Model Question Paper

Thermodynamics - II - Part III

12th Standard

Chemistry

Reg.No. : | | | | | | |

I.Answer all the questions.

II.Use blue pen only.

Time : 01:30:00 Hrs

Total Marks : 60

Part-A

5 x 1 = 5

1) When $\triangle G > 0$ the process is

(a) spontaneous (b) feasible (c) no0n feasible (d) equilibrium

2) $-\triangle G$ represent all forms of work other than

(a) electrical work (b) work of expansion (c) non feasible (d) equilibrium

3) The condition for completion of reaction is

(a) $\triangle G_r^\circ < 0$ (b) $\triangle G_r^\circ > 0$ (c) $\triangle G_r^\circ = 0$ (d) $\triangle G_r^\circ \quad is \quad \infty$

4) Which of the following liquid obeys Trouton's rule ?

(a) H_2 (b) H_2O (c) CH_3COOH (d) $CHCl_5$

5) In which of the following reaction $\triangle S$ is negative ?

(a) reversible (b) irreversible (c) spontaneous (d) non spontaneous

Part-B

5 x 3 = 15

6) Write the mathematical expression for entropy change in various thermodynamic process

7) Write about the spontaneity of reactions based on entropy.

8) Why H_2 and He do not obey Trouton's rule?

9) Why polar substances do not obey Trouton's rule?

10) Why acetic acid does not obey Trouton's rule?

Part-C

4 x 5 = 20

11) In the reaction $\frac{1}{2}N_{2(g)} + 23H_{2(g)} \rightarrow NH_{3(g)}$. The standard entropies of N2(g),H2(g) and NH3(g) are 191.6, 130.5 and 192.5 JK^{-1} mol^{-1} respectively. If free energy change of the reaction is –16.67 kJ. Calculate the ΔH°reaction for the formation of NH3 at 298K.

12) Predict whether the reaction $CO_{(g)} + H2O_{(g)} \rightarrow CO_{2(g)} + H_{2(g)}$ is spontaneous or not. The standard free energies of formation of $CO_{(g)}$, $H2O_{(g)}$ and $CO_{2(g)}$ are – 137.27, –228.6 and – 394.38 kJ $mole^{-1}$respectively.

13) Calculate the standard free energy change of the reaction : $4NH3_{(g)} + 5O_2 \rightarrow 4NO_{(g)} + 6H_2O_{(l)}$ and predict on the feasibility of the reaction. Standard free energies of formation of $NH_{3(g)}$, $NO_{(g)}$ and $H2O_{(i)}$are 16.65, 86.61, –237.20 kJ. $mole^{-1}$ respectively.

14) The standard heat of formation of $H_2O_{(i)}$ from its elements is –285.83 kJ.$mole^{-1}$ and the standard entropy change for the same reaction is –327 JK-1at 25°C. Will the reaction be spontaneous at 25°C?

Part-D

2X10=20

15) a) The boiling point of benzene at 1 atm is 80.2°C. Calculate the enthalpy of vaporisation of benzene at its boiling point.

b) The standard entropy change ΔS_r^o for

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

$H_2O_{(i)}$ are -50.72, -394.36 and - 237.13 kJ mol^{-1} respectively.

16) a) 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 ΔG° of the reaction.

b) The standard entropy change for the reaction

$C_3H_6(g) + 2\frac{9}{2}O_{2(g)} \rightarrow 3CO_2 + 3H_2O$ 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.

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