YAKEEN NEET 2.0

2026

Thermodynamics & Thermochemistry

Physical Chemistry | Lecture -13

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Topics to be covered

1. Revision of Last Class
2. Entropy of universe & gibbs free energy
3. Magarmach Practice Questions, Home work from Modules,

NCERT exemplar

Rules to Attend Class

1. Always sit in a peaceful environment with headphone and be ready with your copy and pen.
2. Never ever attend a class from in between or don't join a live class in the middle of the chapter.
3. Make sure to revise the last class before attending the next class & always complete your Magarmach Practice Questions.
4. Never ever engage in chat whether live or recorded on the topic which is not being discussed in current class as by doing so u can be blocked by the admin team or your subscription can be cancelled.

Rules to Attend Class

5. Try to make maximum notes during the class if something is left then u can use the notes pdf after the class to complete the remaining class.
6. Always ask your doubts in doubt section to get answer from faculty. Before asking any doubt please check whether same doubt has been asked by someone or not.


There is one big flaw in your Preparation that's name is Backlog ? What do we say to Backlog ?
NOT TODAY !!!

Revision of Last Class

Iso. rev. exp.

$\Delta S = n R \ln \frac{V_2}{V_1}$

Adi. rev. exp.

$\Delta S = 0$

Isobaric

$\Delta S = n C_{p,m} \ln \frac{T_2}{T_1}$

Iso. ÷

$\Delta S = n C_{v,m} \ln \frac{T_2}{T_1}$

Entropy of Universe

#MIT

$\Delta S_{Total} = \Delta S_{system} + \Delta S_{surroundings}$

$\Delta S_{Total} = \frac{q_{system}}{T_{system}} - \frac{q_{system}}{T_{surr.}}$

process reversible

$T_{system} \approx T_{surr.}$

$\Delta S_{Total} = 0$

process irreversible

$T_{system} \neq T_{surr.}$

$\Delta S_{Total} \neq 0$

spontaneous $\Rightarrow \Delta S_{Total} > 0$

$\Delta S_{system} = \frac{+q_{system}}{T_{system}}$

$\Delta S_{surr.} = \frac{q_{surr.}}{T_{surr.}} = \frac{-q_{system}}{T_{surr.}}$

QUESTION

Which is incorrect relation?

A $\Delta S_{(System)} + (\Delta S)_{Surrounding} > 0$ for spontaneous process.

B $\Delta S_{(System)} + (\Delta S)_{Surrounding} > 0$ for non-spontaneous process.

C $\Delta S_{(System)} + (\Delta S)_{Surrounding}$ 0 for reversible change.

D $\Delta S_{(System)} + (\Delta S)_{Surrounding} < 0$ for non-spontaneous change

QUESTION

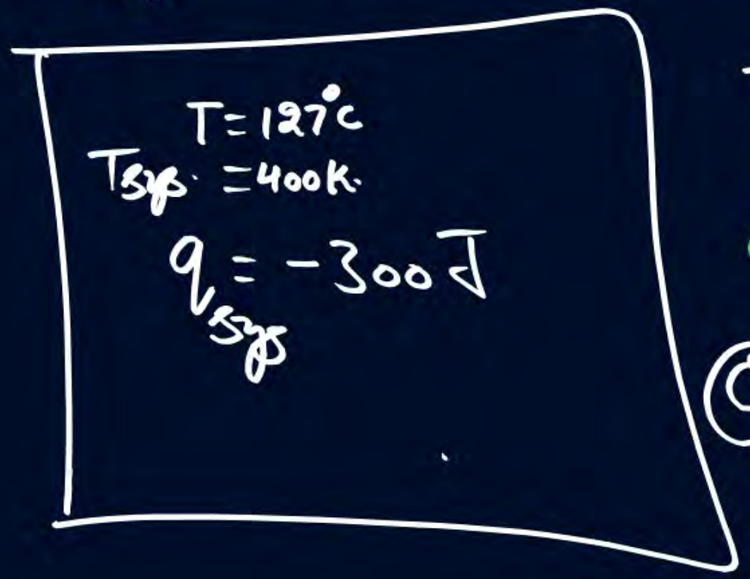
A heated iron, block at 127°C loses 300 J of heat to surroundings at 27°C.

(i) Find the entropy change of system (iron block)

(ii) Find the entropy change in surroundings.

(iii) F the total change in entropy of universe due to above process.

Ind.



$T_{surr.} = 27°C = 300\,K.$

$q_{surr} = +300\,J$

(a) $\Delta S_{system} = \frac{q_{sys.}}{T_{sys.}} = \frac{-300}{400}$

$= -\frac{3}{4}\,J/K$

(b) $\Delta S_{surr.} = \frac{q_{surr.}}{T_{surr.}} = \frac{300}{300} = 1\,J/K$

(c) $\Delta S_{Total} = -\frac{3}{4} + 1$

$= +\frac{1}{4}$

$= +0.25\,J/K$

QUESTION

For the process, $H_2O(l) \longrightarrow H_2O(g)$, at T 100 °C and 1 atmosphere pressure, the correct choice is

A $\Delta S_{system} > 0$ and $\Delta S_{surrounding} > 0$

B $\Delta S_{system} > 0$ and $\Delta S_{surroundings} < 0$

C $\Delta S_{system} < 0$ and $\Delta S_{Surroundings} > 0$

D $\Delta S_{system} < 0$ and $\Delta S_{surroundings} < 0$

Second Law of Thermodynamics

① Spontaneous $\eta \rightarrow \Delta S_{Total} > 0$

or

② Not possible to make machine with 100% efficiency.

