AQA Chemistry A-level
Topic 1.4 - Energetics

Flashcards

What energy change is breaking bonds associated with?

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Energy is taken in to break bonds →

endothermic reaction

What energy change is making bonds associated with?

What energy change is making bonds associated with?

Energy is released to make bonds → exothermic reaction

What are some uses of thermochemistry?

What are some uses of thermochemistry?

Measuring and comparing the energy values of fuels

Calculating the energy requirements for industrial processes

Working out the theoretical amount of energy released/taken

in in a reaction

Predicting if a reaction will take place or not

What is an endothermic reaction?

What is an endothermic reaction?

One with an overall positive enthalpy change (+ΔH) → energy in breaking bonds > energy out making bonds

What is an exothermic reaction?

What is an exothermic reaction?

One with an overall negative enthalpy change (-ΔH) → energy in breaking bonds < energy out making bonds

If a reversible reaction is endothermic one way, what type of the reaction is the other way?

If a reversible reaction is endothermic one way, what type of reaction is the other way?

exothermic

Give 2 examples of exothermic reactions

Give 2 examples of exothermic reactions

Combustion of fuels

Neutralisation

Give an example of an endothermic reaction

Give an example of an endothermic reaction

Thermal decomposition

Define enthalpy change; what symbol is used to represent it?

Define enthalpy change; what symbol is used to represent it?

Energy change of a system at a constant

pressure

represented by ΔH

What are the standard conditions?

What are the standard conditions?

100kPa / 1atm pressure

298K / 25^{0}C temperature

What does "in standard state" mean?

What does "in standard state" mean?

The state an element/compound exists at in standard conditions (100kPa, 298K)
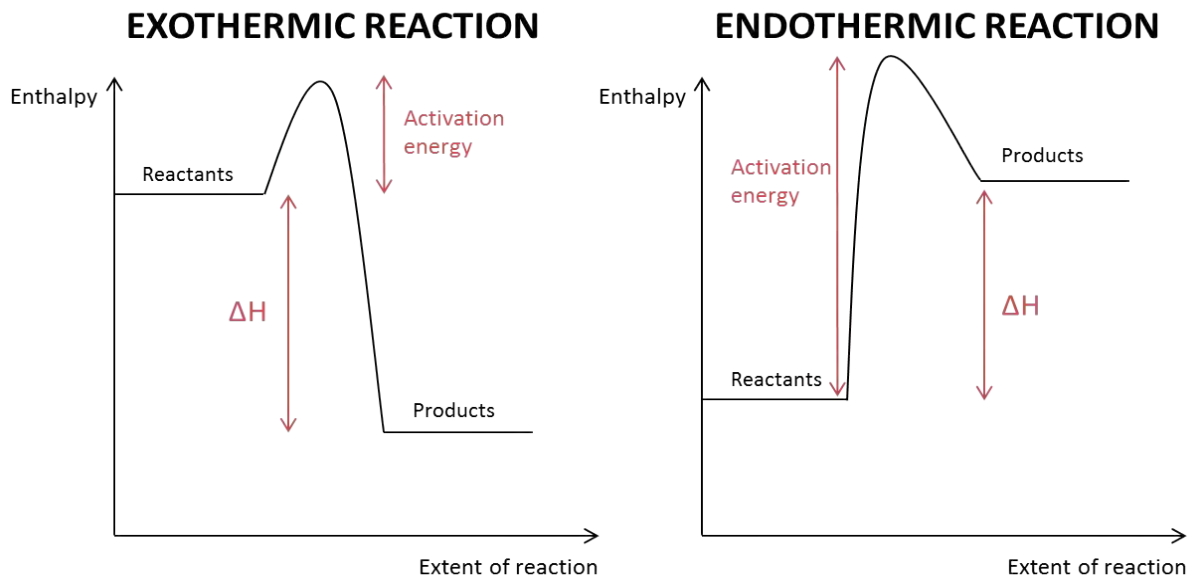
Draw an enthalpy change diagram for an endothermic reaction, and one for an exothermic reaction

Draw an enthalpy change diagram for an endothermic reaction, and one for an exothermic reaction

Define standard enthalpy of formation

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The enthalpy change when one mole of a compound is formed from it constituent elements in standard conditions (100kPa, 298K), with reactants and products in their standard states.

