Edexcel Chemistry IGCSE

Practical 2.14: Determine the approximate percentage by volume of oxygen in air using a metal or a non-metal

Notes

Determine the percentage by volume of oxygen in air using iron

Aim

To determine the approximate percentage by volume of oxygen in air using iron.

Equipment list

- Burette
- Water trough
- Clamp and stand

Chemicals required

- Deionised water
- Iron filings

Method

1. Place wet iron filings inside the end of a burette. Use vaseline to make the filings stick.
2. Using a clamp, stand the burette vertically over a trough of water.
3. Record the starting height of the water in the burette.
4. Leave for a few weeks then record the final height of the water in the burette.
5. Calculate the change in height of the water in the burette. This is the volume of oxygen that was originally in the burette.
6. To calculate the percentage by volume of oxygen in air, divide the change in the burette reading by the original volume of air in the burette and multiply by 100.

Key points

- The water level in the burette will rise because the iron filings react with the oxygen in the burette. The water rises to replace the oxygen that has reacted.
- The burette water level should be read from at eye level using the bottom of the meniscus (the curve of the liquid).

Diagram

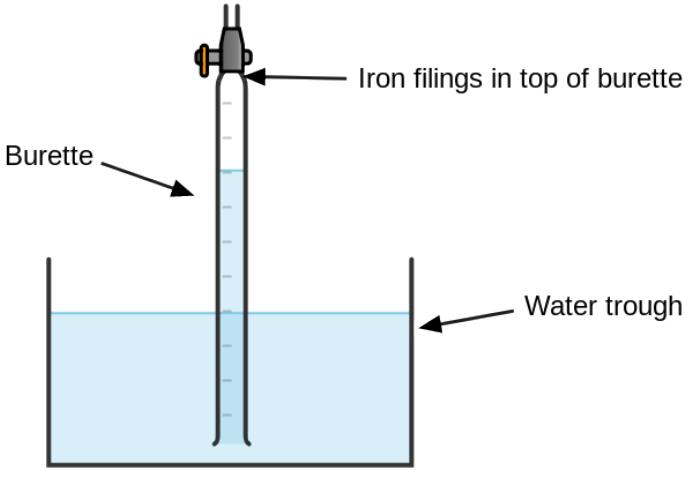

Figure 1 Experiment Setup

Chemix

Safety precautions

- Take care when handling fragile glassware. Clear up any broken glass immediately.
- Do not ingest the water.

Analysis of results

From the experiment, it is possible to calculate the approximate percentage by volume of oxygen in air.

$$\%\ O_2\ in\ air = \frac{\text{change in height of water in the burette}}{\text{initial volume of air in the burette}} \times 100$$

E.g. The initial water height in a 50 cm^3 burette was at 20 but decreases to 14 (remember the burette is upside down so although the values decrease, the water is actually rising).
Therefore the approximate % by volume of oxygen in air:
= [(20-14)/(50-20)] x 100
= 20%

Remember this is only an approximation for the volume of oxygen in air as it only investigates the air in the burette. There is no evidence that this result would be the same for the rest of the air in the room.

Determine the percentage by volume of oxygen in air using phosphorus

Aim
To determine the percentage by volume of oxygen in air using phosphorus.

Equipment list
- Bell jar and bung
- Water trough
- Evaporating dish
- Lighter

Chemicals required
- Deionised water
- Phosphorus

Method
1. Place the phosphorus in an evaporating dish and float the dish in a trough of water.
2. Ignite the phosphorous and then quickly place a bell jar into the water trough, covering the dish. Make sure there is space under the bell jar for water in the trough to move into the jar.
3. Take a note of the starting height of the water level in the bell jar.
4. Leave apparatus until the phosphorus is extinguished.
5. Measure the final water level in the bell jar. The decrease in the volume of air is the volume of oxygen originally in jar
6. Calculate the percentage of oxygen in air using the change in water level divided by the original volume of air in the bell jar and then multiplied by 100.

Key points
- The water level in the bell jar rises because the combustion of phosphorus uses up oxygen. The water rises to replace the volume of oxygen used up.

Safety precautions
- Take care when using the lighter. Run any burns under cold running water for up to 10 minutes, depending on the severity of the burn.
- Be careful of the fragile glassware. Clear up any broken glass immediately.
- Do not ingest the water.
- Wash hands after handling the phosphorus.

Analysis of results
From the experiment, it is possible to calculate the approximate percentage by volume of oxygen in air.

$$\%\ O_2\ \textit{in air} = \frac{\text{change in height of water in the bell jar}}{\text{initial volume of air in the bell jar}} \times 100$$

E.g. The initial water height in the bell jar was 10 cm but increases to 13. The total height of the bell jar is 25 cm.
Therefore the approximate % by volume of oxygen in air:
= [(13-10)/(25-10)] x 100
= (3/15) x 100
= 20%