$\Delta U = q + w$

Adi. $q = 0$

$\underline{\Delta U = w}$

Gibbs Free Energy (G)

free energy of system which can be converted into useful work.

$$G = H - TS$$

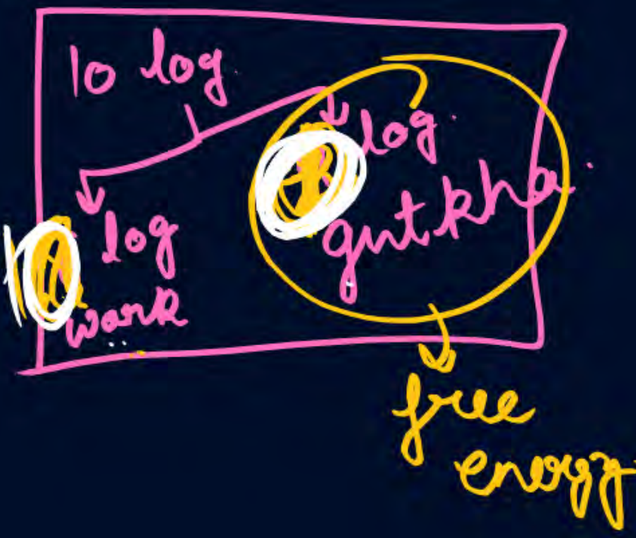
R $\xrightarrow{\text{Const } T \text{ & } P}$ P

$$G_R = (H_R - TS_R) \qquad G_P = H_P - TS_P$$

$$\Delta G = G_P - G_R = H_P - TS_P - H_R + TS_R$$

$$\Delta G = \Delta H - T(S_P - S_R)$$

$$\Delta G = \Delta H - T\Delta S$$



MIT

① $\Delta G = \Delta H - T\Delta S$ (Gibb's Helmholtz eq^n)

② $-\Delta G = W_{max}$

③ all elements elementary state

$\Delta G^\circ_f = 0$

④ $x\,R \longrightarrow y\,P$

$$\Delta G^\circ = \sum y \times \Delta G^\circ_f(P) - \sum x \times \Delta G^\circ_{f(R)}$$

⑤ $\Delta G = (-)ve$ $\Rightarrow^n$ spontaneous.

$\Delta G = (+)ve$ $\Rightarrow^n$ non-spontaneous.

$\Delta G = 0$ $\Rightarrow^n$ equilibrium

⑥ unit $\div$ J or Cal.

⑦ extensive Prop. $\quad H_{900} - 900$

⑧ $\Delta G = \Delta H - T\Delta S$

$\Rightarrow^n$ at eq. $\Delta G = 0$

$\Delta H = T\Delta S \Rightarrow T = \frac{\Delta H}{\Delta S}$

if Temp. $> T \Rightarrow \Delta G = (-)ve$ $\Rightarrow^n$ spon.

if Temp. $< T \Rightarrow \Delta G = (+)ve$ $\Rightarrow^n$ non-spon.

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⑨

	ΔH	ΔS	ΔG
exothermic rxn	(−)ve	(+)ve	(−)ve rxn spontaneous.
	(−)ve	(−)ve	(−)ve at low temp → spon (+)ve at high temp → non-spon
endothermic rxn	(+)ve	(−)ve	(+)ve rxn non-spon.
	(+)ve	(+)ve	(+)ve low temp non-spon. (−)ve high temp spon.

$\Delta G = \Delta H - T\Delta S$

$= +300 - 10 \times 20$

$= +300 - 2000 = (-)ve.$

⑩ $\Delta G^{\circ} = -RT \ln K$ (K → eq. constt.)

⑪ $\Delta G = -T\Delta S_{total}$

$\frac{1}{2}H_2(g) + \frac{1}{2}Cl_2(g) \longrightarrow HCl(g)$ $\quad \Delta G_r^\circ = \Delta G_f^\circ (HCl)$

