



Enthalpy

Enthalpy () & Enthalpy Change ()

1 2 3 4 5

_____ () =

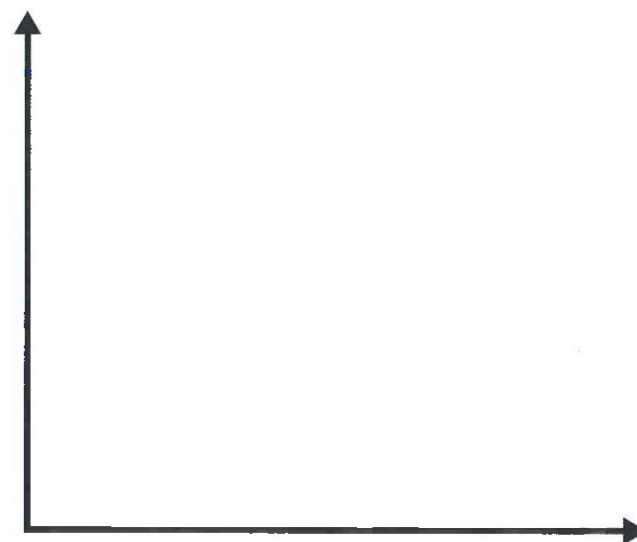
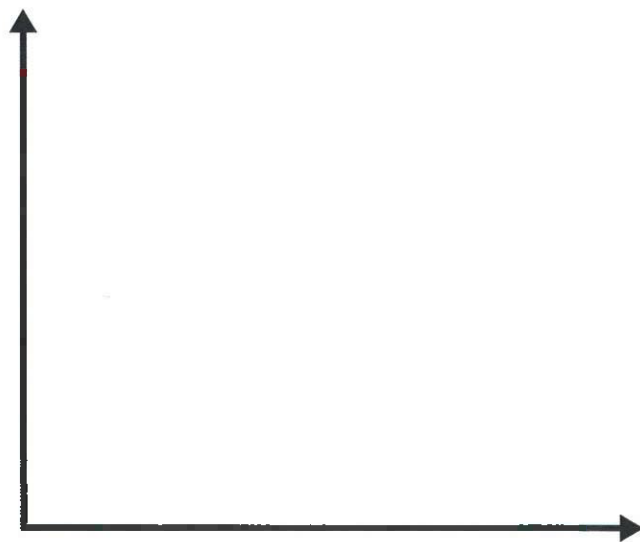
_____ () =

