench at appropriate time
→ Titrate.

→ Total volume must be same by adding

water — allows $V_{\text{reactant}} \propto [\text{reactant}]$