$\frac{1}{2}N_2(g) + \frac{3}{2}H_2(g) \longrightarrow NH_3(g)$ $\quad \Delta G_r^\circ = \Delta G_f^\circ (NH_3)$

$$-\Delta G_r = -\left(\Delta H_{syst.} - T\Delta S_{sys.}\right)$$

$$\Delta S_{Total} = \Delta S_{sys.} + \Delta S_{surr.}$$

$$\Delta S_{Total} = \Delta S_{sys.} - \frac{\Delta H_{sys.}}{T}$$

$$T\Delta S_{total} = T\Delta S_{sys} - \Delta H_{sys.}$$

Spon. rxn $\Rightarrow \Delta S_{total} = (+)ve$

$$T\Delta S_{total} = -\Delta G_r$$

$$\Delta G_r = (-)ve$$

QUESTION

For the process $H_2O(l) \rightleftharpoons H_2O(s)$. Select the correct option

(A) $\Delta H = -ve, \Delta S = +ve, \Delta V = -ve, \Delta G = 0$

(B) $\Delta H = -ve, \Delta S = +ve, \Delta V = -ve, \Delta G = 0$

(C) $\Delta H = -ve, \Delta S = +ve, \Delta V = -ve, \Delta G = 0$

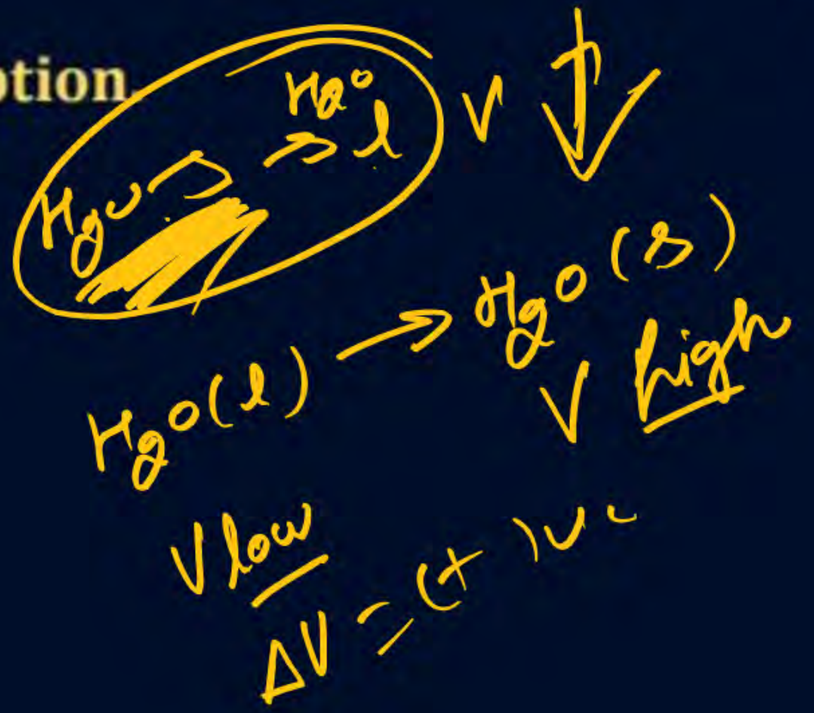
(D) $\Delta H = -ve, \Delta S = +ve, \Delta V = -ve, \Delta G = 0$

$\Delta H = (-)ve$

$\Delta G = 0$

$\Delta S = (-)ve$

$\Delta V = (+)ve$



QUESTION

Consider the following reaction at temperature T:

$$CH_2=CH_2(s)+Cl_2(g)\longrightarrow ClCH_2CH_2Cl(g)$$

$$\Delta_r H^0=-217.5\,kJ/mol,\ \Delta_r S^0=-233.9\,J/K-mol$$

Reaction is supported by:

→ spontaneous.

A Entropy

B Enthalpy

C Both (A) & (B)

D Neither

QUESTION

For a reaction to occur spontaneously :

A. ΔS must be negative

B. $(-\Delta H + T\Delta S)$ must be positive

C. $\Delta H + T\Delta S$ must be negative

D. ΔH must be negative

$\Delta G = (-)ve$ $\quad -\Delta H + T\Delta S$

$\Delta G = -(\Delta H + T\Delta S)$

$-\Delta G = (+)ve$

$\Delta G = (-)ve$

QUESTION

Using the listed [ΔG_f^0 values] calculate ΔG^0 for the reaction:

$3H_2S(g)[-33.6] + 2HNO_3(l)\ [-80.6] \rightarrow 2NO(g)[+86.6] + 4H_2O(l)[-237.1] + 3S(s)\ [0.0]$

(A) -513.2

(B) -1037.0

(C) +433.4

(D) +225.0

$\Delta G^\circ = [2 \times 86.6 + 4 \times -237.1 + 3 \times 0] - [3 \times -33.6 + 2 \times -80.6]$

$= +173.2 - 948.4 + 163 = -513.2$

QUESTION

From the following ΔH^0 and ΔS^0 values, predict which of reactions I, I and III would be spontaneous at 25°C.

	ΔH^0 (kJ)	ΔS^0 (J / K)
I.	+10.5	+30
II.	+1.8	−113
III.	−126	+84

A. III

B. I

C. II and III

D. I and II

QUESTION

Consider the ΔG_f^0 and ΔH_f^0 (kJ/mol) for the following oxides. Which oxide can be most easily decomposed to form the metal and oxygen gas?

$MO \rightarrow M + \frac{1}{2}O_2$ ΔG° = (–)ve.