Exothermic Reaction

Endothermic Reaction

Enthalpy
change

ENERGY
PROFILE
DIAGRAMS





Enthalpy Change () - The Reactions

1 2 3 4 5

Enthalpy Change
of a reaction

REACTION $\quad = \quad$
e.g. $\quad + \quad \rightarrow \quad +$

e.g. $\quad + \quad \rightleftharpoons$

Enthalpy of
Formation

FORMATION

e.g. $\quad + \quad \rightarrow$

Enthalpy of
Combustion

COMBUSTION

e.g. $\quad + \quad \rightarrow \quad +$

Enthalpy of
Neutralisation

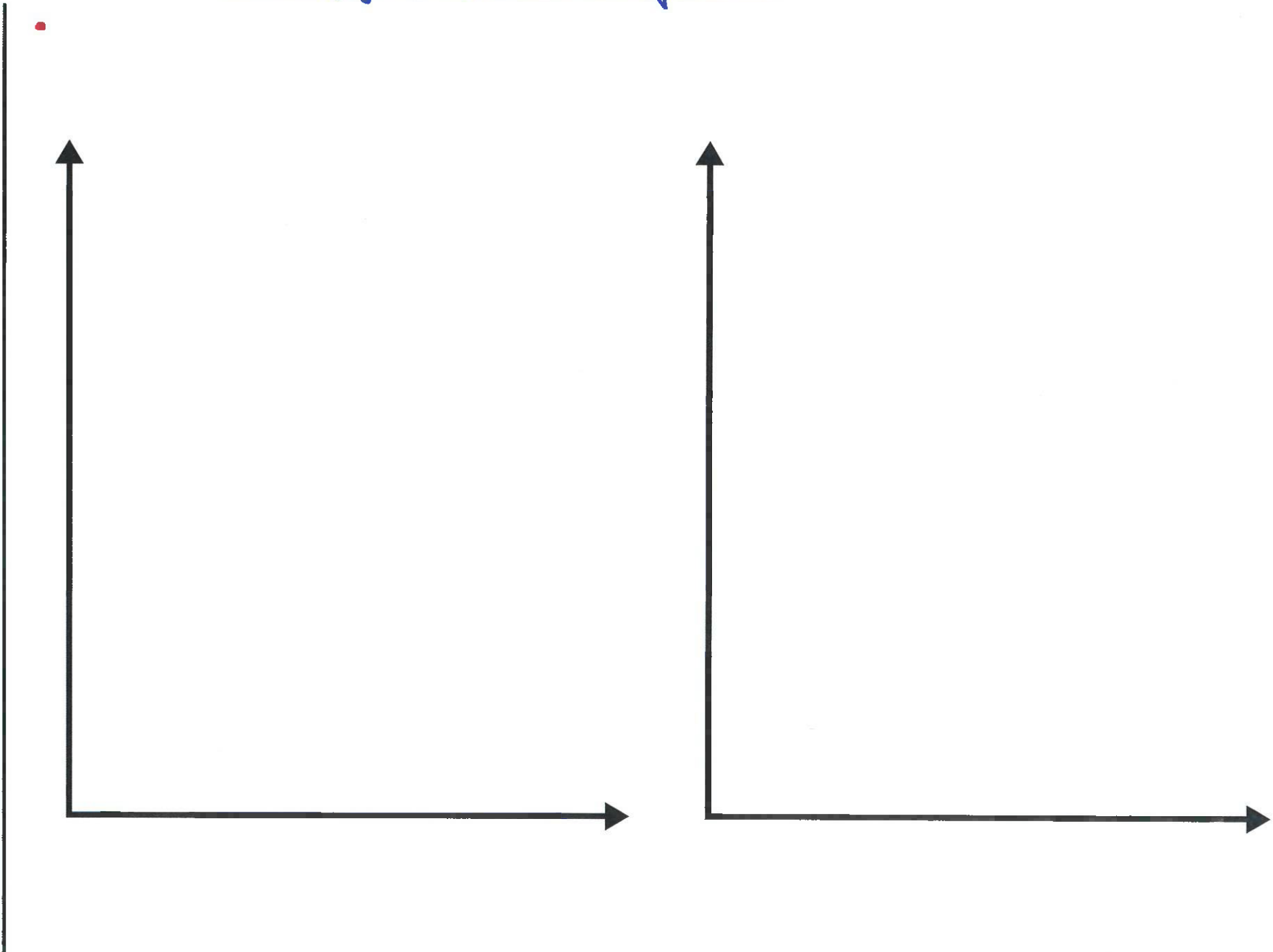
NEUTRALISATION

e.g. $\quad + \quad \rightarrow \quad +$



Energy Profile Diagrams

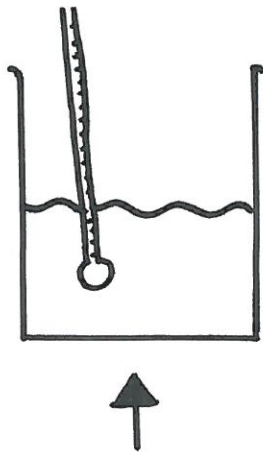
1 2 3 4 5



Calorimetry (=)

Exothermic Reaction :

Endothermic Reaction :



e.g.

