Checkpoint Task

Enthalpy changes

Learner Activity

Exothermic reactions

1. Write a definition of an exothermic reaction.

2. Draw an enthalpy profile diagram for an exothermic reaction.

   Label the axes, ΔH and the activation energy.

3. Give an example of an exothermic reaction.

Endothermic reactions

4. Write a definition of an endothermic reaction.

5. Draw an enthalpy profile diagram for an endothermic reaction.

   Label the axes, ΔH and the activation energy.

6. Give an example of an endothermic reaction.

Bond enthalpy

7. Write a definition of bond enthalpy. (You might know this term as ‘bond energy’.)

8. In a chemical reaction, bonds in the reactants are broken, and new bonds are formed to make the products. Complete the following sentences.

Energy is _____ to break bonds.

Energy is _____ when bonds are formed.

The overall energy change of a reaction is the

_____

Calculations

Remember:

enthalpy change = energy required to break bonds – energy released in making bonds

or

$\Delta_r H = \Sigma$(bond enthalpies in reactants) – Σ(bond enthalpies in products)

9. Use bond enthalpies to calculate the enthalpy change for the following reaction.

$H_2(g) + Br_2(g) \rightarrow 2HBr(g)$

Bond	H–H	Br–Br	H–Br
Bond enthalpy / kJ mol^{-1}	438	193	366

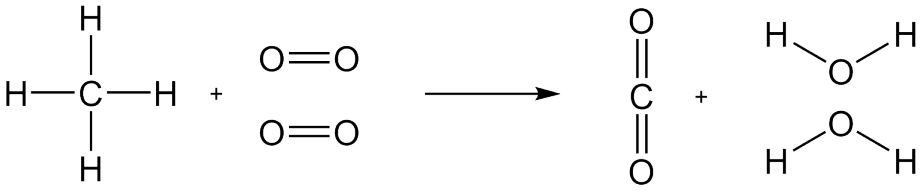
Energy required to break bonds:

Energy released in forming new bonds:

Enthalpy change:

10. Use bond enthalpies to calculate the enthalpy change for the combustion of methane.

$CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(g)$



Bond	C–H	C–C	O–H	C=O	O=O
Bond enthalpy / kJ mol^{-1}	413	347	464	805	498

Energy required to break bonds:

Energy released in forming new bonds:

Enthalpy change:

11.

Bond	C–H	C–C	H–H	C=C
Bond enthalpy / kJ mol^{-1}	413	347	436	612

Use the bond energies above to calculate

a) the enthalpy change for the hydrogenation of ethene

$H_2C{=}CH_2(g) + H_2(g) \rightarrow CH_3CH_3(g)$

b) the enthalpy change for the cracking of decane

$C_{10}H_{22}(g) \rightarrow H_2C{=}CH_2(g) + C_8H_{18}(g)$

12. Explain in terms of bond breaking and bond formation why combustion reactions are exothermic but cracking reactions are endothermic.