Give an example of an equation which represents standard enthalpy of formation

Give an example of an equation which represents standard enthalpy of formation

There are many e.g. H_2 (g) + ½ O_2 (g) $\rightarrow$ H_2O (l)

Define standard enthalpy of combustion

Define standard enthalpy of combustion

The enthalpy change when one mole of a substance is burnt completely in oxygen in standard conditions (100kPa, 298K), with reactants and products in their standard states.
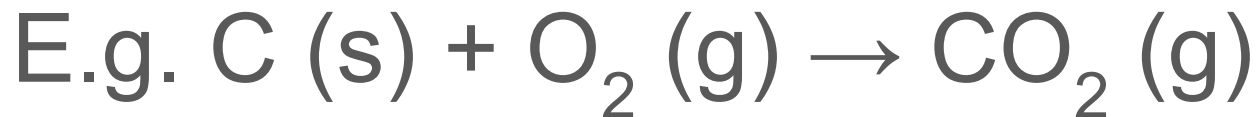
Give an example of an equation which represents standard enthalpy of combustion

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E.g. $C\ (s) + O_2\ (g) \rightarrow CO_2\ (g)$

What is the difference between heat and temperature?

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Heat is the sum of all particles' energy, therefore it is affected by the amount of substance; temperature is related to the mean kinetic energy of the particles in a system, so is independent of the number of particles present.

How can you calculate enthalpy change from experimental data?

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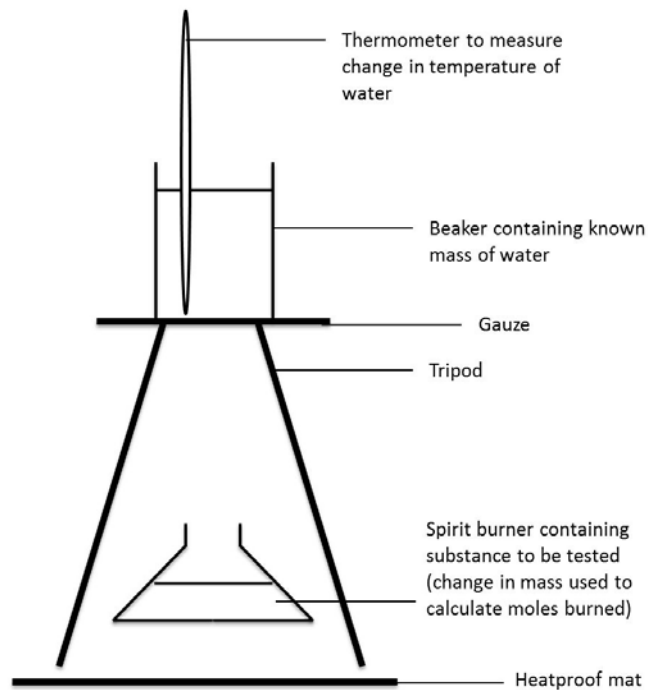
Use the equation Q = mcΔT, where m is the mass of the substance being heated (usually water), c is the specific heat capacity of that substance (water's SHC = 4.18gJ⁻¹K⁻¹) and ΔT is the change in temperature

Draw a simple calorimeter

Draw a simple calorimeter

Thermometer to measure change in temperature of water

Beaker containing known mass of water

Gauze

Tripod

Spirit burner containing substance to be tested (change in mass used to calculate moles burned)

Heatproof mat

How could this calorimeter be made more accurate?

Thermometer to measure change in temperature of water

Beaker containing known mass of water

Gauze

Tripod

Spirit burner containing substance to be tested (change in mass used to calculate moles burned)

Heatproof mat
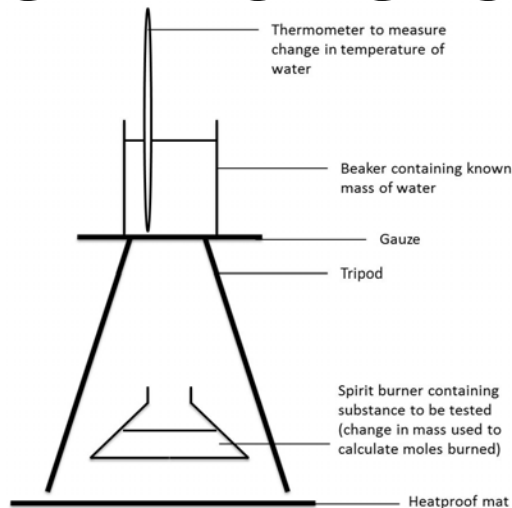
How could this calorimeter be made more accurate?

