CHEMISTRY

NCERT - NCERT CHEMISTRY(GUJRATI)

THERMODYNAMICS -II

Self Evaluation A Choose The Correct Answer

1. The amount of heat exchanged with the surrounding at constant temperature and pressure is called

A. ΔE

B. ΔH

C. ΔS

D. ΔG

Answer:

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2. All the naturally occuring processes proceed spontaneously in a direction which leads to

A. decrease of entropy

B. increase in enthalpy

C. increase in free energy

D. decrease of free energy

Answer:

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3. In an adiabatic process which of the following is true?

A. q = w

B. q = 0

C. $\Delta E = q$

D. $P\Delta V = 0$

Answer:

4. When a liquid boils, there is

    A. an increase in entropy

    B. a decrease in entropy

    C. an increase in heat of vapourisation

    D. an increase in free energy

Answer:

5. If ΔG for a reaction is negative, the change is

    A. Spontaneous

    B. Non-spontaneous

    C. Reversible

    D. Equilibrium

Answer:

6. Which of the following does not result in an increase in the entropy?

    A. crystallisation of sucrose from solution

    B. rusting of iron

    C. conversion of ice to water

    D. vaporisation of camphor

Answer:

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7. In which of the following process, the process is always non-feasible?

A. $\Delta H > 0, \Delta S < 0$

B. $\Delta H < 0, \Delta > 0$

C. $\Delta H > 0, \Delta S > 0$

D. $\Delta H < 0, \Delta S < 0$

Answer:

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8. Change in Gibb's free energy is given by

A. $\Delta G = \Delta H + T\Delta S$

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

C. $\Delta G = \Delta H \times T\Delta S$

D. None of the above

Answer:

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9. For the reaction $2Cl_{(g)} \rightarrow Cl_{2(g)}$, the signs of ΔH and ΔS respectively are

A. +, −

B. +, +

C. –, –

D. –, +

Answer:

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1. What is entropy? What are the units of entropy?

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2. Predict the feasibility of a reaction when

i) both ΔH and ΔS increase

ii) both ΔH and ΔS decrease

iii) ΔH decreases but ΔS increases

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3. Give Kelvin statement of second law of thermodynamics.

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4. How ΔG is related to ΔH and ΔS? What is the meaning of $\Delta G = 0$?

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5. Mention the essential condition for spontaneity in a chemical reaction.

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Self Evaluation Exercises

1. Calculate the maximum efficiency % possible from a thermal engine operating between $110°C$ and $25°C$.

2. What is the entropy change of an engine that operates at $100°C$ when 453.6 k.cal of heat is supplied to it?

3. Calculate the entropy increase in the evaporation of 1 mole of a liquid when it boils at $100°C$ having heat of vaporisation at $100°C$ as 540 cals\gm.

4. In the reaction

$$N_{2(g)} + O_{2(g)} \rightarrow 2NO_{(g)}, \Delta H° \text{ reaction is}$$

$+179.9kJmol^{-1}$ and $\Delta S°_{reaction} = 66.09JK^{-1}mol^{-1}$. Calculate $\Delta G°$ reaction at 300K.

5. Calculate the standard free energy change (Δ°) of the following reaction and say whether it is feasible at 373 K or not

$$\frac{1}{2}H_{2(g)} + \frac{1}{2}I_{2(g)} \rightarrow HI_{(g)}, \Delta H_r^\circ \text{ is } + 25.95 \text{ kJ}$$

mole^{-1}. Standard entropies of $HI_{(g)}$. $H_{2(g)}$ and $I_{2(g)}$ are 206.3, 130.6 and $116.7 JK^{-1}mole^{-1}$.

