Question Paper

Exam Date & Time: 29-Jul-2024 (10:00 AM - 01:00 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

SECOND SEMESTER BSc HEALTH SCIENCES DEGREE EXAMINATION - JULY 2024
SUBJECT: BHS - 104 - CHEMISTRY II
(OLD SCHEME)

Marks: 75 **Duration: 180 mins.**

Answer all the questions.

Answer the following in 2 or 3 sentences

1A)	Consider the chemical equilibrium: $2SO_2(g) + O_2(g) \leftrightarrow 2SO_3(g)$ $\Delta H°rxn = -196$ kJ. Explain the effect of varying the a) pressure and b) temperature for this equilibrium.	(2)
1B)	Ammonia is a commonly used cleaning agent in households and is a weak base, with a K_b of 1.8×10^{-5}. What is the pH of a 1.5 M NH_3 solution?	(2)
1C)	Define buffer and write the Henderson-Hasselbalch equation for a conjugate acid base pair.	(2)
1D)	Define the following terms in phase diagram a) Regions of the diagram b) Lines between regions	(2)
1E)	Does hexane mix with octane? Why/why not?	(2)
1F)	Zn strips dipped in HCl produces more hydrogen gas than in CH_3COOH. Give reason.	(2)
1G)	Write anodic and cathodic reaction in Zn-Cu voltaic cell.	(2)
1H)	What are the key factors that decide the spontaneity of a reaction?	(2)
1I)	At elevated temperatures, solid silicon reacts with chlorine gas to form gaseous $SiCl_4$ as per the equation, $Si(s) + 2Cl_2(g) \leftrightarrow SiCl_4(g)$ When the reaction is started with 0.10 moles of Si and 0.20 moles of C_2I in a one liter flask, 0.050 moles of $SiCl_4$ are obtained at equilibrium. Calculate the equilibrium constant, K_c.	(2)
1J)	Explain the effect of physical state and temperature on S° value of the system.	(2)
1K)	Segregate the following acid/base into Bronsted-Lowry Acid and Base NH_3 , F^-, HNO_3 , CO_3^{2-} $H_2PO_4^-$, and H_3O^+	(2)
1L)	Data: $\Delta H°f$ values: $CH_4(g)$, -74.8 kJ; $CO_2(g)$, -393.5 kJ; $H_2O(l)$, -285.8 kJ. Using the $\Delta H°_f$ data above, calculate $\Delta H°_{rxn}$ for the reaction below. Reaction: $CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(l)$	(2)
1M)	Give reason: Ice floats on the surface of water	(2)

1N) **Define the following terms** **(2)**

i) **Molarity**
ii) **Molality**
iii) **Mass percentage**
iv) **Volume percent**

2. Write a short note on the following questions

2A) **Lead can displace silver from solution as follows:** **(3)**

$Pb(s) + 2Ag^{+}(aq) \rightarrow Pb^{2+}(aq) + 2Ag(s)$

Calculate K and ΔG^{o} at 298.15 K for this reaction.

2B) **a) Distinguish** **(3)**

i) specific heat capacity from molar heat capacity

ii) Lewis acid from a Bronsted acid.

b) For the reaction below,

$CO(g) + NO(g) \rightarrow CO_2(g) + \frac{1}{2} N_2(g)$.

Calculate the enthalpy change using the data given below.

$CO(g) + \frac{1}{2} O_2(g) \rightarrow CO_2(g)$; $\Delta H = -283.0$ kJ

$N_2(g) + O_2(g) \rightarrow 2NO(g)$; $\Delta H = 180.6$ kJ

2C) **i) Iodine-123 is used to study thyroid gland function. This radioactive isotope breaks down in a first-order process with a half-life of 13.1 h. What is the rate constant for the process?** **(3)**

ii) The reaction $2NOCl(g) \rightarrow 2NO(g) + Cl_2(g)$ has an E_a of 1.00×10^2 kJ/mol and a rate constant of 0.286 L/mols at 500 K. What is the rate constant at 490 K?

2D) **A voltaic cell houses the reaction between aqueous fluorine and zinc metal as follows:** **(3)**

$F_2(aq) + Zn(s)$ gives $Zn^{2+}(aq) + 2F^{-}(aq)$; $E^{o}cell = 2.87$ V

Calculate $E^{o}_{fluorine}$, given $E^{o}_{zinc} = -0.76$ V

3. Answer the following questions

3A) i) **Calculate the heat change involved in converting 2.5mol of gaseous water from 130^{o}C to 0^{o}C. Given $c_{water(g)}$ = 33.1 J/mol.^{o}C, $c_{water(l)}$ = 75.4 J/mol.^{o}C, ΔH_{vap} = 40.7 kJ/mol , ΔH_{fus} = 6.02 kJ/mol** **(5)**

ii) **Describe the variation of vapour pressure with temperature and intermolecular forces.**

3B) i) **Calculate the vapor pressure lowering, ΔP, when 10.0 mL of glycerol ($C_3H_8O_3$) is added to 500. mL of water at 50°C. At this temperature, the vapor pressure of pure water is 92.5 torr and its density is 0.988 g/mL. The density of glycerol is 1.26 g/mL** **(5)**

ii) **Salts from strong bases and weak acids give basic solutions. Give reason.**

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