$HgO \rightarrow Hg + \frac{1}{2}O_2$ ΔG

(A) $ZnO(\Delta G^\circ = -318.4, \Delta H^\circ = -348.3)$

(B) $Cu_2O(\Delta G^\circ = -146.0, \Delta H^\circ = -168.8)$

(C) $HgO(\Delta G^\circ = -58.5, \Delta H^\circ = -90.8)$

(D) $PbO(\Delta G^\circ = -187.9, \Delta H^\circ = -217.3)$

QUESTION

For a spontaneous change, free energy change ΔG is:

A. Positive

B. Negative

C. Zero

D. Can be positive or negative

QUESTION – (NEET 2020 Covid)

If for a certain reaction $\Delta_r H$ is 30 kJ mol^{-1} at 450 K, the value of $\Delta_r S$ (in JK^{-1} mol^{-1}) for which the same reaction will be spontaneous at the same temperature is:

A. −33 ✗

B. 33

C. −70 ✗

D. 70 ✓

$\Delta G = \Delta H - T\Delta S$

$-x = 30000 - 450 \times 70$

$T = \frac{\Delta H}{\Delta S}$

$\Delta S = \frac{\Delta H}{T}$

$\Delta S = \frac{30000}{450} = \frac{600}{9}$

QUESTION (NEET 2017)

For a given reaction, $\Delta H = 35.5\ kJ\ mol^{-1}$ and $\Delta S = 83.6\ JK^{-1}\ mol^{-1}$. The reaction is spontaneous at : (Assume that ΔH and ΔS do not vary with temperature)

$T \geq \frac{\Delta H}{\Delta S} = \frac{35500}{83.6}$

400

3600 ✓

✗ ✓

(A) T > 425 K

(B) All temperature

(C) T > 298 K

(D) T < 425 K

QUESTION – (NEET 2014)

For the reaction:

$X_2O_4(l) \rightarrow 2XO_2(g)$ $\Delta U = 2.1$ k cal, $\Delta S = 20$ cal K^{-1} at 300 K Hence ΔG is:

A. 2.7 k cal

B. – 2.7 k cal

C. 9.3 k cal

D. – 9.3 k cal

$\Delta U = 2.1$ KCal

$= 2.1 \times 1000$ Cal

$= 2100$ Cal

$\Delta H = \Delta U + \Delta n_g RT$

$= 2100 + 2 \times 2 \times 300$

$= 3200$ Cal

$2100 + 2 \times 2 \times 300$

3200

$\Delta G = 3200 - 300 \times 20$

$= -2800$ Cal

$= -2.8$ K Cal

$3200 - 300 \times 20$

-2800 Cal

QUESTION (Kerala PMT 2012)

A chemical reaction is spontaneous at 298 K but non- spontaneous at 350 K. Which one of the following is true for the reaction

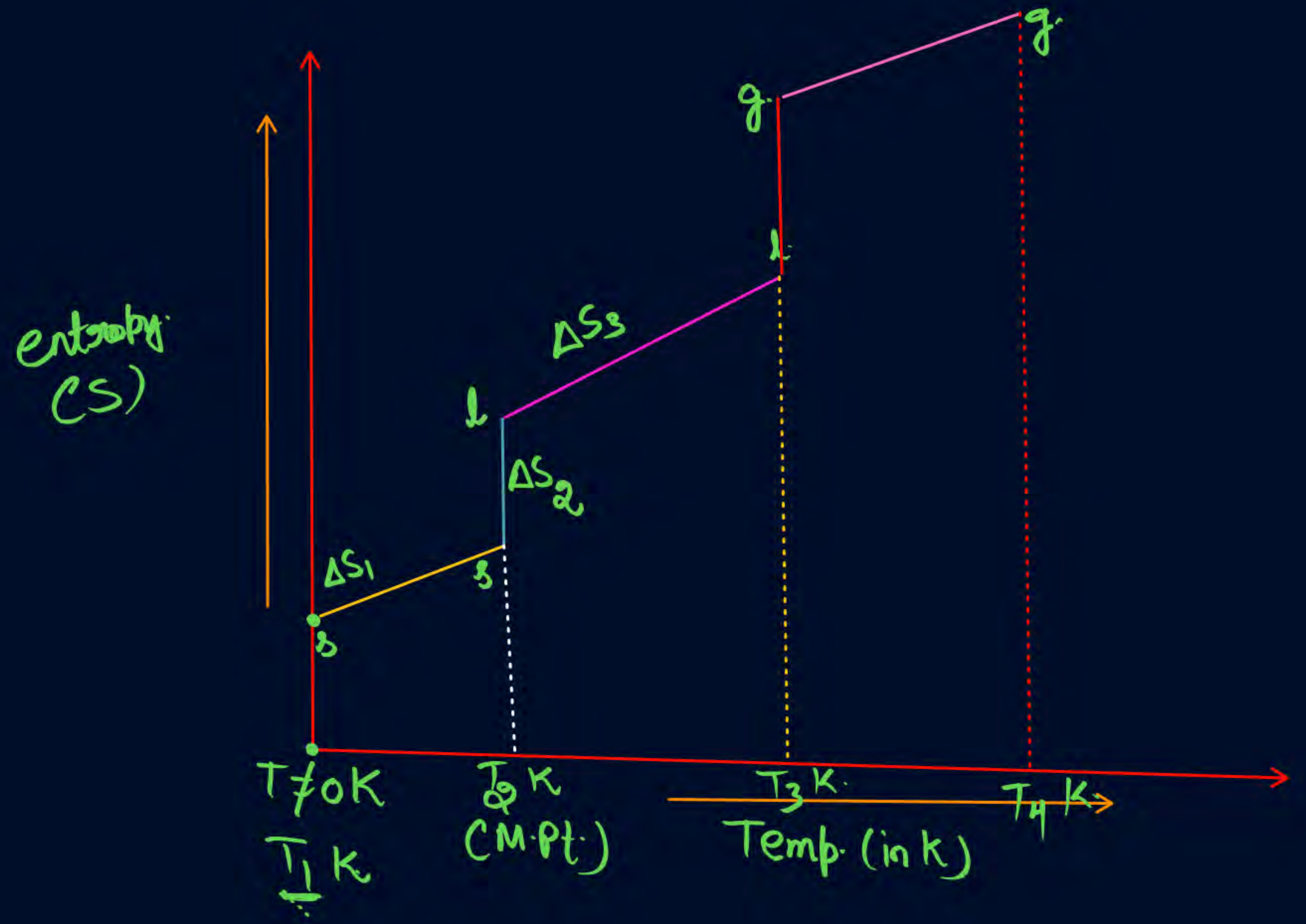
	ΔG	ΔH	ΔS
A	–	–	+
B	+	+	+
C	+	–	+
D	–	–	–

