# Edexcel Chemistry IGCSE

Practical 3.8: Investigate temperature changes accompanying some of the following types of change: salts dissolving in water, neutralisation reactions, displacement reactions and combustion reactions

Notes

# Temperature change in a displacement reaction

*This method is the same for a neutralisation reaction or for dissolving salts in water.*

## Aim

To investigate the temperature change when magnesium displaces copper from copper sulfate.To calculate the heat energy released during a displacement reaction.

## Equipment list

- Polystyrene cup
- Lid for cup (with hole for thermometer)
- Large beaker
- Cotton wool
- Thermometer

## Chemicals required

- Magnesium ribbons
- Copper sulfate

## Method

1. Place the polystyrene cup in the beaker. Fill the gaps around the polystyrene cup with cotton wool to provide more insulation.
2. Add 100 $cm^3$ of copper sulfate to the polystyrene cup. Record the initial temperature of the copper sulfate. Leave the thermometer in the cup.
3. Add the magnesium to the polystyrene cup and put the lid on the cup.
4. Record the highest temperature reached, as measured by the thermometer.
5. Calculate the amount of energy released using the equation $q = mc\Delta T$.

## Key points

- To increase the reliability of this experiment, heat loss must be minimised. For this reason, a polystyrene cup, lid and cotton wool are used.
- The equation for this reaction is:
  $CuSO_4 + Mg \rightarrow MgSO_4 + Cu$
  This is a displacement reaction because magnesium displaces the copper from the ionic compound.

## Safety precautions

- Be careful of the reaction mixture as it may get quite hot. Be careful with the thermometer which may heat up quite quickly since it remains in the reaction mixture throughout the experiment.
- Copper sulfate is an irritant so avoid contact with the skin. Wash hands immediately if the skin comes into contact with it.

## Analysis of results

The energy released during the reaction can be calculated from the equation:

$$Q = mc\Delta T$$

Q: Energy released (J)
c: Specific heat capacity (J/kg°C)
ΔT: Change in temperature

# Temperature change in a combustion reaction

## Aim
To investigate the temperature change in a combustion reaction. To calculate the heat energy released during a combustion reaction.

## Equipment list
- Copper can
- Lighter
- Digital balance
- Measuring cylinder
- Tripod
- Gauze
- Heatproof mat
- Thermometer

## Chemicals required
- Ethanol spirit burner
- Water

## Method
1. Using a measuring cylinder, pour 100 $cm^3$ of water into the copper can.
2. Measure the new mass of a spirit burner containing ethanol.
3. Place the copper can on the tripod with the gauze and place the spirit burner below it.
4. Measure the initial temperature of the water.
5. Light the spirit burner until it extinguishes.
6. Record the maximum temperature that the water reaches.
7. Measure the final mass of the spirit burner.
8. Calculate the amount of energy released from the combustion of ethanol using the equation $q = mc\Delta T$.

## Key points
- The equation for this reaction is:
  $C_2H_5OH + 3O_2 \rightarrow 2CO_2 + 3H_2O$
- A copper can is used in this experiment because copper has a low specific heat capacity so only absorbs a small amount of the heat energy.
- The biggest source of error in this experiment is heat loss to the environment. This could be reduced by placing a lid on the copper can. The lid must have hole for the thermometer.

## Safety precautions
- The copper can will get quite hot. Be careful not to touch it while the experiment is being carried out to avoid burns.
- Don't leave the flame unattended and once lit, don't carry the spirit burner. Tie back long hair.

- Make sure the tripod is stable before starting to heat the water and avoid moving it while the copper can is hot. Hot water can cause burns. If burns do occur, hold the burn under cold running water for up to 10 minutes, depending on the severity.

**Analysis of results**

The energy released during the reaction can be calculated from the equation:

$$q = mc\Delta T$$

q: Energy released (J)
c: Specific heat capacity (J/kg°C)
ΔT: Change in temperature

If you calculate how many grams (or moles) of ethanol burnt, you can calculate the amount of energy released per gram (or mole) of ethanol.