

2018

CBCS

3rd Semester

CHEMISTRY

PAPER—C6T

(Honours)

Full Marks : 40

Time : 2 Hours

*The figures in the right-hand margin indicate full marks.*

*Candidates are required to give their answers in their own words as far as practicable.*

*Illustrate the answers wherever necessary.*

### ***Inorganic Chemistry—II***

Answer any *five* questions :

2×5

1. (a) Arrange the following components with increasing order of dipole moment.  $\text{NF}_3$ ,  $\text{NH}_3$ ,  $\text{NCl}_3$ . Explain the order.  
(b) Calculate the bond orders of  $\text{CN}^-$  and  $\text{O}_2^-$ .

(Turn Over)

- (c) Among NaCl and CuCl, which has higher melting point—and why ?
- (d) Write down the limitations of radius-ratio rule with example.
- (e) How age of rocks can be determined ?
- (f)  $\text{CD}_4$  has slight lower boiling point than  $\text{CH}_4$ —Explain.
- (g) Why  $\text{HgCl}_2$  is colourless but  $\text{HgI}_2$  is deep red in colour ?
- (h) What is the probable energy source of sun ?

2. Answer any four questions :

4×5

- (a) (i) How mass defect is related to binding energy ?
- (ii) Why packing fraction may be positive or negative where as mass defect cannot.
- (iii) Calculate the average binding energy per nucleon in  ${}^3_1\text{H}$  (mass = 3.016050 u) and  ${}^3_2\text{H}$  (mass = 3.016030 u)  $(1\frac{1}{2}+1\frac{1}{2}+2)$
- (b) (i)  $\text{KHF}_2$  can easily be formed where as  $\text{KCl}_2$  does not—Explain.
- (ii) Predict the structures of  $\text{NOCl}$  and  $\text{ICl}_2^+$
- (iii) Calculate the lattice energy of  $\text{Mg}(\text{ClO}_4)_2$  using Kapustinskii equation. Radii of  $\text{Mg}^{2+}$  and

$\text{ClO}_4^-$  ions are 86 pm and 226 pm respectively.

$$K = 1.214 \times 10^5 \text{ kJ unit.} \quad 1+2+2$$

- (c) (i) Draw the M.O. diagram of NO  
 (ii) Why NO is more reactive than  $\text{N}_2$  ?  
 (iii) Explain the ligating behaviour of NO.  $2+2+1$
- (d) (i) Although oxygen shows high second electron affinity value, MgO is well known. Explain.  
 (ii) Suggest reasonable crystal structure of  $\text{CaF}_2$  and  $\text{TiO}_2$  from the following radii (pm)  $\text{Ca}^{2+}$  - 126,  $\text{F}^{-1}$  - 119,  $\text{Ti}^{4+}$  - 74.5,  $\text{O}^{2-}$  = 126.  
 (iii) The melting point of AgCl is  $445^\circ\text{C}$  where as in case of KCl it is  $776^\circ\text{C}$ ; Although the radii of  $\text{K}^+$  and  $\text{Ag}^+$  are almost same.  $1\frac{1}{2}+1\frac{1}{2}+2$
- (e) (i) 1 gm of  $^{226}\text{Ra}$  emits  $11.6 \times 10^{17}$   $\alpha$  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  $\delta$ -bond ?  $2+2+1$
- (f) (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 ?  $2+2+1$

3. Answer any one question :

1×10

(a) (i) Calculate electron gain enthalpy ( $-EA$ ) of chlorine from the following  $\Delta H$  data ( $\text{KJ mol}^{-1}$ )— $\text{DCl}_2 = 242$ ,  $I_{\text{Na}} = 494$ ,  $\Delta H_{\text{Sub}}(\text{Na}) = 109$ ,  $\Delta H_f^\circ(\text{NaCl}) = -414$ ,  $r_{\text{Na}^+} + r_{\text{Cl}^-} = 281$  pm in NaCl.

(ii) Explain the bonding of  $[\text{Re}_2\text{Cl}_8]^{2-}$  in the light of MO theory.

(iii) Among  $\text{MgCO}_3$  and  $\text{CaCO}_3$ —which is thermally more stable and why ?

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

3+4+1+2

(b) (i) Define Frenkel and Schottky defects in solid. Cite examples for each defects.

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

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

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

3+2+2+3