WJEC (Wales) Chemistry GCSE

Specified Practical 2.5

Determination of the amount of energy released by a fuel

[Methods are adapted from the Royal Society of Chemistry]

Welsh Specification

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Calorimetry

Aim

To compare the different amounts of heat **energy produced** by burning various **alcohols** and monitoring **temperature change**.

Equipment

- Retort stand and clamp
- 250 cm^3 conical flask
- 100 cm^3 measuring cylinder
- Thermometer
- Electronic Balance ± 0.01 g
- Spirit burners (with wicks and caps) containing the following alcohols:
  - Methanol
  - Ethanol
  - Propan-1-ol
  - Propan-2-ol
  - Butan-1-ol

Method

1. Measure 100 cm^3 of **cold water** into a conical flask.
2. Clamp the flask above the **spirit burner** on a heatproof mat (see diagram).
3. **Weigh** and record the mass of the spirit burner (and cap) containing the alcohol.
4. Record the **initial water temperature**, making sure the thermometer does not touch the bottom of the flask.
5. Place the spirit burner under the flask and light the wick.
6. Allow the alcohol to **heat the water by 40°C**. Record the temperature with the thermometer.
7. **Extinguish** the flame by replacing the cap.
8. **Re-weigh** the spirit burner and cap, and record this mass.
9. Calculate the mass of alcohol used.
10. Repeat steps 1 to 9 using a fresh 100 cm^3 of cold tap water and a different alcohol.

Analysis

- Calculate **temperature rise** for each fuel.
- Calculate the **mass** of each alcohol burnt.
- Calculate the **energy released** for each alcohol using the following equation:

$$Energy\ released\ per\ gram\ of\ alcohol\ (J/g) = \frac{mass\ of\ water\ (g)\ x\ temperature\ rise\ (°C)\ x\ 4.2}{mass\ of\ alcohol\ (g)}$$

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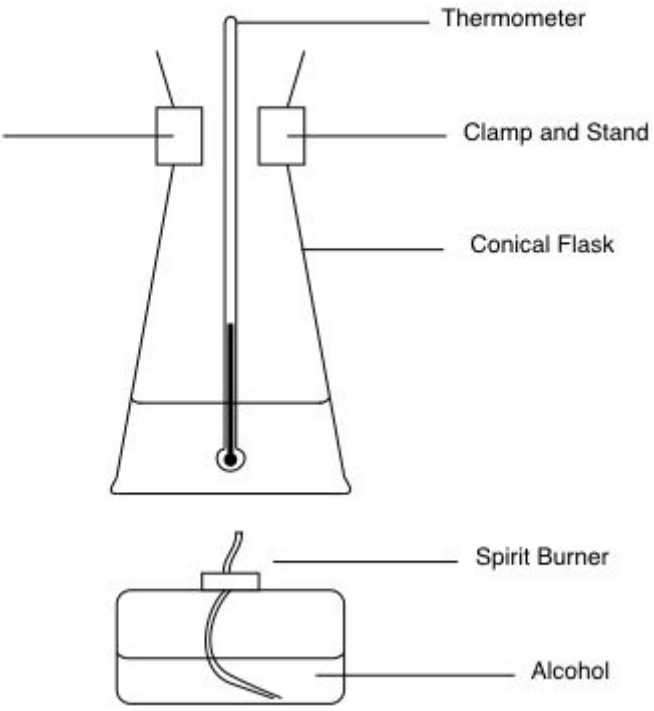
Diagram



Safety Precautions

Due to the following **hazards**, the experiment must be carried out in a **well ventilated** lab whilst wearing **safety goggles**:

- Methanol is highly flammable and toxic.
- Ethanol is highly flammable.
- Propan-1-ol is highly flammable, an irritant and harmful.
- Propan-2-ol is highly flammable, an irritant and harmful.
- Butan-1-ol is harmful and volatile.

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