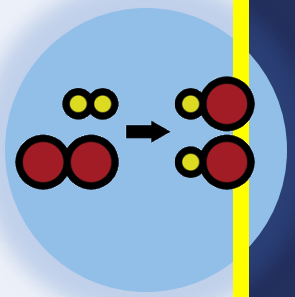
Taking it Further: RPA Determining an Unknown Concentration by Titration

Answer the questions below.

1. State the formula for sulfuric acid.
   H_2SO_4
2. Calculate the relative formula mass of sodium hydroxide (NaOH).
   23+16+1 = 40
3. Write a word equation for the reaction between sulfuric acid and sodium hydroxide.
   Sodium hydroxide + sulfuric acid → sodium sulfate + water
4. What type of reaction is this?
   Neutralisation
5. Name the salt that would be produced in a reaction between hydrochloric acid and potassium hydroxide.
   Potassium chloride



Do Now

Taking it Further: RPA Determining an Unknown Concentration by Titration

Do Now:

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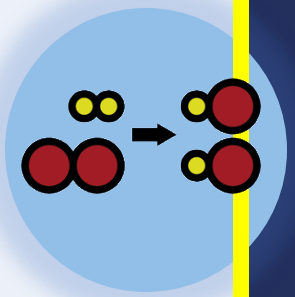
Drill:

1. Describe three ways to tell if a substance is acidic.
2. State the colour that Universal Indicator would turn in an acid.
3. Give a disadvantage of Universal Indicator.



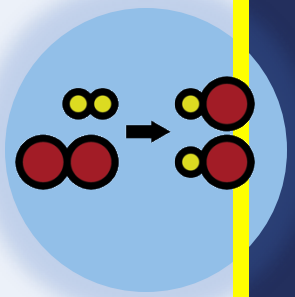
Do Now

Taking it Further: RPA Determining an Unknown Concentration by Titration

Read Now:

Titrations are a method of quantitative analysis. This means that they provide numerical information, unlike in a qualitative analysis. For example, in a titration, you can determine a volume of acid required to neutralise an alkali. This is a numerical quantity. However, in a qualitative analysis, a numerical value is not given. An example of a qualitative analysis that we have seen already is using different food tests to identify the presence of different nutrients. Iodine can be used to test for the presence of starch. If starch is present, iodine turns blue-black. These reagents can show whether or not a nutrient is present, but cannot tell you how much of a nutrient is present. The starch test is also useful when identifying if a leaf has produced starch, showing that it has been converted from glucose produced in photosynthesis.

1. Explain what is meant by a quantitative analysis.
2. Explain the difference between a quantitative analysis and a qualitative analysis.
3. Give an example of a quantitative analysis.
4. Describe the result of a positive test for starch.

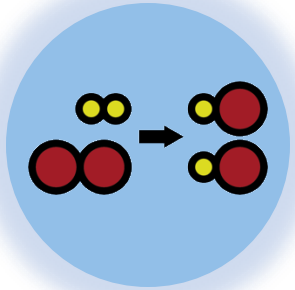


Do Now

Taking it Further: RPA Acid-Alkali Titration

C4.3.11 C4.3.12

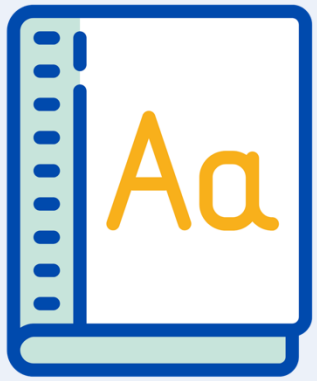
Science Mastery



Following this lesson, students will be able to:

- Describe a method to carry out a titration
- Identify concordant results
- Explain the most appropriate apparatus to use for a given function

Key Words:



