

Edexcel Chemistry A-level

Topic 8 - Energetics I

Flashcards

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What does system mean in a chemical reaction?



What does system mean in a chemical reaction?

The atoms and bonds involved in the chemical reaction



Explain the law of conservation



Explain the law of conservation

The amount of energy in an isolated system remains the same. Energy cannot be destroyed or created, It can only be transferred from one form to another



What energy change is breaking bonds associated with?



What energy change is breaking bonds associated with?

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 is an endothermic reaction?



What is an endothermic reaction?

A reaction with an overall positive enthalpy change ($+\Delta H$) \rightarrow enthalpy of products $>$ enthalpy of reactants



What is an exothermic reaction?



What is an exothermic reaction?

A reaction with an overall negative enthalpy change ($-\Delta H$) \rightarrow enthalpy of products $<$ enthalpy of reactants

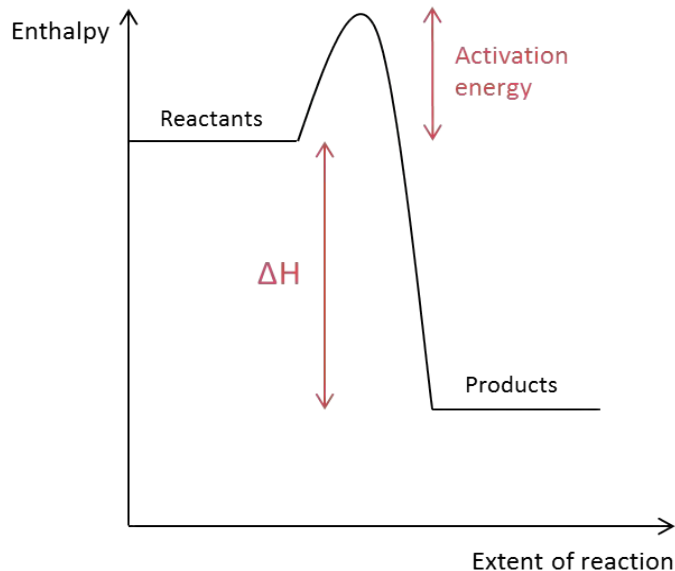


Draw an enthalpy change diagram for an endothermic reaction, and one for an exothermic reaction

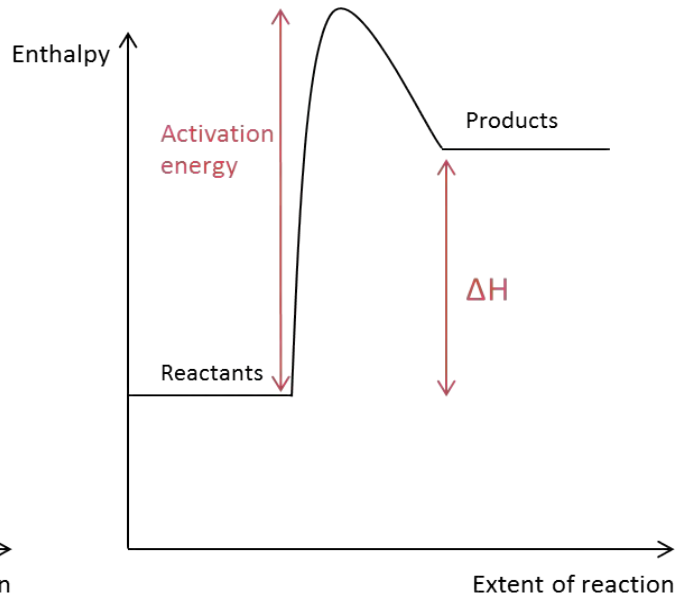


Draw an enthalpy change diagram for an endothermic reaction, and one for an exothermic reaction

EXOTHERMIC REACTION



ENDOTHERMIC REACTION



What does activation energy mean?



What does activation energy mean?

The minimum energy required for a reaction to take place



Which way does the arrow for activation energy point on an enthalpy profile diagram?



