

Question Paper

Exam Date & Time: 29-Jul-2024 (10:00 AM - 12:30 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

SECOND SEMESTER BSc HEALTH SCIENCES DEGREE EXAMINATION - JULY 2024
SUBJECT: BHS-1202 - CHEMISTRY II
(NEW SCHEME)

Marks: 60

Duration: 150 mins.

1. Answer the following in 2 or 3 sentences

- 1A) Consider the chemical equilibrium: $2\text{SO}_2(\text{g}) + \text{O}_2(\text{g}) \leftrightarrow 2\text{SO}_3(\text{g})$ $\Delta H^\circ_{\text{rxn}} = -196 \text{ kJ}$. Explain the effect of varying the a) pressure and b) temperature for this equilibrium. (2)
- 1B) Define the following terms in phase diagram
a) Critical point
b) Lines between regions (2)
- 1C) Write anodic and cathodic reaction in Zn-Cu voltaic cell. (2)
- 1D) At elevated temperatures, solid silicon reacts with chlorine gas to form gaseous SiCl_4 as per the equation,
 $\text{Si}(\text{s}) + 2\text{Cl}_2(\text{g}) \leftrightarrow \text{SiCl}_4(\text{g})$
When the reaction is started with 0.10 moles of Si and 0.20 moles of Cl_2 in a one liter flask, 0.050 moles of SiCl_4 are obtained at equilibrium. Calculate the equilibrium constant, K_c . (2)
- 1E) The observed value of Von't hoff factor is always lower than the expected value for NaCl. Give reason. (2)
- 1F) Which member of each pair is the stronger acid or base? Give reason.
(a) HClO or HClO_3 (b) KOH or CH_3NH_2 (2)

2. Write a short note on the following questions

- 2A) i) Define entropy. (3)
 ii) For the reaction, $2\text{FeO}(s) + 1/2\text{O}_2(g) \rightarrow \text{Fe}_2\text{O}_3(s)$;
 $\Delta S^\circ_{\text{sys}} = -136.6 \text{ J/K}$ and $\Delta H^\circ_{\text{sys}} = -281.5 \times 10^3 \text{ J}$ at 298K.
 The value of ΔS_{uni} is
- 2B) i) Mention the limitation of first law of thermodynamics. (3)
 ii) For the reaction, $\text{CO}(g) + \text{NO}(g) \rightarrow \text{CO}_2(g) + 1/2 \text{N}_2(g)$;
 Calculate the enthalpy change using the data given below.
 $\text{CO}(g) + 1/2 \text{O}_2(g) \rightarrow \text{CO}_2(g)$; $\Delta H = -283.0 \text{ kJ}$
 $\text{N}_2(g) + \text{O}_2(g) \rightarrow 2\text{NO}(g)$; $\Delta H = 180.6 \text{ kJ}$
- 2C) Define the following: (3)
 i) Half life
 ii) Instantaneous rate
 iii) Activated complex
- 2D) Calculate the $[\text{H}_3\text{O}^+]$, pH, $[\text{OH}^-]$, and pOH for a 0.0063 M HNO_3 solution. (3)
 Is HNO_3 a weak or strong acid?
- 2E) Hypochlorous acid is a weak acid formed in laundry bleach. What is the $[\text{H}_3\text{O}^+]$ of a 0.125 M HClO solution? $K_a = 3.5 \times 10^{-8}$ (3)
- 2F) Describe construction and working of Cu-Sn voltaic cell. Given $E^\circ_{\text{Cu}^{+2}/\text{Cu}} = 0.34\text{V}$, $E^\circ_{\text{Sn}^{+2}/\text{Sn}} = -0.14\text{V}$ (3)

3. Answer the following questions

- 3A) a) Calculate the heat change involved in converting 2.5 mol of gaseous water from 130°C to 0°C. Given $c_{\text{water}(g)} = 33.1 \text{ J/mol}\cdot^\circ\text{C}$, $c_{\text{water}(l)} = 75.4 \text{ J/mol}\cdot^\circ\text{C}$, $\Delta H_{\text{vap}} = 40.7 \text{ kJ/mol}$, $\Delta H_{\text{fus}} = 6.02 \text{ kJ/mol}$ (5)
 b) Describe the variation of vapour pressure with temperature and intermolecular forces.
- 3B) a) Calculate the vapor pressure lowering, ΔP , when 10.0 mL of glycerol ($\text{C}_3\text{H}_8\text{O}_3$) 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)
 (b) The 1 kg of ethylene glycol ($\text{C}_2\text{H}_6\text{O}_2$) antifreezes in a car radiator, which contains 4450 g of water. What are the boiling and freezing points of the solution?
 $K_b = 0.512^\circ\text{C/m}$; $K_f = 1.86^\circ\text{C/m}$

-----End-----