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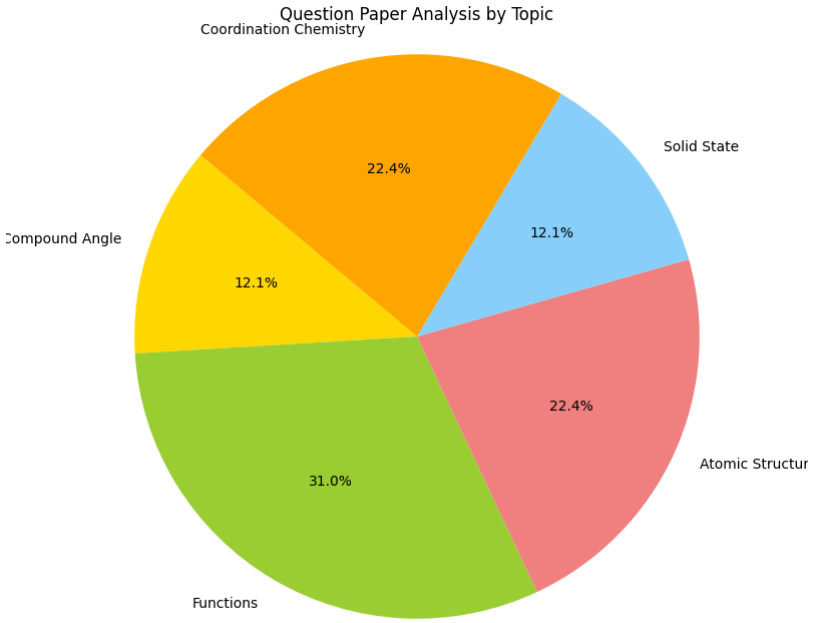
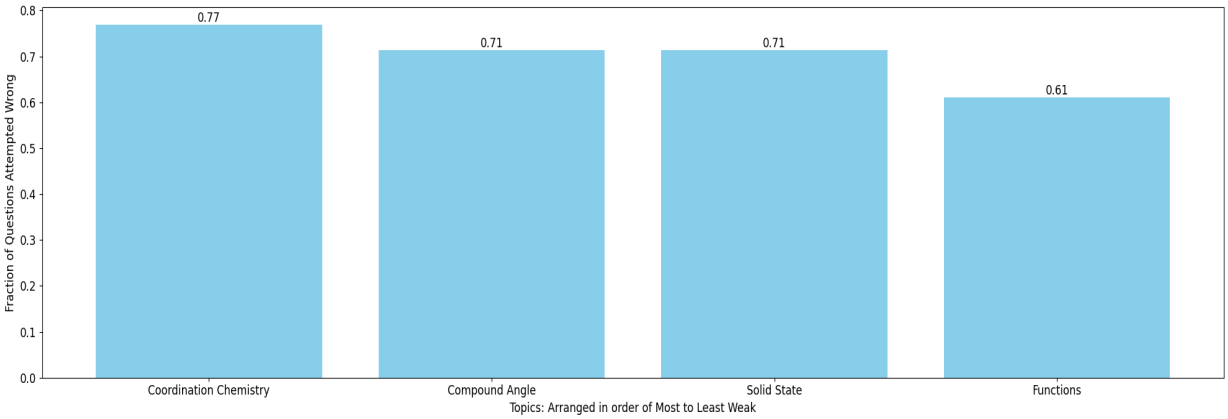
Question Paper Analysis:



Weak Topic Analysis:



Practice Questions:

Coordination Chemistry:

4. **Column-I** **Column II**

(A) $[Ma_2bcde]^{n\pm}$ (P) 3 optically inactive isomers

(B) $[Ma_2b_2c_2]^{n\pm}$ (Q) 4 geometrical isomers

(C) $[Ma_3bcd]^{n\pm}$ (R) 6 stereo(space)isomers

(D) $[M(AB)c_2d_2]^{n\pm}$ (S) 2 optically active isomers

(where AB → Unsym. bidentate ligand having no chiral center, a,b,c,d & e → monodentate ligands)

60. The total number of isomers for a square planar complex $[M(F)(Cl)(SCN)(NO_2)]$ is :

(1) 4 (2) 8 (3) 12 (4) 16 **[JEE MAIN 2019]**

42. Which one of the following complexes will most likely absorb visible light ?

[J-MAIN–2014, Online]

(At nos. Sc = 21, Ti = 22, V = 23, Zn = 30) :-

(1) $[Ti(NH_3)_6]^{4+}$ (2) $[V(NH_3)_6]^{3+}$ (3) $[Zn(NH_3)_6]^{2+}$ (4) $[Sc(H_2O)_6]^{3+}$

