PENANG SANGAM HIGH SCHOOL
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LESSON NOTES

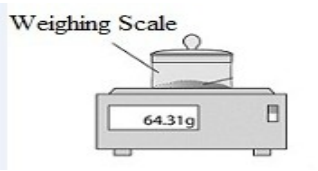
Year/Level: 11 C/D week 17 **Subject:** Chemistry

Strand	3 Reactions
Sub Strand	3.3 acids, bases and salts
Content Learning Outcome	outline the steps in preparing a standard solution state the requirements of a primary standard calculate concentration of solutions

PREPARING A STANDARD SOLUTION

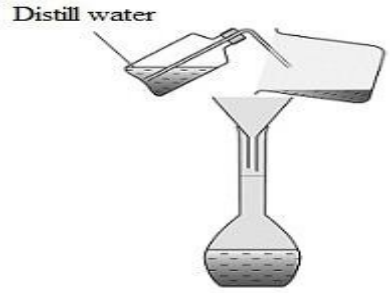
Preparing a Standard Solution

1. Take a watch glass and place it on the electric balance. Tare the balance set it to zero). Carefully weigh out the required mass of salt for example sodium hydroxide. Note: If an electric balance is unavailable then correctly take the mass (in grams) using any weighing balance.



2. Transfer the salt to a beaker. Add water from a wash bottle to dissolve it. Use some of the water to rinse all the salt off the watch glass. Do this at least twice. Stir with a glass rod until the entire solid is dissolved.

3. Transfer the solution to the volumetric flask. Use more water from the wash bottle to rinse out the beaker and the glass rod. Do this at least twice.



4. Add water to just below the line on the volumetric flask. Add the final drops with a pipette/wash bottle to ensure that the bottom of the meniscus is on the line.

5. Put the lid on the flask and turn the flask over a couple of times to mix the solution. Label the solution with your name, the date, and the contents.

ACID- BASE TITRATIONS

1. When all the hydroxide ions in the base are combined with hydronium ions from an acid, we say that the base is **neutralized**
2. In a **titration** experiment, acid is added to a based until the base is fully neutralized
3. The **equivalence point** in titration is the point where the base is fully neutralized by acid
4. An **indicator** is a dye that changes color at a certain pH. It is used to find the equivalence point in a titration

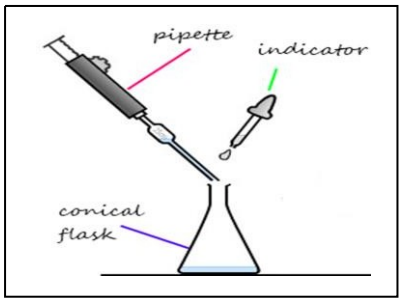
INDICATORS

Indicator	Color		
	Basic	**End-point**	**Acidic**
Phenolphthalein	Red	Light/faint/pale pink	colourless
Methyl orange	Yellow	Orange	Red
Bromothymol blue	Blue	Green	Yellow

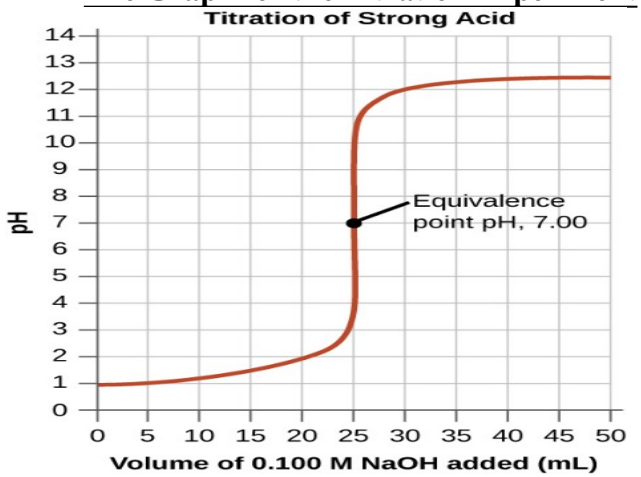
Note: *methyl orange* is used to strong acid e.g. HCl, H_2SO_4
Phenolphthalein is used for strong bases e.g. Na_2CO_3

Rough/Pilot Titration

- Is done to locate the appropriate volume to reach the end point.
- In a titration experiment, a known amount of base is added to a conical flask using a **standard pipette**.
- A few drops of indicator are also added.
- Acid is added to the flask from a **burette** until the base is nertralised.
- Marking on the burette tells how much acid has been added.



The Graph for the Titration Experiment



- If a base is added to an acid in a titration experiment, the pH starts out low and gets higher.
- But the equivalence point is the same.

Standard solution

- is a solution whose concentration is accurately known and the substance used to prepare a standard solution is called the primary standard.

The requirements of good standards are:

- It should be readily available in pure form
- Should be stable in air at room temperature
- Should dissolve readily
- It should have a high molecular mass (Mr)

Reason:

- So that the small errors in weighing will not cause significant errors in calculating the concentration of the standard solution
- In the titration reaction it should not form any product which will interfere with the titration

Doing Titration

Volumetric Flask

- is used to prepare standard solution.
- The flask should be rinsed with distilled water to remove any impurities present

Pipette

- is used to transfer the standard solution to the conical flask.
- It is not necessary to blow out the last drop in the pipette as the volume is calculated excluding the last drop.
- The pipette should be first rinsed with distilled water then the solution it is to contain.

Burette

- contains acid and it should be first rinsed with distilled water and then the solution it is to contain.

Conical Flask

- should be rinsed out with distilled water only.
- The indicator is added to the conical flask and during the titration the flask should be gently swirled to mix the solution

Note: another way to increase the accuracy of our titration is to rinse the sides of the conical flask just before the end point. This washes any extra drop of acid or base into the flask. **The rinsed water does not change the end point because water is neutral and it does not affect the number of moles of acid and base reacting.**

Possible Sources of Error

- Weighing error in making the standard solution
- The standard solution may be contaminated
- Mistakes in reading the burette volume
- Using wrong indicator or too much indicator

Example

Find the concentration of sodium hydroxide if 25ml of it is neutralized by 20ml of 0.2mol/l solution of HCl

Solution

$HCl + NaOH \longrightarrow NaCl + H_2O$

(i) Calculate the moles of HCl

= —— n= 0.02mol/l × 0.02*l* =

0.004mols

(ii) Use the moles of HCl ratio to find the moles of NaOH

NaOH: HCl

1 : 1

X : 0.004

n(NaOH)= ***0.004mols***

(iii) Calculate the concentration of NaOH

= ———

C(NaOH)= **0.16mol/l**

Activity

(a) During an experiment a standard solution was prepared by dissolving 1.24 g of anhydrous potassium carbonate (K_2CO_3) in enough water to make up a 250 ml solution.

(i) Give **two** reasons why anhydrous potassium carbonate is suitable to be used in the preparation of the standard solution.

(ii) Calculate the number of moles of anhydrous potassium carbonate used to prepare the standard solution.

(iii) Determine the concentration of the standard solution in $molL^{-1}$.

20 ml of the standard solution was transferred into a conical flask and titrated against an unknown concentration of hydrochloric acid using methyl orange indicator.

The end point was reached when 15 ml of the titre was transferred to the conical flask from the burette.

(iv) How many moles of potassium carbonate is present in the 20 ml aliquots?

(v) Write a balanced chemical equation for the reaction between potassium carbonate and hydrochloric acid.

(vi) Determine the number of moles of hydrochloric acid required to reach the end point.

(vii) Calculate the concentration of the acid in $molL^{-1}$.