Which way does the arrow for activation energy point on an enthalpy profile diagram?

Always points upwards



What are the standard conditions?



What are the standard conditions?

100 kPa

298 K



What does “in standard state”
mean?



What does “in standard state” mean?

The state an element / compound exists at in standard conditions (100 kPa, 298 K)



Define enthalpy change of formation



Define enthalpy change of formation

The energy change that takes place when 1 mole of a compound is formed from its constituent elements in their standard state under standard conditions



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. $\text{H}_2 (\text{g}) + \frac{1}{2} \text{O}_2 (\text{g}) \rightarrow \text{H}_2\text{O} (\text{l})$



Define enthalpy change of combustion



Define enthalpy change of combustion

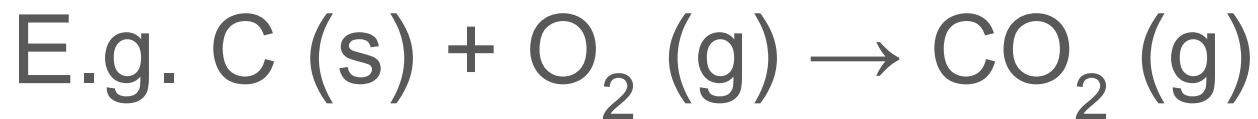
The energy change that takes place when 1 mole of a substance is completely combusted



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



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



Define enthalpy change of neutralisation



Define enthalpy change of neutralisation

The energy change that takes place when 1 mole of water is formed from a neutralisation reaction



What does enthalpy change of reaction mean?



What does enthalpy change of reaction mean?

The energy change associated with a given reaction



How can you calculate
enthalpy change from
experimental data?



How can you calculate enthalpy change from experimental data?

Use the equation $Q = mc\Delta T$, where m is the mass of the substance being heated (usually water), c is the specific heat capacity of that substance (water's SHC = $4.18\text{gJ}^{-1}\text{K}^{-1}$) and ΔT is the change in temperature



Complete this question:

A student carries out an experiment to determine the enthalpy change of combustion of glucose.

In the experiment, 0.831 g of glucose is burned. The energy released is used to heat 100 cm³ of water from 23.7 °C to 41.0 °C.

- (i) Calculate the energy released, in kJ, during combustion of 0.831 g glucose.

The specific heat capacity of water = 4.18 J g⁻¹ K⁻¹.

Density of water = 1.00 g cm⁻³.

- (ii) Calculate the amount, in moles, of glucose that is burned.
- (iii) Calculate the enthalpy change of combustion of glucose.
Give your answer to **three significant figures**.



Complete the question

Step 1: Use $q=mc\Delta t$ to calculate the energy released

$$\begin{aligned}\Rightarrow Q &= 100 \times 17.3 \times 4.18 \\ &= 7231.4 \text{ J} \\ &= \underline{\underline{7.2314 \text{ kJ}}}\end{aligned}$$