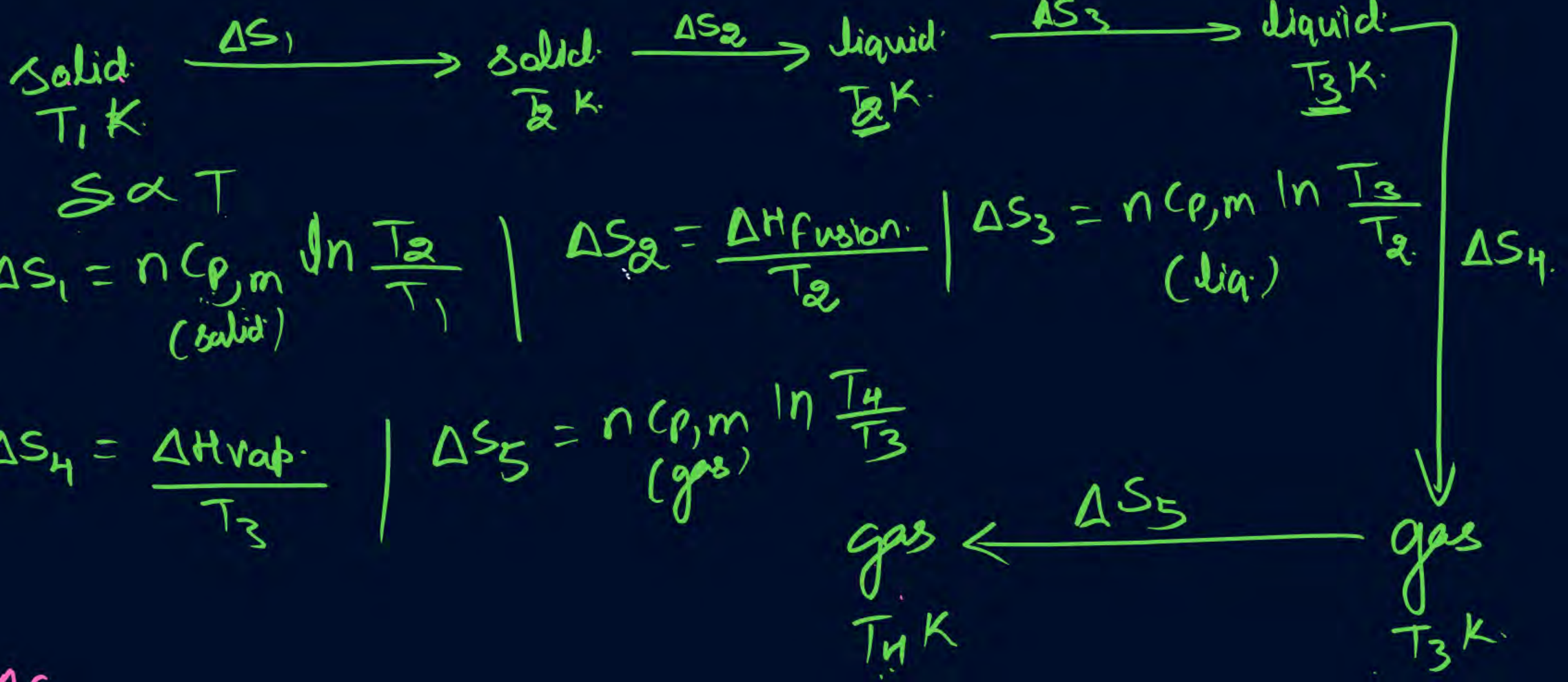
Third law of Thermodynamics

For a perfectly crystalline solid, entropy is zero at zero kelvin (absolute zero)

