## WEST BENGAL STATE UNIVERSITY
B.Sc. Honours 3rd Semester Examination, 2021-22

## CEMACOR06T-CHEMISTRY (CC6)

Time Allotted: 2 Hours                                                                 Full Marks: 40

*The figures in the margin indicate full marks.*
*Candidates should answer in their own words and adhere to the word limit as practicable.*
*All symbols are of usual significance.*

**Answer any *three* questions taking *one* from each unit**

### UNIT-I

1.  (a) Find out the limiting radius ratio for octahedral coordination in a close packed lattice. HgS has a radius ratio value of 0.68 but it crystallizes in the Zinc blend structure. Explain. — 2+2

    (b) Write down Kapustinskii equation for lattice energy and mention the importance of this equation. — 2

    (c) Draw the resonating structures of $CNO^-$ and $NCO^-$ ions showing the formal charge and comment on their relative stability. — 2+2

    (d) Explain the following: — 2×3

    (i)   The dipole moment of carbon monoxide molecule is smaller than expected.

    (ii)  $HgI_2$ is less soluble in water than $HgCl_2$.

    (iii) Melting point of AgCl is 455°C while that of KCl is 776°C though the radii of $K^+$ and $Ag^+$ ions are comparable.

2.  (a) Using VSEPR theory predict the shapes of $XeOF_4$ and $[ICl_4]^-$. — 3

    (b) Calculate the lattice energy of $ThO_2$ using Born Lande equation. Madelung constant = 2.519, Born exponent for $Th^{4+}$ is 14. Radii are: $Th^{4+}$ = 108 pm and $O^{2-}$ = 126 pm. — 3

    (c) $\cdot CH_3$ radical is planar where as $\cdot CF_3$ radical is pyramidal — Explain with Bent's rule. — 2

    (d) Differentiate between Schottky defect and Frenkel defect with example. — 4

    (e) Cite two examples where the VSEPR theory fails to predict the shape of a molecule. — 2

    (f) Explain the solubility trends: — 2

$$MgSO_4 > CaSO_4 > BaSO_4$$

## UNIT-II

3. (a) Draw MO diagram for NO molecule. Compare the bond dissociation energies of NO$^+$ and NO$^-$ species and explain the difference.  $3+1\frac{1}{2}+1\frac{1}{2}$

(b) Distinguish between intrinsic and extrinsic semiconductors with examples.  4

(c) The sequence of boiling point of the following compounds is:  3

$NH_3 \gg PH_3 < AsH_3 < SbH_3$ — Explain.

(d) From the view point of MO theory, explain why $BeH_2$ is a linear molecule.  3

4. (a) Construct the MO diagram for $H_2O$. Calculate the bond order from it.  4+1

(b) Addition of antimony with Germanium produces which type of semiconductor. Discuss.  3

(c) How can you correlate the colour of CdS with the Band Theory?  2

(d) $PH_3$ is more volatile than $NH_3$. — Explain.  2

(e) From MO theory explain why $NO_2^+$ is linear but $NO_2$ is bent.  2

(f) Explain why the O-O bond length varies as $O_2^+ < O_2 < O_2^-$.  2

## UNIT-III

5. (a) What is radioactive equilibrium? How does it differ from chemical equilibrium?  2+1

(b) Write notes on (any *one*):  3

(i) Radio carbon dating, (ii) Uses of isotopes in tracer technique.

(c) A small amount of radioactive material of half life period 20 days got inadvertently spread in a laboratory making the level of radiation 40 times the permissible safety level. After how many days the laboratory would be safe for use?  2

6. (a) Complete the following artificial transmutations  3

$_{24}Cr^{50}(\alpha,n) \longrightarrow$

$_{4}Be^{9} + {}_{1}H^{1} \longrightarrow + {}_{2}He^{4}$

$_{13}Al^{27}(n,p) \longrightarrow$

(b) Distinguish between nuclear fission and nuclear spallation reaction.  2

(c) Half life of one radio-element is 231 minute. How long would it take for 9/10th fraction decay of the element?  3

**N.B. :** *Students have to complete submission of their Answer Scripts through E-mail / Whatsapp to their own respective colleges on the same day / date of examination within 1 hour after end of exam. University / College authorities will not be held responsible for wrong submission (at in proper address). Students are strongly advised not to submit multiple copies of the same answer script.*

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