Add draught screens at the sides, add a lid on top of the beaker, add mineral wool around the beaker → all to insulate and reduce heat lost to the surroundings

Thermometer to measure change in temperature of water

Beaker containing known mass of water

Gauze

Tripod

Spirit burner containing substance to be tested (change in mass used to calculate moles burned)

Heatproof mat
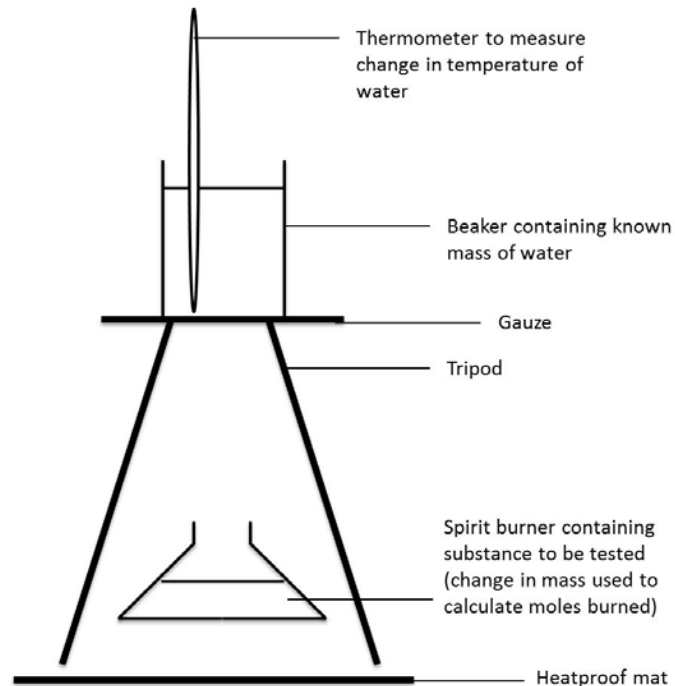
What is a flame calorimeter; how does it differ to a simple calorimeter?

What is a flame calorimeter; how does it differ to a simple calorimeter?

Reduces heat lost to the surrounding to give more accurate results: has a spiral chimney made of copper, an enclosed flame and the fuel is burnt in pure oxygen, not air.

How would you measure the enthalpy change for a reaction occurring in (aq)?

How would you measure the enthalpy change for a reaction occurring in (aq)?

Use an expanded polystyrene cup as a calorimeter (good insulator → reduce heat loss). Heat is generated in the solution; measure this temperature change. Take heat capacity of solution to be 4.18 and density of solution = $1gcm^{-3}$.

What can you use to make experimental determination of enthalpy change of reaction more accurate?

What can you use to make experimental determination of enthalpy change of reaction more accurate?

Cooling curves

What is Hess's Law?

What is Hess's Law?

States that the enthalpy change for a reaction is the same regardless of the route taken

What is the enthalpy of an element?

What is the enthalpy of an element?

The enthalpy of all elements in their standard states (the states in which they exist at 100kPa and 298K) is defined as 0

Define bond dissociation enthalpy.

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The enthalpy change required to break a covalent bond, with all species in the gaseous state; differs for the same bond type in different molecules.

Define mean bond enthalpy.

Define mean bond enthalpy.

Average value (across different chemical environments) for the bond dissociation enthalpy of a given bond.

Why may experimental methods for enthalpy determination not be very accurate?

Why may experimental methods for enthalpy determination not be very accurate?

Heat is lost to the surroundings

Not in standard conditions

Reaction may not go to completion

Why will using bond enthalpies not be as accurate as using standard enthalpy of combustion/formation?

Why will using bond enthalpies not be as accurate as using standard enthalpy of combustion/formation?

Bond enthalpies are a mean for the same bond across different molecules; standard enthalpy of combustion and formation apply just to that molecule, therefore they are more accurate.