↓

– 273°C


entropy
(S)
g
g
l
l
ΔS3
ΔS2
ΔS1
s
s
T≠0K
T1 K
(Initial)
T2 K
(M.Pt.)
T3 K
T4 K
Temp. (in K)



$S \propto T$

$\Delta S_1 = n C_{p,m}\,(\text{solid}) \ln \frac{T_2}{T_1}$

$\Delta S_2 = \frac{\Delta H_{fusion}}{T_2}$

$\Delta S_3 = n C_{p,m}\,(\text{liq.}) \ln \frac{T_3}{T_2}$

$\Delta S_4 = \frac{\Delta H_{vap.}}{T_3}$

$\Delta S_5 = n C_{p,m}\,(\text{gas}) \ln \frac{T_4}{T_3}$

$\Delta S = \Delta S_1 + \Delta S_2 + \Delta S_3 + \Delta S_4 + \Delta S_5$

Q. $H_2O(s)$ $\xrightarrow{\Delta S_1}$ $H_2O(s)$ $\xrightarrow{\Delta S_2}$ $H_2O(l)$ $\xrightarrow{\Delta S_3}$ $H_2O(l)$ $\xrightarrow{\Delta S_4}$ $H_2O(g)$ $\xrightarrow{\Delta S_5}$ H_2O

$-10^\circ C$ $273\,K$ $273\,K$ $373\,K$ $373\,K$ $110^\circ C$

$T_1 = 263\,K$ $T_2 = 273\,K$ $T_3 = 373\,K$ $T_4 = 383\,K$

$$\Delta S = \Delta S_1 + \Delta S_2 + \Delta S_3 + \Delta S_4 + \Delta S_5$$

$$= n C_{p,m}\,{}_{H_2O(s)} \ln \frac{T_2}{T_1} + \frac{\Delta H_{fusion}}{T_2} + n C_{p,m}\,{}_{H_2O(l)} \ln \frac{T_3}{T_2} + \frac{\Delta H_{vap.}}{T_3} + n C_{p,m}\,{}_{H_2O(g)} \ln \frac{T_4}{T_3}$$

QUESTION

Identify the correct statement regarding entropy

A. At absolute zero temperature, the entropy of perfectly crystalline substances is positive

B. At absolute zero temperature entropy of perfectly crystalline substance is taken to be zero

C. At 0°C the entropy of a perfectly crystalline substance is taken to be zero

D. At absolute zero temperature, the entropy of all crystalline substances is taken to be zero

★★★★★ trick

Find Cube of $(32)^3$

$a = 3,\ b = 2$

$(a+b)^3 = a^3 + 3a^2b + 3ab^2 + b^3$

$18 + 2/3$

$9 \times 2/3$

$18 \times 2/3$

a^2

$a^3 \times \frac{b}{a}$

$a^2b \times \frac{b}{a}$

$ab^2 \times \frac{b}{a}$

a^3	a^2b	ab^2	b^3
	$2a^2b$	$2ab^2$	

$(32)^3$ $a=3$ $b=2$

27 18 12 8

+36 24

27 54 36 8

3zero 2zero 1zero 0zero

add

27000
5400
360
8

32768

$(12)^3$ $a=1$ $r=2$ $1 \times \frac{2}{1}$

1	2	4	8
	4	8	
1	6	12	8

$12 \times 12 = 144$, 144×12

1	0	0	0
	6	0	0
		1	2	0
			8
1	7	2	8

$(102)^3$ $b=2$ $a=10$ $1000 \times \frac{2}{10}$ $200 \times \frac{2}{10}$ $40 \times \frac{2}{10}$

1000	200	40	8
	400	80	
1000	600	120	8

1000000
60000
1200
8

1061208

Home work from modules

Prarambh → Q70 to Q90

Prabal → Complete exercise after revision.

" " " " "

PYQ → " " " " "

Magarmach Practice Questions (MPQ)

SINGLE CHOICE QUESTIONS

QUESTION – (NCERT Exemplar)

Thermodynamics is not concerned about_____.

A. energy changes involved in a chemical reaction.

B. the extent to which a chemical reaction proceeds.

C. the rate at which a reaction proceeds.

D. the feasibility of a chemical reaction.

QUESTION – (NCERT Exemplar)

Which of the following statements is correct?

A. The presence of reacting species in a covered beaker is an example of open system.

B. There is an exchange of energy as well as matter between the system and the surroundings in a closed system.

C. The presence of reactants in a closed vessel made up of copper is an example of a closed system.

D. The presence of reactants in a thermos flask or any other closed insulated vessel is an example of a closed system.

QUESTION – (NCERT Exemplar)

The state of a gas can be described by quoting the relationship between_____.

A. pressure, volume, temperature

B. temperature, amount, pressure

C. amount, volume, temperature

D. pressure, volume, temperature, amount

QUESTION – (NCERT Exemplar)

The volume of gas is reduced to half from its original volume. The specific heat will be _____.

