# 8.2 CALORIMETRY

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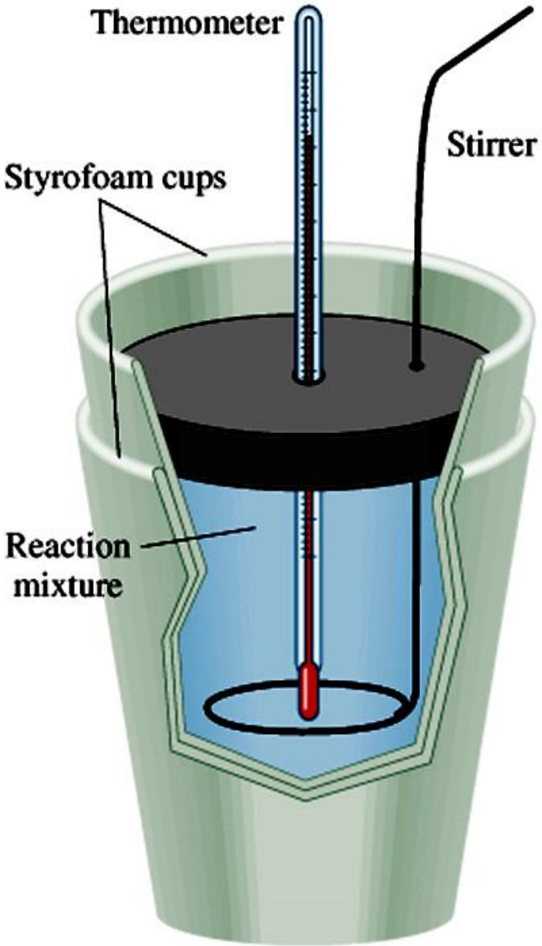
Objectives:

- Define heat capacity and specific heat capacity
- Calculate heat change in a calorimeter

# CALORIMETRY

- A method used in the laboratory **to measure the heat change** of a reaction.
- Apparatus used is known as the **calorimeter**
- Examples of calorimeter
  - Simple calorimeter
  - Bomb calorimeter

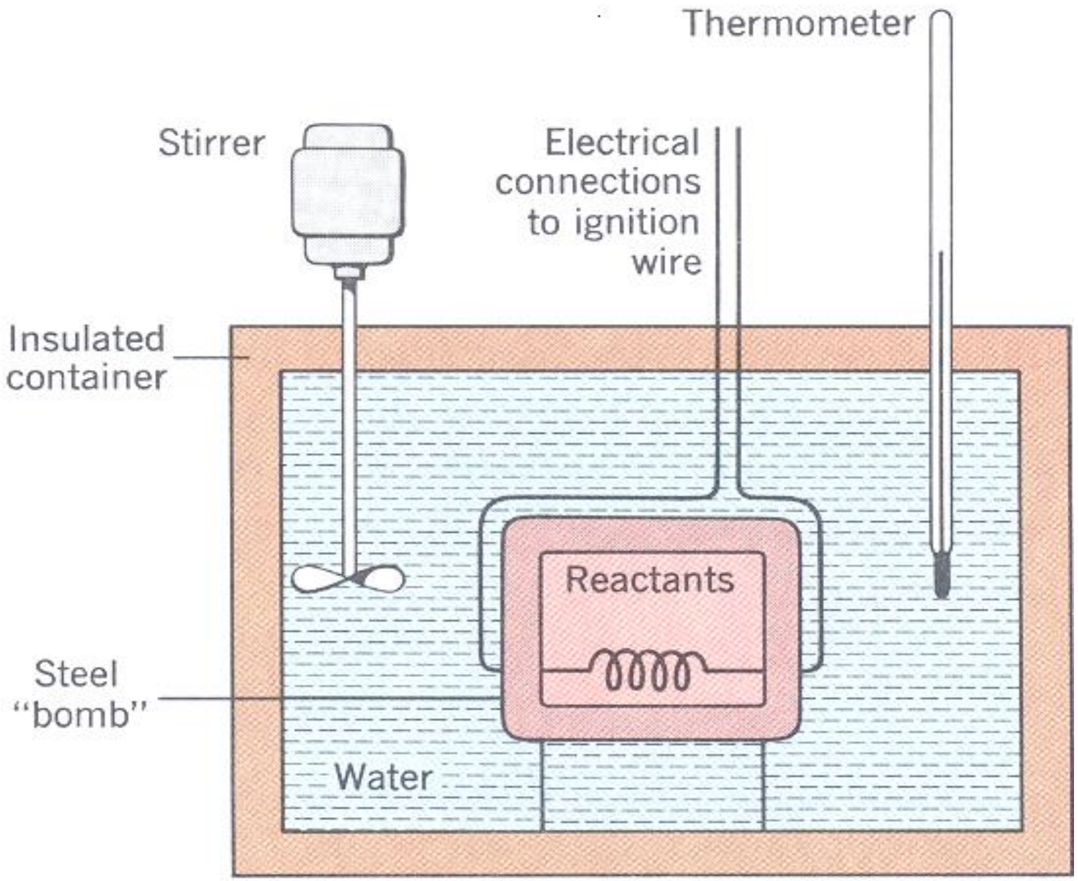
# Simple calorimeter
# (constant pressure calorimeter)

