বিদ্যাসাগর বিশ্ববিদ্যালয়
VIDYASAGAR UNIVERSITY

Question Paper

B.Sc. Honours Examinations 2021
(Under CBCS Pattern)
Semester - III
Subject: CHEMISTRY
Paper: C-6 T & P
(Inorganic Chemistry - II)

Full Marks : 60(Theory-40 + Practical-20)
Time : 3 Hours

Candiates are required to give their answer in their own words as far as practicable.
The figures in the margin indicate full marks.

THEORY (Marks : 40)

Group - A

Answer any **three** questions : 12×3=36

1. (a) Define lattice energy. Write down the Born-Lande equation relating to lattice energy and give meaning of the various term involve in it.

   (b) Give electronic configuration of B_2, C_2 and N_2 molecules on appropriate molecular orbital energy level diagram and hence explain the remarkable differences in their bond dissociation energies given in the perenthesis. B_2 (294 kJ / mol), C_2 (605 kJ / mol), N_2 (945 kJ / mol),

(c) On analysis, an ore of Uranium shows the mass ratio for ^{238}U to $^{206}Pb = 6.08$. All ^{206}Pb atoms are supposed to appear from the disintegration of ^{238}U. Find the age of the ore. (given $t_{\frac{1}{2}}$ for $^{238}U = 4.5 \times 10^9$ Yrs, the next longest lived nuclide ^{234}U in the series $= 2.5 \times 10^5$ Yrs)

2. (a) Establish Born-Haber cycle for the formation of MgS(s) starting from Mg(s) and $S_8(g)$ and hence calculate the electron affinity of S(g) [for the reaction $S(g) + 2e \rightarrow S^2(g)$] using the thermodynamic data given below :

Enthalpy of formation of MgS(s) = –345 k.J. / mol

Enthalpy of sublimation of Mg(s) = 153 k.J. / mol

Sum of 1st and 2nd ionization energy Mg(g) = 2187 k.J. / mol

Enthalpy of atomization of $S_8(s) = 559$ k.J. / mol

Latice Energy of MgS(s) = –2940 k.J. / mol

(here 's' stands for solid and 'g' for gas)

(b) Simultaneously the most soluble alkali iodide and most soluble lithium halide in polar solvent is LiI — Explain.

(c) SO_3 is planar but SO_3^{2-} is pyramidal — Explain.

(d) In what way the mode of decay of a particular nucleus related to n / p ratio ?

4+3+2+3

3. (a) Using VSEPR theory, predict the structure and shape of I_3^- and $SOCl_2$

(b) Conductivity of Ge is enhanced by the addition of trace amount of Ga in it — Explain.

(c) MgO is harder and has higher melting point as compare to that of NaCl — Explain.

(d) Briefly discuss the advantages and limitations of nuclear fission and fussion processes as the probable alternative to fossil fuels as energy sources. (2+2) + 2 + 2 + 4

4. (a) S-O bond energy among the oxohalides follow the order : $SOF_2 > SOCl_2 > SOBr_2$ — Explain.

(b) $PbCl_2$ is white whereas PbI_2 is yellow — Explain.

(c) $MgCO_3$ is thermally less stable than $CaCO_3$ — Why?

(d) Draw the MO energy level diagram of H_2O and hence comment on the angular structure of H_2O molecule. 3 + 2 + 2 + 5

5. (a) Using hard sphere model find the limiting radius ratio (r_+ / r_-) for tetrahedral coordination.

(b) NF_3 is inert to hydrolysis but why is PF_3 readily hydrolyzed ?

(c) Which of the two angles $\angle F-C-F$ and $\angle H-C-H$, in the molecular CH_2F_2 is wider and why ?

(d) What is meant by 'partial ionic character of a covalent bond' ? What are its consequences?

(e) Give the resonating structure of nitrate and nitrite ions. 3+2+2+3+2

6. (a) Discuss the qualitative idea of band theory and hence explain the conducting, semiconducting and insulating properties with suitable example.

(b) Write notes on (any two)

(i) Schottky defect

(ii) Radio carbon dating

(iii) Nuclear Isomerism 6 + (3×2)

Group - B

7. Answer any **two** questions : 2×2=4

(a) Why CO_2 is gaseous monomer whereas SiO_2 is polymeric solid ?

(b) LiCl is soluble in organic solvent, but other alkali chlorides are not. — Explain

(c) Discuss the structure of XeF_6 in the light of VSEPR theory.

(d) O_2 is paramagnetic — Explain.

PRACTICAL (Marks : 20)

Paper : C-6 P

Group - A

1. Answer any ***one*** question : $15 \times 1 = 15$

a. Describe the method of estimation of Cu(II) ion (in g/l) present in a supplied solution by iodine titration.

b. Discuss the method of estimation of Fe in Portland cement using $K_2Cr_2O_7$

c. Describe the method to estimate the available chlorine in a supplied sample of bleaching powder.

Group - B

2. Answer any ***one*** question : $5 \times 1 = 5$

a. Write the method of estimation of vitamin C.

b. Write the principle of estimation of Cr and Mn in steel.

c. Write the principle of estimation of Cu in brass.