A. reduce to half

B. be doubled

C. remain constant

D. increase four times

QUESTION – (NCERT Exemplar)

During complete combustion of one mole of butane, 2658 kJ of heat is released. The thermochemical reaction for above change is:

A $2C_4H_{10}(g) + 13O_2(g) \rightarrow 8CO_2(g) + 10H_2O(l)$ $\quad \Delta_cH = -2658.0\ kJ\ mol^{-1}$

B $C_4H_{10}(g) + 13/2O_2(g) \rightarrow 4CO_2(g) + 5H_2O(g)$ $\quad \Delta_cH = -1329.0\ kJ\ mol^{-1}$

C $C_4H_{10}(g) + 13/2O_2(g) \rightarrow 4CO_2(g) + 5H_2O(l)$ $\quad \Delta_cH = -2658.0\ kJ\ mol^{-1}$

D $C_4H_{10}(g) + 13/2O_2(g) \rightarrow 4CO_2(g) + 5H_2O(l)$ $\quad \Delta_cH = +2658.0\ kJ\ mol^{-1}$

QUESTION – (NCERT Exemplar)

$\Delta_f U^\ominus$ of formation of $CH_4(g)$ at certain temperature is –393 kJ mol^{-1}. The value of $\Delta_f H^\ominus$ is:

A zero

B $< \Delta_f U^\ominus$

C $> \Delta_f U^\ominus$

D equal to $\Delta_f U^\ominus$

QUESTION – (NCERT Exemplar)

In an adiabatic process, no transfer of heat takes place between system and surroundings. Choose the correct option for free expansion of an ideal gas under adiabatic condition from the following.

A $q = 0, \Delta T \neq 0, w = 0$

B $q \neq 0, \Delta T = 0, w = 0$

C $q = 0, \Delta T = 0, w = 0$

D $q = 0, \Delta T < 0, w \neq 0$

QUESTION – (NCERT Exemplar)

The pressure-volume work for an ideal gas can be calculated by using the Expression $w = -\int_{V_i}^{V_f} p_{ex} dV$. The work can also be calculated from the pV plot by using the area under the curve within the specified limits. When an ideal gas is compressed (a) reversibly or (b) irreversibly from volume V_i to V_f, choose the correct option.

A w (reversible) = w (irreversible)

B w (reversible) < w (irreversible)

C w (reversible) > w (irreversible)

D w (reversible) = w (irreversible) + $p_{ex}\Delta V$

QUESTION – (NCERT Exemplar)

The entropy change can be calculated by using the expression $\Delta S = \frac{q_{rev}}{T}$. When water freezes in a glass beaker, choose the correct statement amongst the following:

A. ΔS (system) decreases but ΔS (surroundings) remains the same.

B. ΔS (system) increases but ΔS (surroundings) decreases.

C. ΔS (system) decreases but ΔS (surroundings) increases.

D. ΔS (system) decreases and ΔS (surroundings) also decreases.

QUESTION – (NCERT Exemplar)

On the basis of thermochemical equations (a), (b) and (c), find out which of the algebraic relationships given in options (A) to (D) is correct.

(a) $C_{(graphite)} + O_2(g) \rightarrow CO_2(g)$; $\Delta_r H = x\ kJ\ mol^{-1}$

(b) $C_{(graphite)} + \frac{1}{2} O_2(g) \rightarrow CO(g)$; $\Delta_r H = y\ kJmol^{-1}$

(c) $CO(g) + \frac{1}{2} O_2(g) \rightarrow CO_2(g)$; $\Delta_r H = z\ kJ\ mol^{-1}$

A $z = x + y$

B $x = y - z$

C $x = y + z$

D $y = 2z - x$

QUESTION – (NCERT Exemplar)

Consider the reactions given below. On the basis of these reactions find out which of the algebraic relations given in options (A) to (D) is correct?

(a) $C(g) + 4H(g) \rightarrow CH_4(g)$; $\Delta_r H = x\ kJ\ mol^{-1}$

(b) $C_{(graphite)} + 2H_2(g) \rightarrow CH_4(g)$; $\Delta_r H = y\ kJ\ mol^{-1}$

(A) $x = y$

(B) $x = 2y$

(C) $x > y$

(D) $x < y$

QUESTION – (NCERT Exemplar)

The enthalpies of elements in their standard states are taken as zero. The enthalpy of formation of a compound

A. is always negative

B. is always positive

C. may be positive or negative

D. is never negative

QUESTION – (NCERT Exemplar)

Enthalpy of sublimation of a substance is equal to

A enthalpy of fusion + enthalpy of vapourisation

B enthalpy of fusion

C enthalpy of vapourisation

D twice the enthalpy of vapourisation

QUESTION – (NCERT Exemplar)

Which of the following is not correct?

A. ΔG is zero for a reversible reaction.

B. ΔG is positive for a spontaneous reaction.

C. ΔG is negative for a spontaneous reaction.

D. ΔG is positive for a non-spontaneous reaction.

MULTIPLE CHOICE QUESTIONS

QUESTION* – (NCERT Exemplar)

Thermodynamics mainly deals with

(A) interrelation of various forms of energy and their transformation from one form to another.

(B) energy changes in the processes which depend only on initial and final states of the microscopic systems containing a few molecules.

(C) how and at what rate these energy transformations are carried out.

(D) the system in equilibrium state or moving from one equilibrium state to another equilibrium state.

