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 practiable.
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 no exist but BH_4^- exists. Why?

   (c) Why D_2O insteed of H_2O is used in the nuclear reactor to thermalise the fast neutrons?

   (d) How does the defects influence the colour and electrical conductivity of the ionic crystals?

[Turn Over]

(e) Very often the alkaline earthe 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 geometrics 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) $^{14}_{8}O$ (b) $^{234}_{92}U$. 2+3

(d) (i) The nuclear binding energy per nucleon for $^{12}_{6}C$ is 7.683 MeV. The isotopic mass for $^{12}_{6}C$ 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 $k_1 >> k_2$. 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 seperation = 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, $(SiH_3)_3N$ 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 $\dot{C}H_3$ and $\dot{C}F_3$ radicals are different ? 3+3+2+2

(b) (i) Discuss the effect of instantaneous dipole induced dipole interaction with suitable example.

(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^- (cynate) is more stable than CNO^- (fulminate).

(iv) Define the conducting property of metal cluster in light of band theory. 2+4+2+2