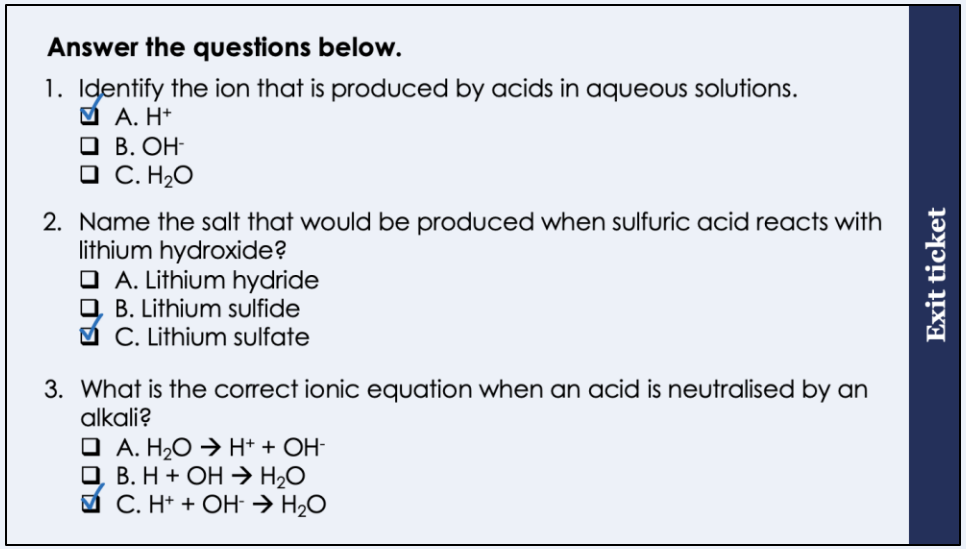
acid	**alkali**	**titration**	**neutralisation**
titre	**concordant**	**phenolphthalein**	

Lesson Objectives

This is the fix-it portion of the lesson

The **fix-it** is an opportunity to respond to gaps in knowledge, especially those identified by the **pre-unit quiz**.

- The teacher should customise this slide as needed, to facilitate
  - **reteach**, **explanation, demonstration** or **modelling** of ideas and concepts that students have not yet grasped or have misunderstood.
  - **practise** answering specific questions or of key skills.
  - **redrafting** or **improving** previous work.



Answer the questions below.

1. Identify the ion that is produced by acids in aqueous solutions.
   - ☑ A. H^+
   - ☐ B. OH^-
   - ☐ C. H_2O
2. Name the salt that would be produced when sulfuric acid reacts with lithium hydroxide?
   - ☐ A. Lithium hydride
   - ☐ B. Lithium sulfide
   - ☑ C. Lithium sulfate
3. What is the correct ionic equation when an acid is neutralised by an alkali?
   - ☐ A. $H_2O \rightarrow H^+ + OH^-$
   - ☐ B. $H + OH \rightarrow H_2O$
   - ☑ C. $H^+ + OH^- \rightarrow H_2O$