QUESTION* – (NCERT Exemplar)

In an exothermic reaction, heat is evolved and system loses heat to the surrounding. For such system

A q_p will be negative

B $\Delta_r H$ will be negative

C q_p will be positive

D $\Delta_r H$ will be positive

QUESTION* – (NCERT Exemplar)

The spontaneity means, having the potential to proceed without the assistance of external agency. The processes which occur spontaneously are:

(A) flow of heat from colder to warmer body.

(B) gas in a container contracting into one corner.

(C) gas expanding to fill the available volume.

(D) burning carbon in oxygen to give carbon dioxide.

QUESTION* – (NCERT Exemplar)

For an ideal gas, the work of reversible expansion under isothermal condition can be calculated by using the expression $w = -nRT\ln\frac{V_f}{V_i}$. A sample containing 1.0 mole of an ideal gas is expanded isothermally and reversibly to ten times of its original volume, in two separate experiments. The expansion is carried out at 300 K and at 600 K respectively. Choose the correct option.

A Work done at 600 K is 20 times the work done at 300 K.

B Work done at 300 K is twice the work done at 600 K.

C Work done at 600 K is twice the work done at 300 K.

D $\Delta U = 0$ in both cases.

QUESTION* – (NCERT Exemplar)

Consider the following reaction between zinc and oxygen and choose the correct options out of the options given below:

$2\,Zn(s) + O_2(g) \rightarrow 2\,ZnO(s)$; $\Delta H = -693.8\ kJ\ mol^{-1}$

(A) The enthalpy of two moles of ZnO is less than the total enthalpy of two moles of Zn and one mole of oxygen by 693.8 kJ.

(B) The enthalpy of two moles of ZnO is more than the total enthalpy of two moles of Zn and one mole of oxygen by 693.8 kJ.

(C) 693.8 kJ mol^{-1} energy is evolved in the reaction.

(D) 693.8 kJ mol^{-1} energy is absorbed in the reaction.

MATRIX MATCH TYPE QUESTIONS

QUESTION – (NCERT Exemplar)

Match the following:

Graphs (A)		Names (B)	
i	Adiabatic process	(a)	Heat
ii	Isolated sytem	(b)	At constant volume
iii	Isothermal change	(c)	First law of thermodynamics
iv	Path function	(d)	No exchange of energy and matter
v	State function	(e)	No transfer of heat
vi	$\Delta U = q$	(f)	Constant temperature
vii	Law of conservation of energy	(g)	Internal energy
viii	Reversible process	(h)	$P_{ext} = 0$
ix	Free expansion	(i)	At constant pressure
x	$\Delta H = q$	(j)	Infinitely slow process which proceeds through a series of equilibrium states.
xi	Intensive property	(k)	Entropy
xii	Extensive property	(l)	Pressure
		(m)	Specific heat

QUESTION – (NCERT Exemplar)

Match the following processes with entropy change:

	Reaction		Entropy Change
i	A liquid vapourises	(a)	$\Delta S = 0$
ii	Reaction is non-spontaneous at all temperatures and ΔH is positive	(b)	ΔS = positive
iii	Reversible expansion of an ideal gas	(c)	ΔS = negative

QUESTION – (NCERT Exemplar)

Match the following parameters with description for spontaneity:

	Δ(Parameters) $\Delta_r H^\ominus$	$\Delta_r S^\ominus$	$\Delta_r G^\ominus$		Description
i	+	–	+	(a)	Non-spontaneous at high temperature.
ii	–	–	+ at high T	(b)	Spontaneous at all temperatures
iii	–	+	–	(c)	Non-spontaneous at all temperatures

QUESTION – (NCERT Exemplar)

Match the following:

i	Entropy of vapourisation	(a)	decreases
ii	K for spontaneous process	(b)	is always positive
iii	Crystalline solid state	(c)	lowest entropy
iv	ΔU in adiabatic expansion of ideal gas	(d)	$\frac{\Delta H_{vap}}{T_b}$

ASSERTION AND REASON TYPE

QUESTION – (NCERT Exemplar)

Assertion (A): Combustion of all organic compounds is an exothermic reaction.
Reason (R): The enthalpies of all elements in their standard state are zero.

A. A and R both are correct and R is the correct explanation of A.

B. A and R both are correct but R is not the correct explanation of A.

C. A is true but R is false.

D. A is false but R is true.

QUESTION – (NCERT Exemplar)

Assertion (A): Spontaneous process is an irreversible process and may be reversed by some external agency.

Reason (R): Decrease in enthalpy is a contributory factor for spontaneity.

(A) A and R both are correct and R is the correct explanation of A.

(B) A and R both are correct but R is not the correct explanation of A.

(C) A is true but R is false.

(D) A is false but R is true.

QUESTION – (NCERT Exemplar)

Assertion (A): A liquid crystallizes into a solid and is accompanied by decrease in entropy.

Reason (R): In crystals, molecules organize in an ordered manner.

(A) A and R both are correct and R is the correct explanation of A.

(B) A and R both are correct but R is not the correct explanation of A.

(C) A is true but R is false.

(D) A is false but R is true.

THANK YOU