+



+



Calorimetry - Alternative Calculation

1

2

3

4

5

Exothermic

•

•

•

•

Endothermic

•

•

•

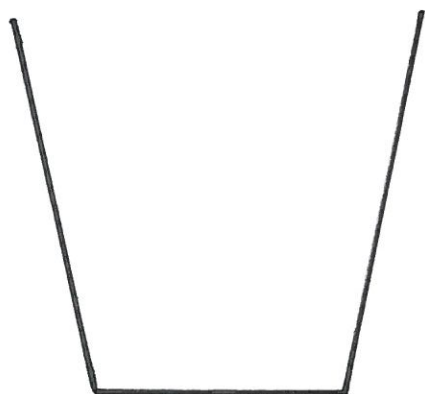
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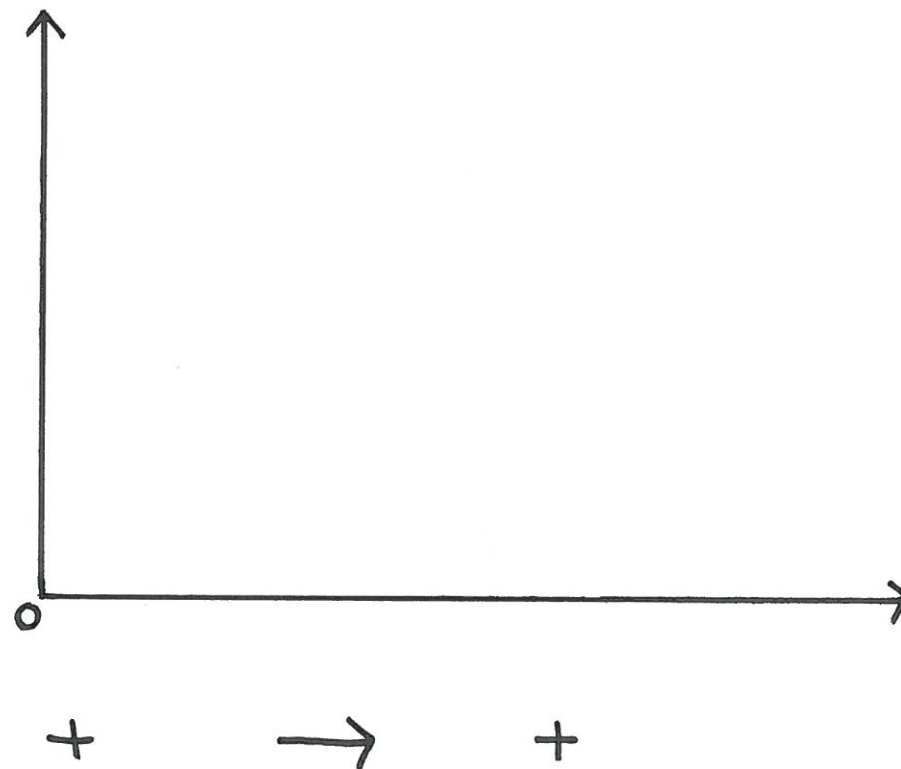


Measuring & Calculating $\Delta H^\ominus$

1 2 3 4 5



"
"
"





Measuring & Calculating ΔH_c°

1 2 3 4 5

i.e.

Result will be different to official value because :

①

②

Hess' Law - Introduction



REACTANTS

PRODUCTS



=

=

=

More Likely Scenarios

①

②

REACTANTS

PRODUCTS

REACTANTS

PRODUCTS



Hess' Law - Using ΔH_f°

1 2 3 4 5

Reminder -

When? -

Important -

e.g.

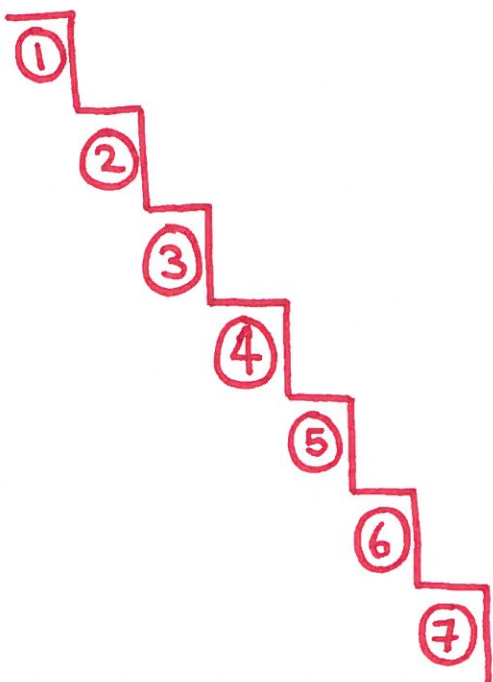
+

→

+



Rules:



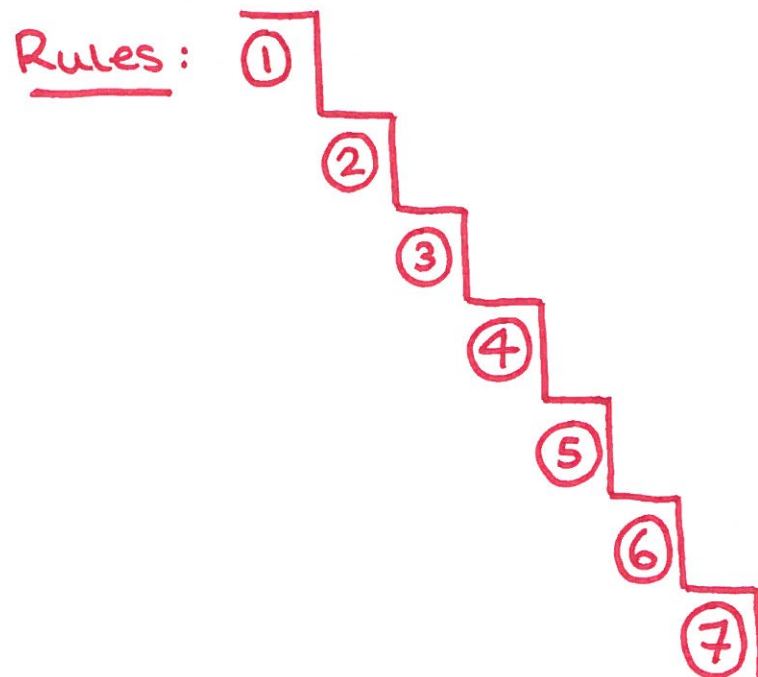
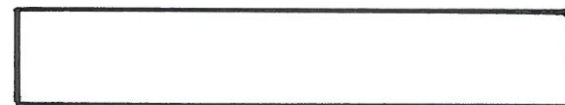


Hess' Law - Using ΔH_c°

1 2 3 4 5

Reminder -
when? -
Important!

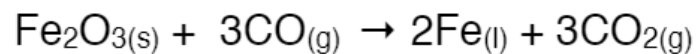
+ + →





EXAMPLE HESS' LAW CALCULATIONS - QUESTION 1

Use the information given to calculate the standard enthalpy change of the following reaction:



	$\Delta H^\ominus_f$ (kJ.mol ⁻¹)
$\text{Fe}_2\text{O}_{3(s)}$	-822
$\text{CO}_{(g)}$	-111
$\text{Fe}_{(l)}$	+14
$\text{CO}_{2(g)}$	-394



EXAMPLE HESS' LAW CALCULATIONS - QUESTION 2

Write the equation for the standard enthalpy of combustion of Glucose ($\text{C}_6\text{H}_{12}\text{O}_{6(\text{s})}$)

Use the following enthalpy changes to calculate the Standard enthalpy of formation of Glucose:

	(kJ.mol ⁻¹)
$\Delta H^\ominus_f \text{ CO}_{2(\text{g})}$	-394
$\Delta H^\ominus_f \text{ H}_2\text{O}_{(\text{g})}$	-286
$\Delta H^\ominus_c \text{ C}_6\text{H}_{12}\text{O}_{6(\text{s})}$	-2830



Constructing Hess' Cycles Using Equations

1

2

3

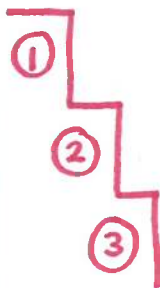
4

5

①

②

Q: Use the data to calculate the enthalpy change for the following reaction:



Mean Bond Enthalpies

e.g.

Bonds Broken =

Bonds Formed =

+

→

+

+

→

+

C-H : 413

C-C : 348

C-O : 360

O-H : 463

O=O : 498

•

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