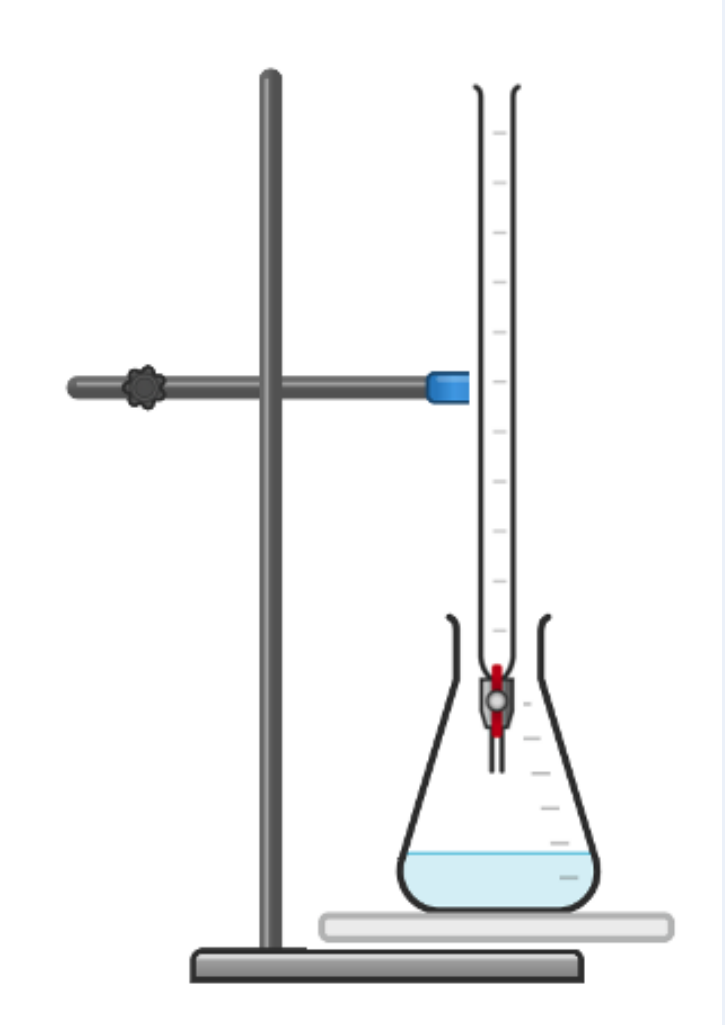
Exit ticket

Fix-it

Titration

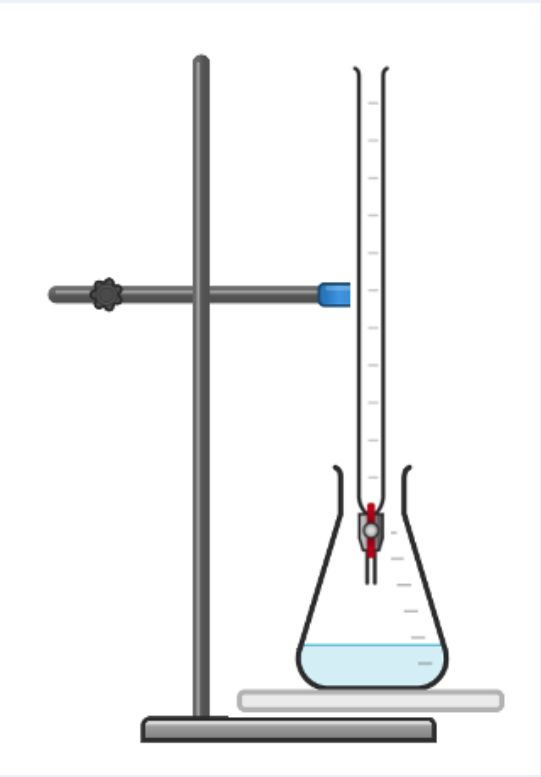
A titration is a **quantitative analysis**.

It can be used to determine the volume of an acid (or alkali) needed to neutralise a volume of an alkali (or acid).



Titration Demonstration

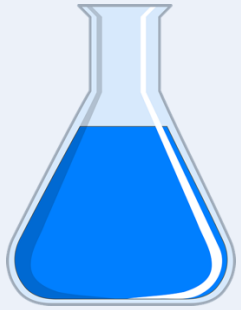
1. Measure 25 cm^3 of **alkali** using a **pipette**
2. Add the alkali to a **conical flask**
3. Set up a **burette** with **acid**. Rinse the burette with the acid solution and flush the tap to remove air bubbles
4. Add a few drops of **indicator** (phenolphthalein) to the conical flask
5. Place the conical flask on a **white tile**
6. Record the **starting volume** of acid in the burette
7. Open the tap to gradually add **acid** from the **burette** to the **conical flask**, while **swirling** the conical flask
8. When the **indicator changes colour**, this is the **end-point** of the titration
9. Use the **starting** and **final** volumes on the burette to determine the **volume of acid** used