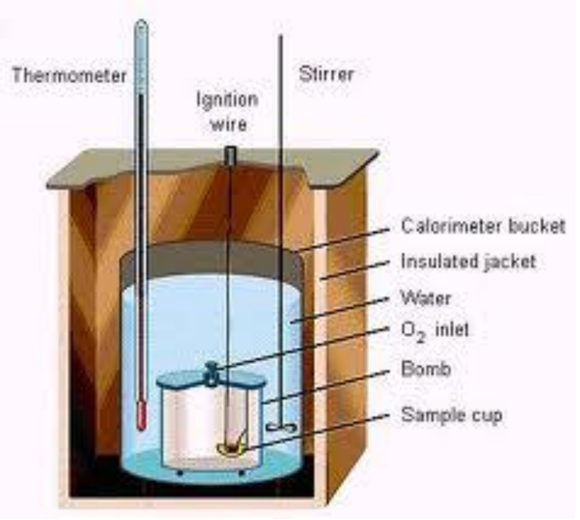



- The outer Styrofoam cup insulate the reaction mixture from the surroundings (it is assumed that no heat is lost to the surroundings)
- Heat released by the reaction is absorbed by solution and the calorimeter

***Used to measure***
***heat of neutralisation, heat of solution or heat of dilution***

# A bomb calorimeter
## (constant volume calorimeter)




**- Used to measure heats of combustion**

# HEAT CAPACITY, C

- the ***heat capacity* (*C*)** **of a substance is the amount of heat (Q or *q*) required to raise the temperature of a given quantity mass of the substance by one degree Celsius.**

$$Q = C\Delta T$$

*(Unit for C is J $^{o}C^{-1}$ )*

$\Delta T = T_{final} - T_{initial}$

# SPECIFIC HEAT CAPACITY, c

- the ***specific heat capacity (c)*** **of a substance is the amount of heat (*q*) required to raise the temperature of one gram of a substance by one degree Celsius.**

$$Q = m c \Delta T$$

*(Unit for c is J g$^{-1}$ $^{o}$C$^{-1}$ )*

$\Delta T = T_{final} - T_{initial}$

## Law of conservation of energy

**Heat released = heat absorbed**

$$-Q_{\text{rxn}} = Q_{\text{water}} + Q_{\text{cal}}$$

***But…***

$$Q_{\text{water}} = m\ c\ \Delta T$$

$$Q_{\text{bomb}} = C_{cal}\ \Delta T$$

$$Q_{rxn} = (m\ c\ \Delta T\ +\ C_{cal}\ \Delta T)$$

**Once $Q_{reaction}$ is calculated, we can stoichiometrically convert it into ΔH.** $Q_{\text{rxn}} \rightarrow \Delta H$

**Since $Q_{rxn}$ is defined as the heat released, ΔH has a negative value!**

# SUMMARY

- Heat absorbed = heat released
- Heat change, $\boldsymbol{Q = m\,c\,\theta}$ or $\boldsymbol{Q = C\,\theta}$