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6. Calculate standard free energy of formation of $H_2O_{(l)}$. The standard enthalpy of formation of $H_2O_{(l)}$ is 285.85 kJ and standard entropies of

$H_{2(g)}$, $O_{2(g)}$ and $H_2O_{(l)}$ are130.5, 205.0 and 70.3 $J.K^{-1}mole^{-1}$ respectively. Temperature is 25 C

7. In the reaction $\frac{1}{2}N_{2(g)} + \frac{3}{2}H_{2(g)} \rightarrow NH_{3(g)}$. The standard entropies of $N_{2(g)}$, $H_{2(g)}$ and $NH_{3(g)}$ are 191.6,130.5 a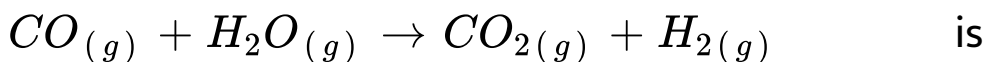nd 192.5$JK^{-1}mol^{-1}$ respectivly. If free energy charge of the reaction is -16.67 kJ. Calculate the $\Delta H^{\circ}_{reaction}$ for the formation of NH_3 at 298 K.

8. Predict whether the reaction

$$CO_{(g)} + H_2O_{(g)} \rightarrow CO_{2(g)} + H_{2(g)}$$ is

spontaneous or not. The standard free energies of

formation of $CO_{(g)}$, $H_2O_{(g)}$ and $CO_{2(g)}$ are –

137.27, –228.6 and –394.38 kJ $mo \leq ^{-1}$ respectivley.
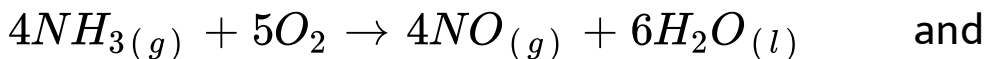
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9. Calculate the standard free energy change of the

reaction   :

$$4NH_{3(g)} + 5O_2 \rightarrow 4NO_{(g)} + 6H_2O_{(l)}$$ and

predict on the feasibility of the reaction. Standard

free   energies   of   formation   of

$NH_{3(g)}$, $NO_{(g)}$ and $H_2O_{(l)}$ are 16.65, 86.61, −237.20 kJ. mole^{-1} respectively.

10. The standard heat of formation of $H_2O_{(l)}$ from its elements is −285.83 kJ. mole^{-1} and the standard entropy change for the same reaction is $-327 JK^{-1}$ at $25°C$. Will the reaction be spontaneous at $25°C$?
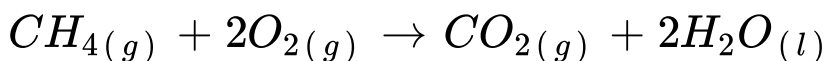
11. The boiling point of benzene at 1 atm is $80.2°C$. Calculate the enthalpy of vaporisation of benzene at its b. pt.

12. The standard entropy change $\Delta S_r°$ for

$$CH_{4(g)} + 2O_{2(g)} \rightarrow CO_{2(g)} + 2H_2O_{(l)}$$

is -242.98 JK^{-1} at $25°C$. Calculate the standard reaction enthalpy for the above reaction if standard Gibbs energy of formation of $CH_{4(g)}$, $CO_{2(g)}$ and $H_2O_{(l)}$ are -50.72, -394.36 and - 237.13 kJ mol^{-1} respectively.
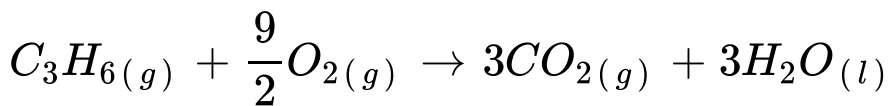
13. Standard enthalpy change for combustion of methane is –890 kJ mol^{-1} and standard entropy change for the same combustive reaction is -242.98 $J. K^{-1}$ at $25°C$. Calculate $\Delta G°$ of the reaction.

14. The standard entropy change for the reaction

$$C_3H_{6(g)} + \frac{9}{2}O_{2(g)} \rightarrow 3CO_{2(g)} + 3H_2O_{(l)}$$

is – 339.23 JK-1 at $25°C$. Calculate the standard

reaction enthalpy change if the standard Gibbs energy of formation of $C_3H_{6(g)}, CO_{2(g)}$ and $H_2O_{(l)}$ are 62.78, – 394.36 and –237.13 kJ.mol^{-1} respectively.