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B.Sc./3rd Sem (H)/CHEM/23(CBCS)

2023

3rd Semester Examination

CHEMISTRY (Honours)

Paper : C 6-T

[Inorganic Chemistry - II]

[CBCS]

Full Marks : 40

Time : Two Hours

*The figures in the margin indicate full marks.
Candidates are required to give their answers
in their own words as far as practicable.*

Group - A

1. Answer any *five* questions :

2×5=10

- (a) What is the probable energy source of sun?
- (b) How age of rocks can be determined?
- (c) Write down the limitations of radius ratio rule with an example.
- (d) Calculate the bond orders of CN^- and O_2^- .
- (e) Arrange the following compounds with increasing order of their dipole moment. NH_3 , NF_3 , NCI_3 .
Explain the order.

P.T.O.

(2)

(f) CD_4 has slight lower boiling point than CH_4 . — Explain.

(g) Why $HgCl_2$ is colourless but HgI_2 is deep red in colour?

(h) Between $NaCl$ and $CuCl$, which has higher melting point and why?

Group - B

2. Answer any *four* questions :

5×4=20

(a) (i) Predict the structures of $NOCl$ and ICl_2^+ .

(ii) KHF_2 can easily be formed whereas $KHCl_2$ does not — Explain.

(iii) Calculate the lattice energy of $Mg(ClO_4)_2$ using Kapustinskii equation. Radii of Mg^{2+} and ClO_4^- ions are 86 pm and 226 pm, respectively. $K = 1.214 \times 10^5$ kJ unit.

1+2+2

(b) (i) How mass defect is related to binding energy?

(ii) Why packing fraction may be positive or negative whereas mass defect cannot.

(iii) Calculate the average binding energy per nucleon in 3_2H (mass = 3.016030 μ) and 3_1H (mass = 3.016050 μ)

1½+1½+2

(3)

(c) (i) Explain why Be shows electrical conductivity.

(ii) U-238 cannot be commonly used as nuclear fuel — Explain.

(iii) What do you mean by nuclear isomerism?

2+2+1

(d) (i) 1 gm of ^{226}Ra emits 11.6×10^{17} α particles per year. Calculate the value of the Avogadro number. ($t_{1/2} = 1590$ year).

(ii) With the help of MO theory calculate the bond order of NO.

(iii) What do you mean by δ -bond? 2+2+1

(e) (i) Although oxygen shows high second electron affinity value, MgO is well known. Explain.

(ii) Suggest reasonable crystal structure of CaF_2 and TiO_2 from the following radii (pm)

$$\text{Ca}^{2+} = 126, \text{F}^{-} = 119, \text{Ti}^{4+} = 74.5, \text{O}^{2-} = 126.$$

(iii) The melting point of AgCl is 445°C whereas in case of KCl it is 776°C ; Although the radii of K^{+} and Ag^{+} are almost same. Explain.

$1\frac{1}{2} + 1\frac{1}{2} + 2$

P.T.O.

(4)

(f) (i) Draw the molecular orbital (MO) energy level diagram of NO molecule.

(ii) NO is more reactive than N_2 . Explain.

(iii) Explain the ligating behaviour of NO.

2+2+1

Group - C

3. Answer any *one* question :

10×1=10

(a) (i) Define Frenkel and Schottky defects in solid. Cite example for each defects.

(ii) What do you mean by receptor-guest interaction?

(iii) What is artificial radioactivity? Give an example.

(iv) Write down the hazards of radiation and how this can be prevented? 3+2+2+3

(b) (i) Calculate electron gain enthalpy (−EA) of chlorine from the following ΔH data (kJ mol^{−1}) :

$$D_{Cl_2} = 242, I_{Na} = 494, \Delta H_{sub}(Na) = 109,$$

$$\Delta H_f^0(NaCl) = -414, r_{Na^+} + r_{Cl^-} = 281 \text{ pm in } NaCl.$$

(ii) Explain the bonding of $[Re_2Cl_8]^{2-}$ in the light of MO theory.

(5)

(iii) Among $MgCO_3$ and $CaCO_3$ — which is thermally more stable and why?

(iv) What are the differences between ion-dipole interaction and induced dipole interaction?

3+4+1+2
