

يجب مراعاة الترتيب في الإجابة وعدم تداخل الإجابات (كل جزئية في صفحة منفردة)

Answer the following questions:

(الامتحان من صفتان)

أجب عن الأسئلة الآتية:

(C=12, H=1, K=84, N=14, and O=16)

Question No. (1) (8Marks)

- (a): A gaseous mixture of oxygen (O_2) and krypton (Kr) has a density of 1.104 gm/l at 57.995K pa. and 27 °C. What is the partial pressure of O_2 in the mixture? (3)
- (b): Calculate the compressibility factor and Predict the behavior of 110 gm of CO_2 gas at the following specified conditions: (2)
- i- Pressure of 760 mmHg. and occupying a volume of 63.550 lit. at a temperature of 37 °C?
- ii- Pressure of 202.650 k pa. and occupying a volume of 50 lit. at a temperature of 17 °C?
- (c): Calculat the volume of N_2 gas at S.T.P conditions is required to react completely with 24 liters of H_2 at 0.974 atm and 24.5 °C? Rxn: $N_2 + 3H_2 \longrightarrow 2NH_3$ (3)

Question No. (2): (8Marks)

- (a): One mole of water was vaporized at 100°C and at constant pressure of 1 atm. Calculate ΔE for the following process: H_2O (liquid at 100°C, 1 atm.) \longrightarrow H_2O (vapor at 100.°C, 1 atm.) If you are given the following data: Enthalpy of vaporization ΔH_{vap} of water = 9.72 kcal /mole. Density of water liquid (at 100°C)=1 gm/cm³ (Assume that the water vapor behaves as ideal gas). (4)
- (b): Calculate the standard enthalpy change ΔH^0_r , the equilibrium constant (K_{eq}) at 25°C for the following reaction: $2NaHCO_3(s) \rightarrow Na_2CO_3(s) + CO_2(g) + H_2O(g)$ and why ($NaHCO_3$) can be used as a fire extinguisher, if you are gavin the following thermodynamic data at 25°C.? (4)

Compound	State	ΔG^0_f Kcal/ mol	S^0 cal/ mol K
$NaHCO_3$	s	-202.90	36.90
Na_2CO_3	s	-249.60	32.40
CO_2	g	-94.26	51.06
H_2O	g	-54.63	45.10

Question No. (3): (8Marks)

- (a): Determine the percent excess air, When 100 gm of a coal containing 72% by weight carbon, 18% by weight hydrogen, and 10% by weight ash gives a gas containing 68.73 mole of nitrogen plus CO , CO_2 , O_2 and H_2O . (3)
- (b): Calculate the volume of air required and the volume and composition of the flue gases at S.T.P., when 1 Kg. of oil is burned with 20% excess of that theoretically required, if the oil analysis is 84% carbon and 16% hydrogen by weight.(5)

Question No. (4): (12 Marks)

- (a): What is meant by colligative properties of solutions and demonstrate the three applications in our life time governed by these properties? (4)
- (b): Ethylene glycol $C_2H_6O_2$ is used as anti-coolant in vehicle's engine cooler (رديلاتير السيارات), specially in cold climates. If the temperature reached to -10°C, what weight of ethylene glycol $C_2H_6O_2$ must be added to 100 gm of water to prevent the formation of ice? (for water $T_f^0 = 273K$. and $\Delta H_{fus} = 1436$ cal/mol) (4)
- (c): What is the density at 17°C of aqueous solution containing 0.75 gm of sucrose, ($C_{12}H_{22}O_{11}$), per 2 liter of a solution developed a rise of 26.4 cm at osmotic equilibrium? (4)

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اقلب الصفحة

Question No. (5): (8Marks)

(a): Calculate the standard electrode potential, E° , for the half-cell, $(\text{Fe}^{+++} + 3\text{e}^- \longrightarrow \text{Fe})$ if you are given:
 $\text{Fe}^{++} + 2\text{e}^- \longrightarrow \text{Fe} \quad E^\circ_1 = -0.440 \text{ volt} \quad \text{Fe}^{+++} + \text{e}^- \longrightarrow \text{Fe}^{++} \quad E^\circ_2 = 0.771 \text{ volt} \quad (3)$

(b): Consider a galvanic cell that uses the reaction: $\text{Cu}_{(s)} + 2\text{Fe}^{+3}_{(aq)} = 2\text{Fe}^{+2}_{(aq)} + \text{Cu}^{+2}_{(aq)}$

Calculate the electrode potential (E) and ΔG under the condition that, $[\text{Fe}^{+3}] = 1 \times 10^{-4}$ molar, $[\text{Fe}^{+2}] = 0.2$ molar and $[\text{Cu}^{+2}] = 0.25$ molar and at temperature of 25°C .? ($F = 96500$ coulombs/ mole electron) (5)

Given, $2\text{Fe}^{+3}_{(aq)} + 2\text{e}^- = 2\text{Fe}^{+2}_{(aq)} \quad E^\circ = 0.77 \text{ volt} \quad \text{Cu}^{+2}_{(aq)} + 2\text{e}^- = \text{Cu}_{(s)} \quad E^\circ = 0.34 \text{ volt}$

Question No. (6): (10Marks)

(a): Identify the main constituents of Portland cements? and express them in clinker chemistry notation:? (2)

(b): Demonstrate the main features of the kiln used for burning the raw mix to produce Portland cement? and Explain the main reactions occurring inside it? (4)

(c): What are the main raw material resources for fertilizers industry? Explain in a flow sheet diagram how ammonium nitrate fertilizer is produced? (4)

With My Best Regards and Good Luck
Prof. Dr. Ahmed Ahmed Al sarawy