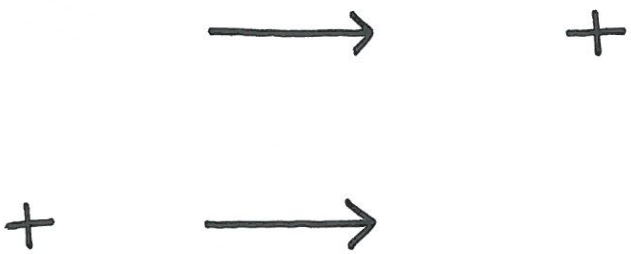
TT

ΔH_{latt}

Lattice Enthalpy - ΔH_{LATT}

1 2 3 4 5

Equal & Opposite



Factors Affecting ΔH_{LATT}

①

②

e.g.

e.g.

TT

"Need to know" ΔH's

1 2 3 4 5

ΔH_f

$\Delta H_{I.E.}$

ΔH_a

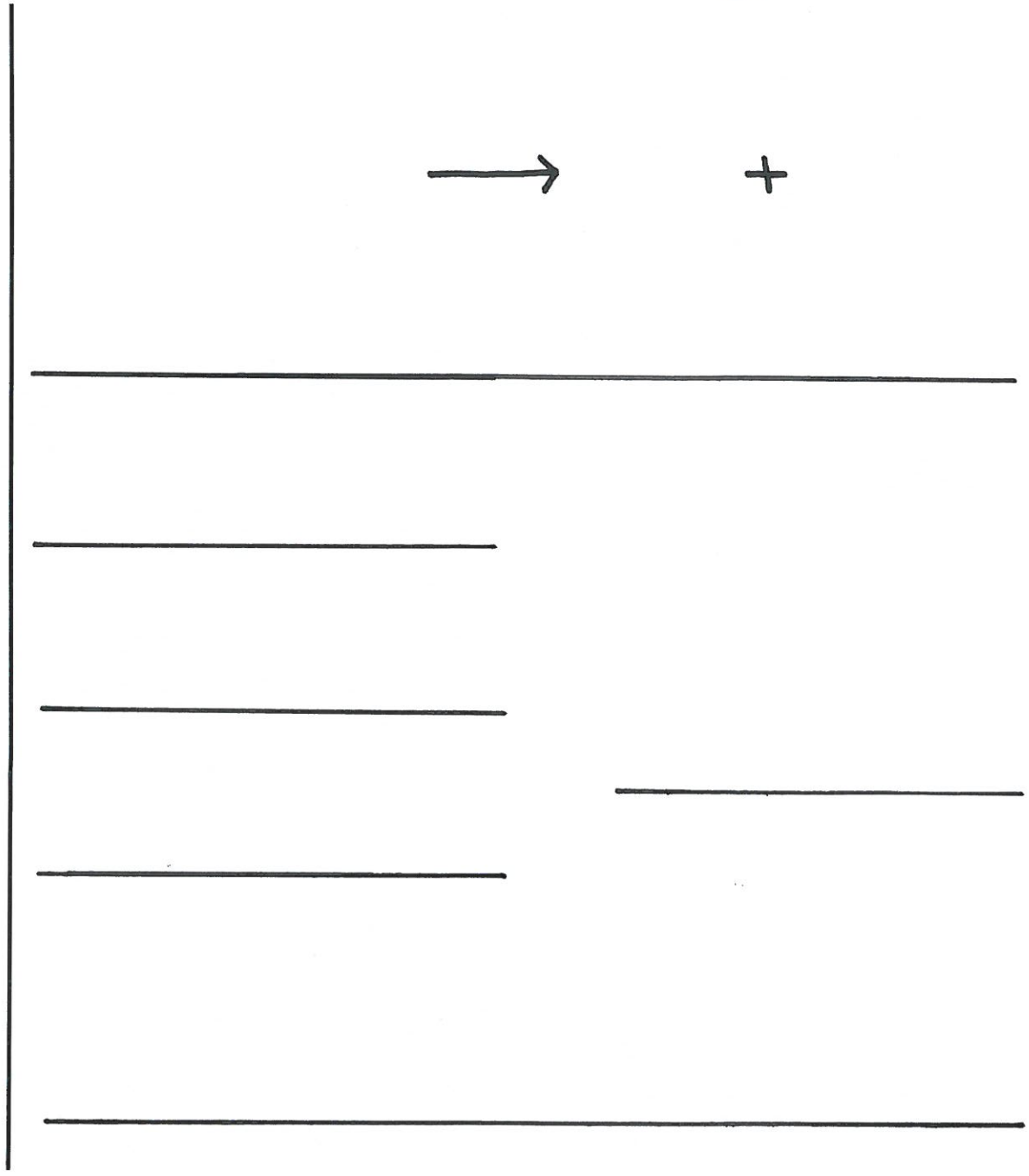
$\Delta H_{B.E}$

$\Delta H_{E.A.}$

ΔH_{LATT}

Born - Haber Cycles

1 2 3 4 5



Enthalpy Changes Needed

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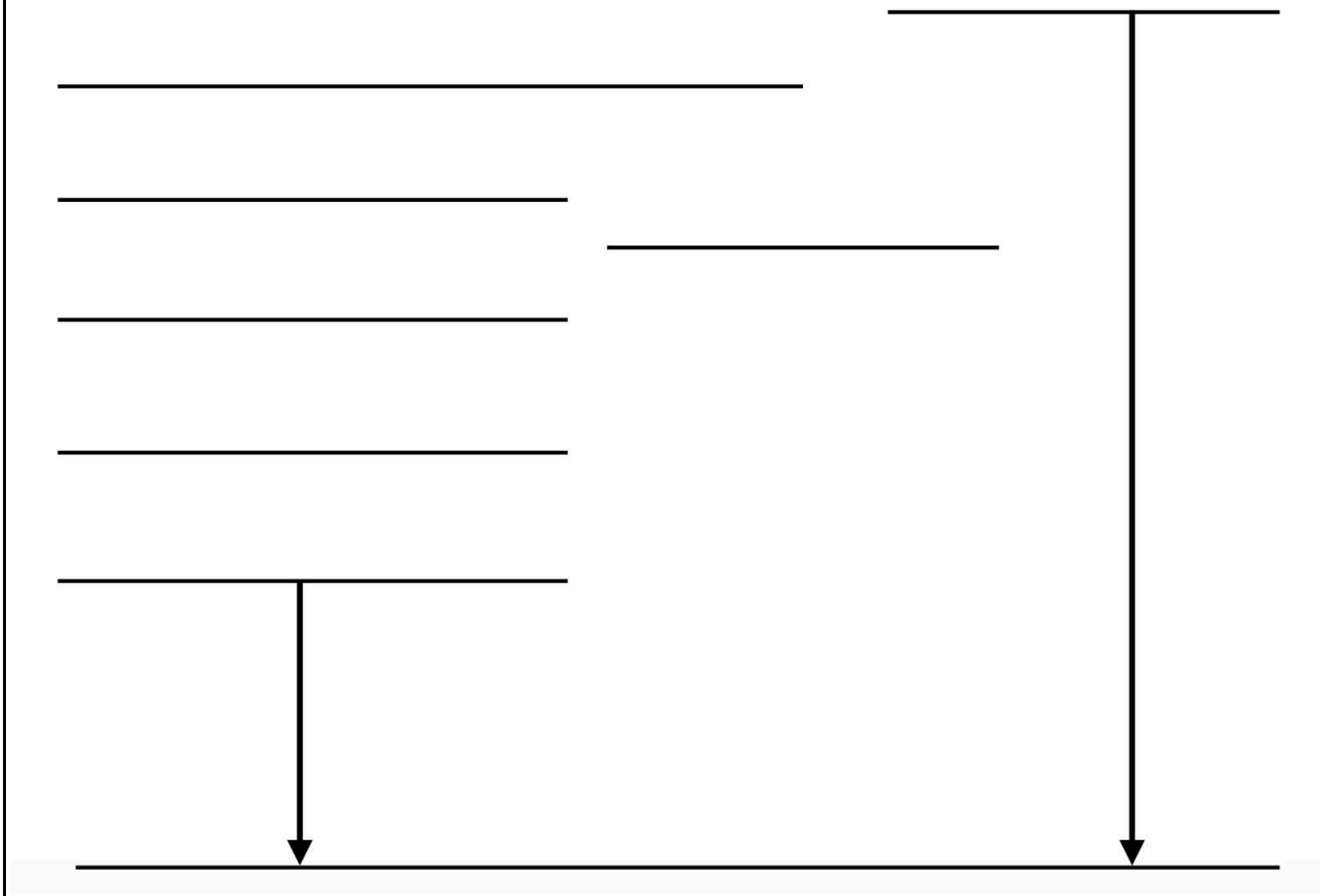
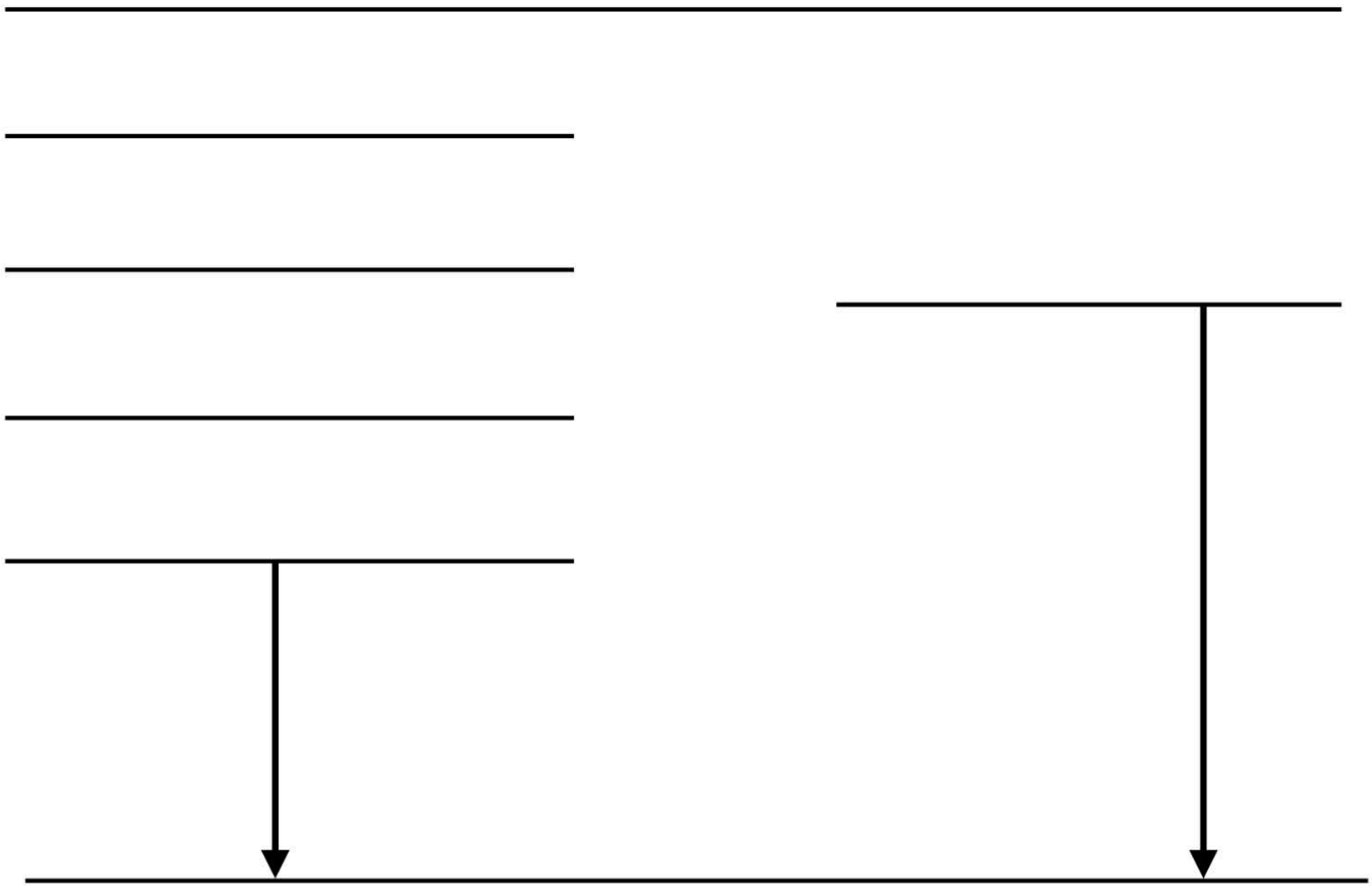
-
-
-

BORN-HABER CYCLES - MgO



BORN-HABER CYCLES - $CaBr_2$



Born-Haber Vs Perfect Ionic Model

1 2 3 4 5

-

- The perfect ionic model assumes that ionic compounds have:
  a)

  b)

- Covalent character when:

The Difference

e.g.