Step 2

$$\Rightarrow \text{Moles} = \text{Mass} / M_r$$

Mr of glucose = 180

$$0.831 / 180 = \underline{\underline{0.00462 \text{ mol}}}$$

Step 3

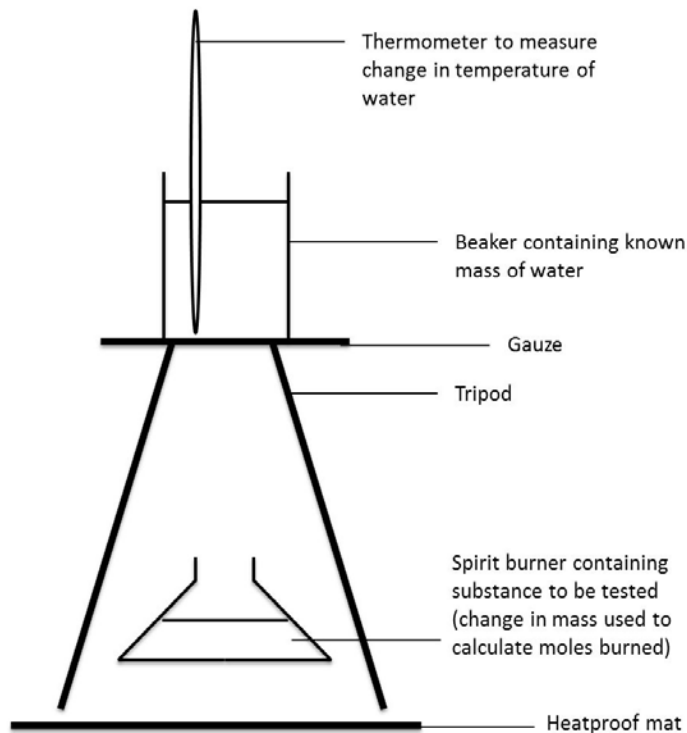
$$\Rightarrow 7.2314 / 0.00462 = \underline{\underline{1570}} \text{ . kJ mol}^{-1}$$



Draw a simple calorimeter



Draw a simple calorimeter



Why might experimental methods for enthalpy determination not be accurate?



Why might experimental methods for enthalpy determination not be accurate?

Heat is lost to the surroundings

Not in standard conditions

Reaction may not go to completion



What does average bond enthalpy mean?



What does average bond enthalpy mean?

The mean energy required to break 1 mole of bonds in gaseous molecules



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 whereas standard enthalpy of combustion and formation apply just to that molecule, therefore they are more accurate.



How to calculate enthalpy change of reaction using average bond enthalpies?



How to calculate enthalpy change of reaction using average bond enthalpies?

$$\Delta H = \Sigma (\text{bond enthalpies of reaction}) - \Sigma (\text{bond enthalpies of products})$$



What is Hess's Law?



What is Hess's Law?

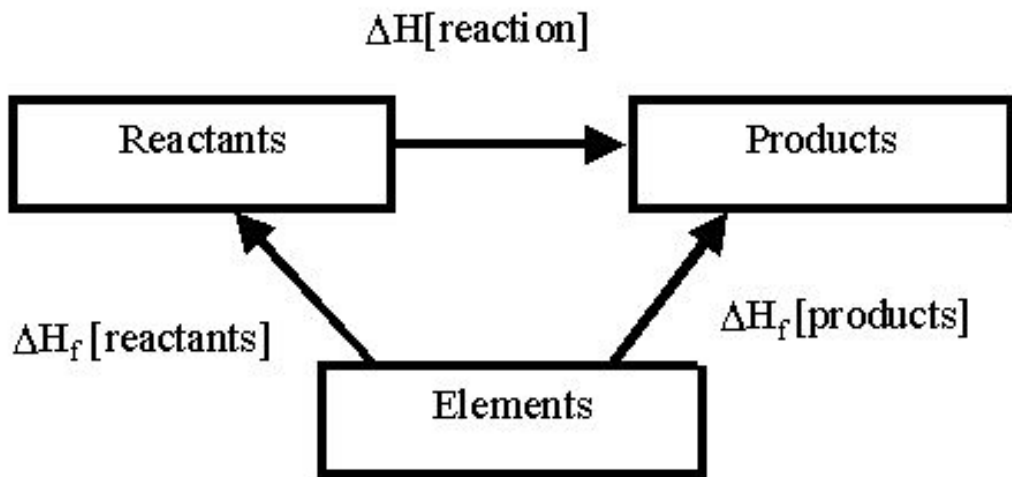
States that the enthalpy change for a reaction is the same regardless of the route taken



How do you calculate the enthalpy of reaction using Hess' cycles from enthalpy change of formation data?



How do you calculate the enthalpy of reaction using Hess' cycles from enthalpy change of formation data?



How do you calculate the enthalpy of reaction using Hess' cycles from enthalpy change of combustion data?



How do you calculate the enthalpy of reaction using Hess' cycles from enthalpy change of combustion data?

