

B.Sc. 3rd Semester (Honours) Examination, 2023 (CBCS)

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 answer in their own words as far as applicable.

1. Answer *any five* questions from the following: 2×5=10
- To which radioactive series does $^{237}\text{Ac}_{89}$ belong?
 - Mention one example of both d^3s and dsp^2 hybridised compound.
 - Define ionic potential and indicate its implication in Chemistry.
 - Calculate the formal charge on the constituent atoms in CO_3^{2-} .
 - Which one of $^{206}\text{Pb}_{82}$, $^{207}\text{Pb}_{82}$, $^{208}\text{Pb}_{82}$ is the stablest nuclide and why?
 - Explain why the conductivity of 'Ge' is enhanced many folds when trace amount of 'As' is added to it.
 - Compare between Schottky and Frenkel defects.
 - H_2O has more boiling point than HF though their hydrogen bond strength are in reverse order.— Explain.
2. Answer *any two* questions from the following: 5×2=10
- State the Fajan's Polarisation Rules. Applying these classify MgO and SnCl_4 into ionic and covalent compounds as the case may be. 2+1.5+1.5
 - (i) 'The dissociation energies of N_2^+ and O_2^+ are very similar'— Comment using MO theory.
 - (ii) N_3^- is more resonance stabilized than HN_3 .— Explain. 3+2
 - Is tritium expected to be an alpha or beta emitter? Write the equation for its decay. Calculate the activity of 0.1g $^{220}\text{Rn}_{86}$. ($T_{1/2} = 55.65$ s) 1+1+3
 - (i) State and explain Bent's rule with suitable examples.
 - (ii) Calculate the lattice energy of NaCl using the given data.
Madelung Constant (A) = 1.748, Equilibrium ionic distance = 2.79\AA ,
Born Exponent = 8, Electronic Charge = 4.8×10^{-10} esu. 2+3

3. Answer any two questions from the following:

10×2=20

- (a) (i) He gas is frequently available near uranium mines. — Explain.
- (ii) Predict the shapes of the following species and identify the hybridizations of central atoms : XeOF_4 and I_5^- .
- (iii) Explain why LiClO_4 is much more soluble than CsClO_4 in water.
- (iv) Ne_2 does not exist, explain with the help of MO diagram. 2+(2+2)+2+2
- (b) (i) Ozone molecule shows unusually low dipole moment. — Explain.
- (ii) What is F-Centre? How F-Centres influence the colour and electrical conductivity of ionic crystals?
- (iii) MgSO_4 is freely soluble in water whereas BaSO_4 is insoluble in it. On the other hand BaO is 2000 times more soluble than MgO in water.— Explain. 3+(1+2)+4
- (c) (i) A piece of wood was found to have $^{14}\text{C}:^{12}\text{C}$ ratio 0.7 times to that in a living plant. Calculate the period when the plant died ($T_{1/2}$ of $^{14}\text{C} = 5760$ Years).
- (ii) From the plot of binding energy per nucleon vs mass number curve, explain why the lighter elements undergo fusion but the heavier elements undergo fissions.
- (iii) Give a short note on liquid drop model. 4+3+3
- (d) (i) Write a short note on the band theory of metals.
- (ii) What are semiconductors? Give an example of p-type semiconductor. Explain why the electrical conductivity of metal decreases with the rise in temperature but reverse occurs with semiconductors.
- (iii) Illustrate with suitable example(s) 'instantaneous dipole — induced dipole' interactions. 2+(2+1+2)+3
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