IIT JAM 2024 NAT Model Questions

Subject - Chemistry (CY)

Q.1 The BB bond order in B_2 is _____.

Q.2 The number of unpaired electrons in $[Co(H_2O)_6]^{2+}$ is _____.

Q.3 The number of significant figures in 5.0820×10^2 is _____.

Q.4 The d spacing for the first-order X-ray (= 1.54 Å) diffraction event of metallic iron (fcc) at 2Θ = 20.2° is _____ Å. (round off to three decimal places)

Q.5 The volume fraction for an element in an fcc lattice is _____. (round off to two decimal places)

Q.6 Sea water containing 1 M NaCl has to be desalinated at 300 K using a membrane permeable only to water. The minimum pressure (in bars) required on the sea-water side of the membrane is _____ (Round off to one decimal place) ($R = 8.3$ J mol^{-1} K^{-1}, 1 bar = 10^5 N/m^2)

Q.7 A bacterial colony grows via cell division where each mother bacterium independently produces two daughter cells in 20 minutes. If the concentration of bacteria is 10^4 cm^{-3} , the colony becomes harmful. Starting from a colony with an initial concentration of 5 cm^{-3} , the time taken (in minutes) for the colony to become harmful is _____ (Round off to nearest integer)

Q.8 At a certain wavelength, liquid P transmits 70%, whereas liquid Q transmits 30% of the incident light when separately placed in a spectrophotometric cell (path length = 1 cm). In a binary mixture of liquids P and Q (assume non-interacting liquids), the absorbance in the same cell is 0.25. The volume fraction of liquid P in the binary mixture is _____ (Round off to two decimal places)

Q.9 Titanium tetrachloride (TiCl4) reacts with THF to form an octahedral complex X under an inert atmosphere at 25° C. If 5.0 g of TiCl4 is used and the yield is 80%, the amount of X (in grams) formed is _____ (Round off to one decimal place) (Use atomic weights: Ti = 48, Cl = 35.5, O = 16, C = 12, and H = 1)

Q.10 How many of the following interhalogen species have 2 lone pairs of electrons on the central atom?

ClF_3, ClF_2^- , ClF_5 and ICl_2^+

Q.11 ^{24}Na decays to one-fourth of its initial amount in 29.8 hours. Its decay constant is_____ $hour^{-1}$ (rounded up to four decimal places).

Q.12 The magnitude of crystal field stabilisation energy (CFSE) of octahedral $[Ti(H_2O)_6]^{3+}$ complex is 7680 cm^{-1} . The wavelength at the maximum absorption (max) of this complex is _____ nm (rounded up to the nearest integer).

Q.13 Elemental analysis of an organic compound containing C, H and O gives percentage composition: C: 39.9 % and H: 6.7 %. If the molecular weight of the compound is 180, the number of carbon atoms present in the molecule is_____.

Q.14 For H2 molecule, the fundamental vibrational frequency ($\overline{e}$) can be taken as 4400 cm^{-1} . The zero point energy of the molecule is _____ kJ mol^{-1} (rounded up to two decimal places). [h = 6.6×10^{-34} J s, c = 3×10^{8} ms^{-1} , NA = 6×10^{23} mol^{-1}]

Q.15 The solubility of PbI_2 in 0.10 M KI(aq) is _____ $\times10^{-7}$ M (rounded up to two decimal places). [The solubility product, K_{sp} = 7.1×10^{-9}]

ANSWER KEY

Question No.	Question Type (QT)	Subject Name (SN)	Key/Range (KY)	Mark (MK)
1	NAT	CY	1 to 1	1
2	NAT	CY	3 to 3	1
3	NAT	CY	5 to 5	1
4	NAT	CY	4.390 to 4.400	1
5	NAT	CY	0.73 to 0.75	1
6	NAT	CY	24.8 to 25.0 OR 49.7 to 49.9	2
7	NAT	CY	210 to 225	2
8	NAT	CY	0.73 to 0.75	2
9	NAT	CY	6.9 to 7.1	2

10	NAT	CY	2 to 2	2
11	NAT	CY	0.0460 to 0.0470	2
12	NAT	CY	520 to 521	2
13	NAT	CY	6 to 6	2
14	NAT	CY	25.80 to 26.40	2
15	NAT	CY	7.0 to 7.2	2