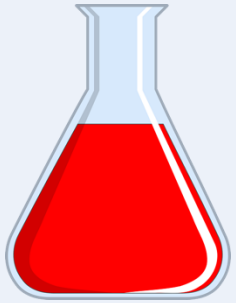
Using Titration

Sodium hydroxide + sulfuric acid → sodium sulfate + water

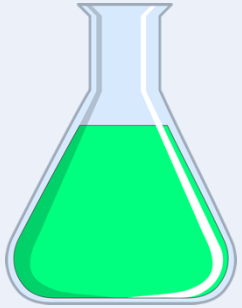
$2NaOH$ + H_2SO_4 → Na_2SO_4 + $2H_2O$



Volume = 25 cm^3



Volume = ?



End-point of titration

Alkali

Neutral/Acid

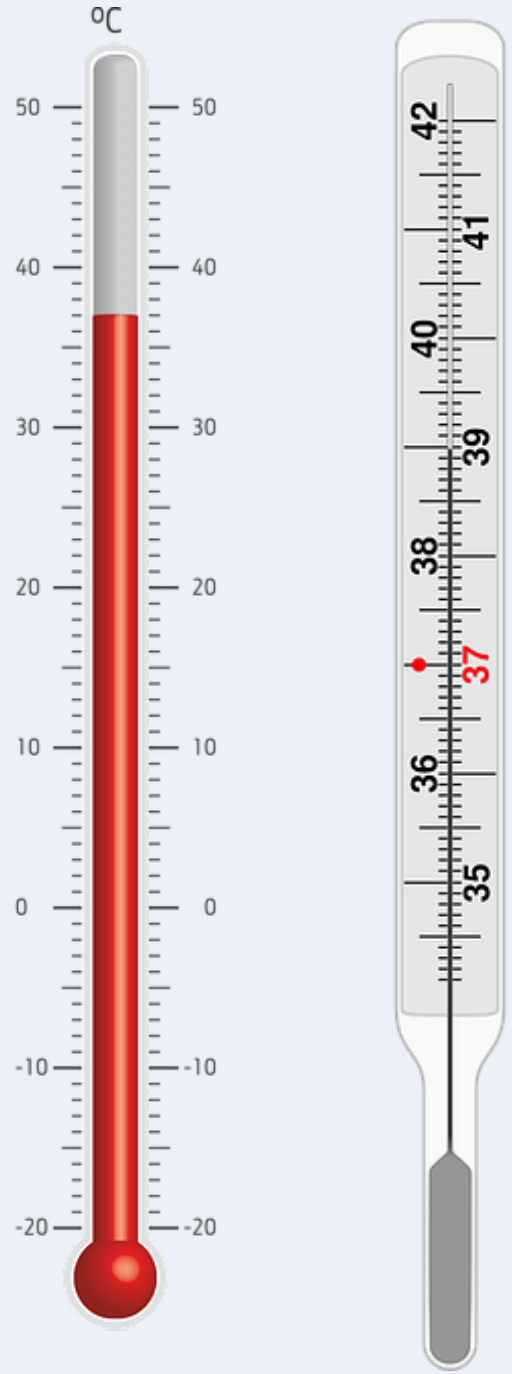
Resolution of instruments

We can estimate uncertainty of measurements from the **resolution** of the **instrument**.

