

Roll No.

(01/22-II)

5193

B. Sc. EXAMINATION

(Third Semester)

CHEMISTRY

CH-202

Physical Chemistry

Time : Three Hours

Maximum Marks : 26

Note : Question No. 1 is compulsory. Attempt *four* questions from Section A and Section B, selecting *two* questions from each Section.

(Compulsory Question)

1. (a) Why is zinc used in Parke's Process for desilverisation of lead ?
- (b) Under what condition k_p, k_c, k_a and k_x are all equal ?

- (c) Which of the properties remain constant when equilibrium is attained ?
- (d) The value of equilibrium constant k_p for the reaction $\text{N}_2\text{O}_4 \rightleftharpoons 2\text{NO}_2$ at 25°C is 0.14. Calculate standard free energy change ΔG° for the reaction.
- (e) Under what condition an extensive property may become an intensive property ? Give an example.
- (f) What is change in internal energy when an ideal gas expands isothermally ?

1×6=6

Section A

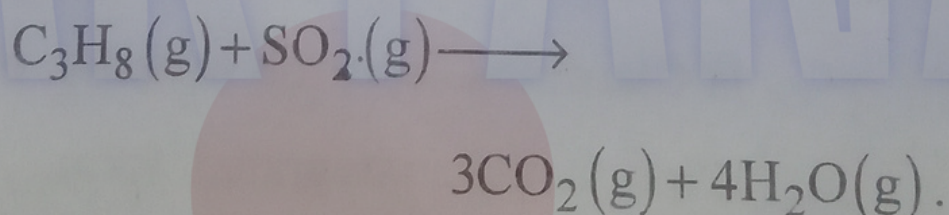
1. (a) Derive an expression for the work done in the isothermal reversible expansion of a real gas. 3
- (b) Calculate the enthalpy change for the reaction $\text{H}_2(\text{g}) + \text{Br}_2(\text{g}) \longrightarrow 2\text{HBr}(\text{g})$.

Given that the Bond energies of H-H, Br-Br and H-Br are 435, 192 and 364 kJ mol⁻¹ respectively. 2

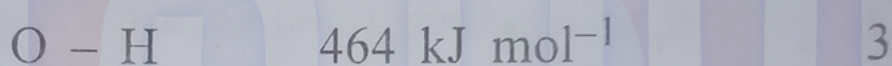
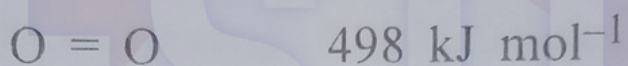
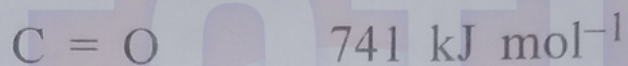
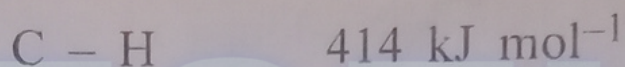
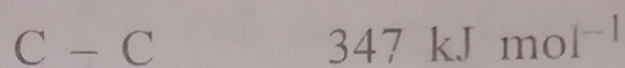
3. (a) Derive expression for, molar heat capacities C_p and C_v in terms of internal analysis change and enthalpy change and hence show $C_p - C_v = R$ for one mole of an ideal gas. 3

(b) Given that the heat of reaction of burning of Rhombic sulphur (S_R) in oxygen at 25°C to produce SO_2 gas is -296.9 kJ/mol. The heat capacities at constant pressure for $S_R = 23.7$, $O_2 = 29.2$ and $SO_2 = 79.5$ Jk⁻¹ mol⁻¹. Find heat of reaction at 85°C. 2

4. (a) Propane has the structure $H_3C-CH_2-CH_3$. Calculate the change in enthalpy for the following reaction :



Given that average bond enthalpies are :



- (b) How is final temperature of irreversible adiabatic expansion of an ideal gas measured ? 7

Section B

5. (a) Calculate the enthalpy change for the reaction $\text{N}_2 + \text{O}_2 \rightleftharpoons 2\text{NO}$. Given that the equilibrium constant for this reaction is 4.08×10^{-4} at 2000 K and 3.60×10^{-3} at 2500 K. 3
- (b) Starting from Clapeyron equation, how is Clausius-Clapeyron equation obtained ? Express it in integrated form. 2

6. Apply Le-Chatelier principle to predict suitable conditions for getting maximum yield of the product in each of the following cases :

(i) Manufacturing of Ammonia by Haber's Process

(ii) Manufacturing of Nitric Oxide by Birkland-Eyde process for manufacturing of Nitric acid.

(iii) Manufacturing of Hydrogen by Bosch process. 5

7. (a) 0.83 g succinic acid was shaken up with 100 ml each of water and ether. The water layer was found to contains 0.70 g of succinic acid the rest having passed on into ether layer. Calculate the quantity of succinic acid, which can be extracted from 1000 ml of ether solution containing 1 g of the acid, using 100 ml of water in one lot and in two equal fractions. 3

(b) A solute undergoes association in a solvent according to the equation

$nX \longrightarrow X_n$. How can you determine the value of n by applying distribution law ?

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