

2019

B.Sc.

3rd Semester Examination
CHEMISTRY (Honours)

Paper - C 6-T

Full Marks : 40

Time : 2 Hours

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

Answer any *five* questions : 2×5

1. (a) Explain why the geometry of penta coordinate system is not rigid.
- (b) BH_3 does not exist but BH_4^- exists. Why?
- (c) Why D_2O instead of H_2O is used in the nuclear reactor to thermalise the fast neutrons?
- (d) How do the defects influence the colour and electrical conductivity of the ionic crystals?

[Turn Over]

- (c) Very often the alkaline earth salts disobey the radius ratio rule. Justify.
- (f) The bond angle of $\angle F-P-F$ in PF_3 is higher than that of $\angle H-P-H$ in PH_3 . Explain
- (g) What is the significance of odd-even rule in predicting the stability of the nuclides.
- (h) Why CO_2 is gas while SiO_2 is solid at room temperature ?

2. Answer any *four* questions : 4×5

- (a) (i) Show that the structural geometries of NO_2^+ , NO_2 and NO_2^- are different. 3
- (ii) Explain why the hydrolytic products of NCl_3 , NF_3 and PCl_3 are of different types. 2
- (b) (i) Draw the MO diagram of CO.
- (ii) Why dipole moment of CO is very low?
- (iii) Explain the ligating behaviour of CO. 2+1+2

- (c) (i) Define half-life period and average life period and show that $t_{1/2} = 0.693 t_{av}$

- (ii) Predict the mode of decay in the following nuclides in the light of n/p ratio (a) ${}^8_{14}\text{O}$ (b) ${}^{92}_{234}\text{U}$. 2+3
- (d) (i) The nuclear binding energy per nucleon for ${}^6_{12}\text{C}$ is 7.683 MeV. The isotopic mass for ${}^6_{12}\text{C}$ is 12.00 amu. Find the mass defect and mass of six proton and six neutrons.
- (ii) How does the meson theory of exchange force explain the nuclear stability?
- (iii) Draw the variation trend of concentration of A, B and C in the process $A \xrightarrow{k_1} B \xrightarrow{k_2} C$ where $k_1 \gg k_2$. 2+2+1
- (e) (i) Discuss the different factors governing the lattice energy.
- (ii) Calculate the lattice energy of KCl from the given data : interionic separation = 314 pm, born exponent for Ar configuration = 9, Madelung constant (A) = 1.746.
- (iii) How Kapustinskii equation helps to predict lattice energy of an unknown crystal system of salt. 2+2+1

[Turn Over]

- (f) (i) Compared to Me_3N , $(\text{SiH}_3)_3\text{N}$ has got almost no basicity – Why?
- (ii) CO and N_2 are isosteric species but CO can act as a potential lig and while N_2 cannot – explain.
- (iii) What is the main drawback of Born-Haber cycle? 2+2+1

3. Answer any one question : [1×10]

- (a) (i) Discuss the use of radioactivity in agriculture and medical field.
- (ii) Define the acidic property of different halogen hydrides in light of MO theory.
- (iii) Explain why FeO and FeS very often act as semiconductors.
- (iv) Why the geometry of $\dot{\text{C}}\text{H}_3$ and $\dot{\text{C}}\text{F}_3$ radicals are different ? 3+3+2+2
- (b) (i) Discuss the effect of instantaneous dipole induced dipole interaction with suitable example.

(5)

- (ii) A radioactive sample shows activity of 48 counts per min, and after 5 min it reduces to 20 counts per min. Find the decay constant and half-life period of the sample.
- (iii) Explain why OCN^- (cyanate) is more stable than CNO^- (fulminate).
- (iv) Define the conducting property of metal cluster in light of band theory. 2+4+2+2
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