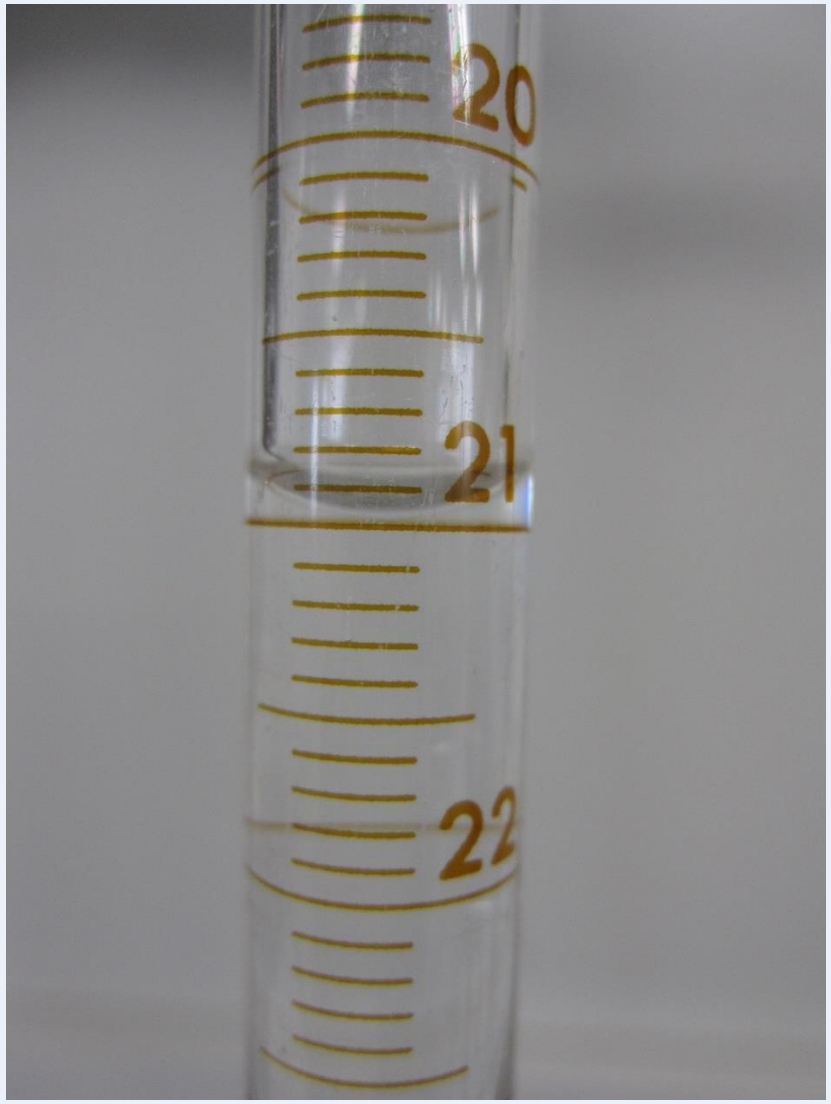
The uncertainty can be estimated as **half** the **smallest interval**.

For a thermometer with resolution of 1 °C, the uncertainty is 0.5 °C.

For a pipette with resolution of 0.1 cm^3, the uncertainty is 0.05 cm^3.



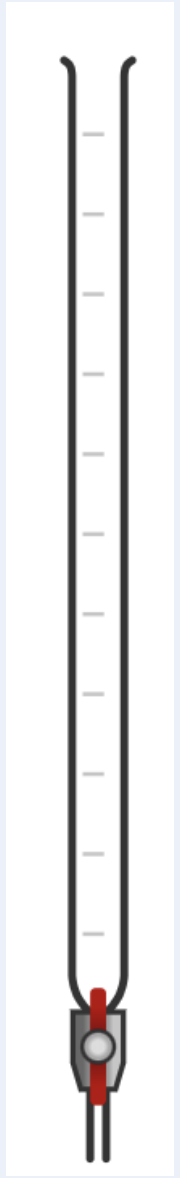
What volume is shown on this measuring cylinder?



Talk Task

Using a burette

A burette is used to measure a variable volume, as the tap can be used to add liquid drop by drop.



Why should the tap be flushed after liquid is added to the burette?

How would the volume of liquid added be measured using a burette?

Why is the first titre often a rough result?

