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EXPRESS WAY,
JABI - ABUJA.
FACULTY OF SCIENCES
DEPARTMENT OF CHEMISTRY
2024_2 EXAMINATION

COURSE CODE: CHM 301
COURSE TITLE: PHYSICAL CHEMISTRY III
COURSE UNIT: 2
TIME: 2 HOURS
INSTRUCTION: *Answer question one and any other two questions.*

Question 1

(a) Calculate the molecular mass of 9.21g non-volatile organic compound, dissolved in 50g of pure water at 25°C, which depresses the vapour pressure of the water from 3.16×10^3 to $3.10 \times 10^3 \text{ Nm}^{-2}$.

(b) Define the term enthalpy of fusion

(c) What is the physical significance of decrease in Gibbs free energy?

(d) Calculate the entropy of mixing of 1.00 mol of H_2 with 2.00 mol of O_2 assuming that no chemical reaction occurs.

(e) Mention five(5) features of Carnot cycle

(f) Calculate the final pressure of a sample of water vapour that expands reversibly and adiabatically from 8.73 Torr and 500 cm^3 to a final volume of 3.0 dm^3 .
Take $\gamma = 1.3$.

Question 2:

(a) Explain the depression of freezing point as an example of colligative properties

(b) What do you understand by the term enthalpy of fusion

(c) Given that the fugacity coefficient of a certain gas at 290 K and 2.1 MPa is 0.68. Calculate the difference of its molar Gibbs energy from that of a perfect gas in the same state. (

(d) Discuss thermodynamic reversible process

QUESTION 3

- (a) The free energy change ΔG for a particular process is $-121.00 \text{ kJ mol}^{-1}$ at 298 K and $-117.00 \text{ kJ mol}^{-1}$ at 308 K. Calculate the enthalpy change for the process at 303 K.
- (b) Write equation to show the net work done in all the four (4) stages of the Carnot cycle
- (c) What do you understand by the term heat of neutralization

Question 4

- (a) Given a 1.00 mol of a monoatomic gas initially at $3.00 \times 10^2 \text{ K}$ and occupying $2.00 \times 10^{-3} \text{ m}^3$ is heated to $3.25 \times 10^2 \text{ K}$ and the final volume is $4.00 \times 10^{-3} \text{ m}^3$. Assuming ideal behaviour, calculate the entropy change for the process.
- (b) Given 15 gram molecules of H_2 on interaction with 5.2 gram molecules of iodine vapours at 444°C , produce 10 gram molecules of HI . Calculate the equilibrium constant of the reaction.
- (c) Distinguish between heat of reaction and heat of formation

Question 5

- (a) Given a 1.00 mol of an ideal gas is compressed isothermally and reversibly from $1.00 \times 10^{-2} \text{ m}^3$ to $1.00 \times 10^{-3} \text{ m}^3$. Calculate the entropy change.
- (b) Derive an equation to show the change in entropy accompanying heating process
- (c) Mention four (4) applications of Hess's law in physical chemistry