*Ref. No. EX/MET/CHEM/T/121/2017*

**B. MET. ENGG. EXAMINATION, 2017**

**(1st Year, 2nd Semester)**

**Chemistry-II**

**Full Marks: 100**

**Time: Three Hours**

*The figures in the margin indicate full marks*

***Answer any five questions***

1. (a) Write the Werner theory of coordination compound and give evidence in favour of it.
(b) Write short notes on
(i) ionization isomerism
(ii) linkage isomerism
(iii) coordination
(c) Write the possible isomers of the coordination compound $[Co(en)_2Cl_2]$ (en = ethylenediamine) and discuss their optical properties.
(d) Give examples of complexes having coordination numbers 2, 4 and 6.

(4+2)+(3+3+3)+3+2 = 20

2. (a) What do you mean by "Ligand" ? Write down the structure of a hexadentate chelating ligand and its octahedral metal complex with $M^{n+}$.
(b) Define 'complex' and 'double' salts. Distinguish between them.
(c) What do you mean by "Chelate complex" and "Innermetallic complex"? Differentiate between them. Discuss with examples the importance of complex formations in qualitative analysis of basic radicals.
(d) Write down the three complexes of $CrCl_3.6H_2O$. How do they distinguish from each other?
(e) Write the IUPAC nomenclature of the following compounds
(i) $[Co(en)_2Cl_2]Cl$
(ii) $[Co(NH_3)_5(NO_2)]Cl_2$
(iii) $[Pd(NH_3)_4][PdCl_4]$
(iv) $[Cr(acac)_3]$

(2+2)+3+(2+1+3)+3+4 = 20

3. (a) Draw the isotherms of a real gas and explain the idea of continuity of state.
(b) Describe the two types of intermolecular interactions responsible for deviations from ideal gas behavior, and indicate the direction of their effect on the pressure.

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(c) Express the critical constants ($P_c$, $V_c$, and $T_c$) in terms of the constants 'a', 'b, and 'R' of a van der Waals' gas.
(d) Calculate the pressure exerted by 3 moles of a van der Waal gas occupying a volume of 2000 ml at 37 °C. For the gas: a = 2 $li^2atm.mole^{2-}$ and b= 30 cc $mole^{1-}$.

5+5+5+5 =20

4. (a) Write down the fundamental postulates of the Kinetic theory of gases.
(b) Draw the isotherms of a van der Waal's gas. Illustrate with the help of the isotherm the region of "supercooled vapor" and "superheated liquid" state of the gas.
(d) The critical volume of nitrogen gas is 81 $cm^3$. The van der Waal's constant b is three times the actual volume of a mole of the gas. If $N_2$ molecule can be treated as a billiard ball, calculate the radius. 5+(5+2.5+2.5)+5=20

5 (a) The melting point of phenol is $40^0$C. A solution containing 0.172 g of acetanilide ($C_8H_9ON$) in 12.54 g phenol freezes at $39.25^0$C. Calculate the freezing point constant and the latent heat of fusion of phenol.
(b) The freezing point of pure benzene is 5.44 $^0$C and that of a solution containing 2.092 g benzaldehyde in 100 g benzene is $4.44^0$C. Calculate the molecular weight of benzaldehyde. Given $K_f$ = 5.1.

(c) 2.4 g urea and 3.4 g sucrose are dissolved in 180 g of water. Calculate the vapour pressure of the solution. The vapour pressure of water is 23.65 mm at that temperature.

(5+5) + 5+5 =20

6. (a) The normal boiling point of chloroform is 61.2 $^0$C and its heat of vaporization is 59 Cal/g. If 0.50 g of an organic substance is dissolved in 50 g of chloroform, the boiling point of the solution becomes $61.42^0$C. Calculate the molecular weight of the solute.

(b) A solution containing 2.4323 g of sulfur in 100 g of naphthalene (mp $80.1^0$C) gave a freezing point depression of $0.64^0$C. The latent heat of fusion of naphthalene is 35.6cal/g. What is the molecular formula of sulfur in the solution?
(c) 5 g of a solute was dissolved in 40 g of acetone at $27^0$C. The vapour pressure of the solution was found to be 271 Torr. Calculate the molar mass of the solute. Given the vapour pressure of pure acetone at at $27^0$C is 283 Torr.
(d) At $25^0$C, the vapour pressure of water is 23.55 mm. What would be the vapour pressure of a solution containing 30 g urea in 50 g of water at that temperature?

5x4 =20