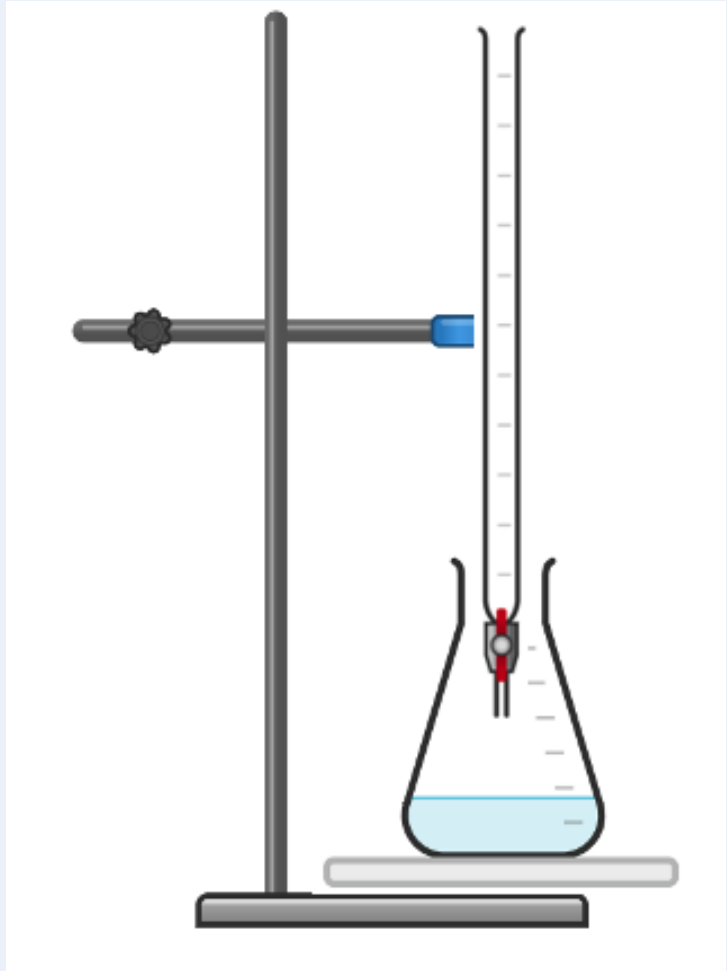
Talk Task

What steps do we take to make our measurements as accurate as possible?

The following steps are all things that should be done during a titration. **Explain** how each helps to make the measurements as **accurate** as possible:

- *Rinsing the burette*
- *Adding acid from the burette gradually/drop by drop*
- *Swirling the conical flask while adding acid*
- *Using a white tile*
- *Reading volume of liquid from the centre of the meniscus at eye level*

How will we know if our results are repeatable?
How will we know if our results are reproducible?



Talk Task

Drill

1. Give the name for the volume of liquid that is measured using a titration.
2. Define concordant results.
3. Describe the function of the indicator in a titration.
4. Describe the function of the white tile in a titration.
5. Define the end-point of a titration.
6. Name the piece of equipment that should be used to measure a fixed volume.
7. Name the piece of equipment that should be used to measure a variable volume.

Check for understanding

Drill answers

1. Titre
2. Results that fall within 0.2 cm^3 of each other.
3. To signify the end-point (where the acid/alkali has been completely neutralised).
4. It is placed underneath the conical flask so that the colour change can be seen more clearly.
5. When the acid or alkali has been completely neutralised.
6. Pipette
7. Burette

Check for understanding

Answer the questions below.

1. What is the end point of a titration?
   - ☑ A. When the acid/alkali has been completely neutralised
   - ☐ B. When all of the acid/alkali has been used up
   - ☐ C. The volume used to complete the titration

2. Which explains why an indicator such as phenolphthalein is used for titration rather than Universal Indicator?
   - ☑ A. It has an obvious colour change
   - ☐ B. It speeds up the reaction
   - ☐ C. It is cheaper and easier to obtain

3. Which is the most appropriate piece of apparatus to measure a volume of 25 cm^3?
   - ☐ A. A measuring cylinder
   - ☐ B. A conical flask
   - ☑ C. A pipette

Exit ticket

Feedback

Lesson C4.3.11 C4.3.12	
What was good about this lesson?	What can we do to improve this lesson?

Send us your feedback by clicking this link
or by emailing sciencemastery@arkonline.org
Thank you!