TT

$\Delta H^{\ominus}_{sol}$

Enthalpy of Solution - $\Delta H^{\ominus}_{sol}$

ie. → +

The Equation!

= +

① → +

② →

→

The Balance

ENTHALPY OF SOLUTION - Example Question 1

1. Define the term Enthalpy of Solution?

.....

.....

2. Write the equation that represents the Enthalpy of Solution of Magnesium Chloride.

.....

3. Calculate the Enthalpy of Solution for Magnesium Chloride, given that:

$\Delta H^{\ominus}_{Lattice}\ MgCl_2$ = 2493 kJ.mol^{-1}

$\Delta H^{\ominus}_{Hydration}\ Mg^{2+}$ = -1920 kJ.mol^{-1}

$\Delta H^{\ominus}_{Hydration}\ Cl^-$ = -364 kJ.mol^{-1}

.....

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ENTHALPY OF SOLUTION - Example Question 2

1. Complete the Enthalpy changes and equations for Barium Sulfate.

Enthalpy Change	Equation	Value
$\Delta H^{\ominus}_{Lattice}\ BaSO_4$		+2383
$\Delta H^{\ominus}_{Hydration}\ Ba^{2+}$		*X*
$\Delta H^{\ominus}_{Hydration}\ SO_4^{2-}$		-1004
	$BaSO_{4(s)} \rightarrow Ba^{2+}_{(aq)} + SO_4^{2-}{}_{(aq)}$	+19

2. Calculate the missing value for the $\Delta H^{\ominus}_{Hydration}$ of Ba^{2+} *(X)*

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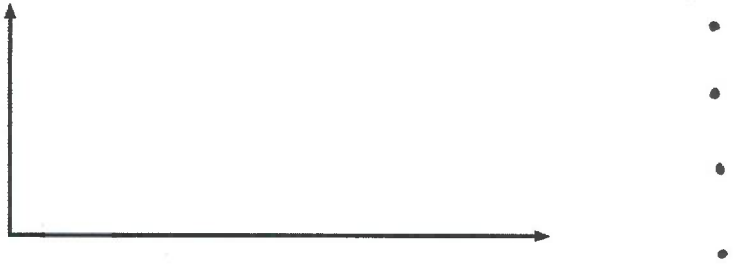
Entropy of a System - ΔS system

You get an INCREASE in entropy when:



Calculating ΔS

e.g. 1

e.g. 2

Gibbs Free Energy - ΔG

1 2 3 4 5

Is a reaction feasible / spontaneous?

☆

①
②

A Qualitative View

ΔH	ΔS	Feasible?

☆☆ NB!! ☆☆

EXAMPLE GIBBS CALCULATIONS

1. Calcium Oxide reacts with water to form Calcium Hydroxide

$$CaO_{(s)} + H_2O_{(l)} \rightarrow Ca(OH)_{2(s)}$$

Thermodynamic Data:	ΔH_f / kJ.mol^{-1}	S / J.K.mol^{-1}
$CaO_{(s)}$	-636.5	39.7
$H_2O_{(l)}$	-285.9	70.0
$Ca(OH)_{2(s)}$	-986.6	76.1

a) Calculate the Enthalpy changes for the reactions.

b) Calculate the Entropy Change for the reactions.

c) At what temperature would this reaction **NOT** be feasible?

EXAMPLE GIBBS CALCULATIONS

2. Plants are able to produce Glucose from Carbon Dioxide and water.

$$6CO_{2(g)} + 6H_2O_{(l)} \rightarrow C_6H_{12}O_{6(s)} + 6O_{2(g)} \qquad \Delta H = +2800 kJ.mol^{-1}$$

	$CO_{2(g)}$	$H_2O_{(l)}$	$C_6H_{12}O_{6(s)}$	$O_{2(g)}$
S / J.K.mol^{-1}	214	70	218	205

a) Calculate the Entropy Change for the reation.

b) Calculate ΔG for the reaction at 298K.

c) Explain why this reaction is **NOT** feasible at **ANY** temperature.

The ΔG Vs T Graph

1 2 3 4 5