

B.Sc. 3rd Semester (Honours) Examination, 2022 (CBCS)

412

Subject : Chemistry

Course : CC-VI

(Inorganic Chemistry-II)

Time: 2 Hours

Full Marks: 40

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

1. Answer *any five* questions from the following: 2×5=10
- Name the fissile nuclides which were used in the atom bomb dropped on Hiroshima and Nagasaki during World War-II.
 - 'ZnO is white when cold but yellow when hot'— Explain.
 - Define ionic potential and indicate its implication in chemistry.
 - Calculate the formal charge on the constituent atoms in BF_3 .
 - 'Radioactive equilibrium is known though all nuclear reactions are irreversible'. — Explain.
 - 'Water has higher boiling point than hydrogen fluoride though hydrogen bond strengths are in reverse order' — Account for the fact.
 - ' He_2 molecule is unstable'— explain using Molecular Orbital theory.
 - What are the *p*-type semiconductors? Give one example.
2. Answer *any two* questions from the following: 5×2=10
- State and explain Bent rule and apply the same to predict the most probable structure of OsF_4 . 1+1+3
 - What do you mean by radius ratio principle? What information can be obtained from it? Find out the limiting radius ratio for tetrahedral and cubic coordination. 1+1+(1.5+1.5)
 - What is spallation reaction? Give example. How does it differ from nuclear fission reaction? 1+1+3
 - Define dipole moment. Mention its unit. 'The more polar the bonds in a molecule, the more the value of its dipole moment'.— Comment. 1+1+3
3. Answer *any two* questions from the following: 10×2=20
- (i) The final product of ^{238}U is ^{206}Pb . A sample of pitchblende contains 0.0453 g of ^{206}Pb for each gram of ^{238}U present in it. Assuming that the mineral pitchblende formed at the time of formation of earth did not contain any ^{206}Pb , calculate the age of the earth. (Given, $t_{1/2}$ of $^{238}\text{U} = 4.5 \times 10^9$ years).

- (ii) Why is fusion of hydrogen into helium nuclide energetically favourable but not of rhodium into uranium nuclide?
- (iii) How does the meson theory of exchange force explain the nuclear stability? 4+3+3
- (b) (i) What do you mean by lattice energy of an ionic crystal? Calculate the lattice energy of NaCl using the following data:
Madelung Constant (A) = 1.748, Equilibrium ionic distance = 2.79 Å, Born Exponent = 8.0, Electronic charge = 4.8×10^{-10} esu.
- (ii) Describe the shapes of ICl_4^+ and H_3O^+ on the basis of VSEPR theory.
- (iii) ' NH_3 , BCl_3 , BrF_3 have comparable molecular formulae but their shapes are different.'— Explain. (1+3)+3+3
- (c) (i) ' MgSO_4 is water soluble, but BaSO_4 is not.' — Explain.
- (ii) Predict the possible mode of decay of the following nuclides: ${}_{13}\text{Al}^{29}$ and ${}_{11}\text{Na}^{24}$
- (iii) 'The thermal stability of isomorphous sulphates of Ca(II), Sr(II) and Ba(II) with respect to decomposition into metal oxide and SO_3 increases in the sequence :
 $\text{CaSO}_4 < \text{SrSO}_4 < \text{BaSO}_4$.' — Explain. 3+4+3
- (d) (i) What is meant by artificial transmutation? Give two examples.
- (ii) Compare the geometry of NO_2 and NO_2^+ from VSEPR theory. Compare the bond angles of NO_2 , NO_2^+ , NO_2^- .
- (iii) 'The bond length in N_2^+ is greater than that in N_2 while bond length in NO^+ is lesser than that of NO .' — Explain the observation using Molecular Orbital theory. 3+4+3
-