22. The ionization isomer of $[Cr(H_2O)_4Cl(NO_2)]Cl$ is – **[JEE 2010]**

(A) $[Cr(H_2O)_4(O_2N)]Cl_2$ (B) $[Cr(H_2O)_4Cl_2](NO_2)$

(C) $[Cr(H_2O)_4Cl(ONO)]Cl$ (D) $[Cr(H_2O)_4Cl_2(NO_2)].H_2O$

19. The coordination number and the oxidation state of the element 'E' in the complex $[E(en)_2(C_2O_4^{-2})]NO_2^{\oplus}$(where (en) is ethylene diamine) are, respectively - **[AIEEE–2008]**

(1) 6 and 2 (2) 4 and 2 (3) 4 and 3 (4) 6 and 3

Compound Angle:

2. Prove that $\frac{\sin 5A-\sin 3A}{\cos 5A+\cos 3A} = \tan A$

5. Which of the following relations is (are) possible?

(A) $\sin \theta = \frac{\pi}{2}$ (B) $\tan \theta = 2016$

C) $\cos \theta = \frac{1+t^2}{1-t^2} (t \neq 0, \pm 1)$ (D) $\sec \theta = \frac{3}{4}$

9. The maximum value of the expression $\frac{1}{\sin^2\theta+3\sin\theta\cos\theta+5\cos^2\theta}$ is **[JEE 2010]**

11. The positive integer value of $n > 3$ satisfying the equation $\frac{1}{\sin\left(\frac{\pi}{n}\right)} = \frac{1}{\sin\left(\frac{2\pi}{n}\right)} + \frac{1}{\sin\left(\frac{3\pi}{n}\right)}$ is **[JEE 2011]**

11. Prove that $\cos^4\frac{\pi}{8} + \cos^4\frac{3\pi}{8} + \cos^4\frac{5\pi}{8} + \cos^4\frac{7\pi}{8} = \frac{3}{2}$

Solid State:

26. In a solid "AB" having NaCl structure "A" atoms occupy the corners of the cubic unit cell. If all the face-centred atoms along one of the axes are removed, then the resultant stoichiometry of the solid is **[JEE-2000]**

(A) AB_2 (B) A_2B (C) A_4B_3 (D) A_3B_4

18. Match the crystal system / unit cells mentioned in Column I with their characteristic features mentioned in Column II. Indicate your answer by darkening the appropriate bubbles of the 4 × 4 matrix given in the ORS. **[JEE 2007]**

Column I	**Column II**
(A) simple cubic and face-centred cubic	(P) have these cell parameters a = b = c and $\alpha = \beta = \gamma$
(B) cubic and rhombohedral	(Q) are two crystal systems
(C) cubic and tetragonal	(R) have only two crystallographic angles of 90°
(D) hexagonal and monoclinic	(S) belong to same crystal system.

27. An element having an atomic radius of 0.14 nm crystallizes in an fcc unit cell. What is the length of a side of the cell? **[Jee-Main (online)-13]**

(A) 0.96 nm (B) 0.4 nm (C) 0.24 nm (D) 0.56 nm

4. What is the percent by mass of titanium in rutile, a mineral that contain Titanium and oxygen, if structure can be described as a closet packed array of oxide ions, with titanium in one half of the octahedral holes. What is the oxidation number of titanium? (Ti = 48)

12. An element crystallizes in a structure having FCC unit cell of an edge 200 pm. Calculate the density, if 200 g of this element contains 24×10^{23} atoms.

Functions:

9. Let f be a one-one function with domain {x, y, z} and range {1,2,3}. It is given that exactly one of the following statements is true and the remaining two are false.

$f(x) = 1; f(y) \neq 1; f(z) \neq 2$. Determine $f^{-1}(1)$

$\{1 - x \quad \text{if } x < 0$

30. The real valued function $f(x) = \frac{\operatorname{cosec} x}{\sqrt{x - [x]}}$, where [x] denotes the greatest integer less than or equal to x, is defined for all x belonging to **[JEE - Main 2021]**

(A) all reals except integers (B) all non-integers except the interval [−1, 1]

(C) all integers except 0, −1, 1 (D) all reals except the Interval [−1, 1]

4. Let $f: R \to [1, \infty)$ be defined as

$f(x) = \log_{10}\left(\sqrt{3x^2 - 4x + k + 1} + 10\right)$. If $f(x)$ is surjective, then

(A) $k = \frac{1}{3}$ (B) $k < \frac{1}{3}$ (C) $k > \frac{1}{3}$ (D) $k = 1$

4. Let $f: [0, a] \to S$ be a function defined by $f(x) = 3\cos \frac{x}{2}$. If the largest value of a for which $f(x)$ has

38. Let R_1 and R_2 be relations on the set {1, 2.....50} such that
$R_1 = \{(p, p^n) : p \text{ is a prime and } n \geq 0 \text{ is an integer}\}$ and
$R_2 = \{(p, p^n) : p \text{ is a prime and } n = 0 \text{ or } 1\}$.
Then, the number of elements in $R_1 - R_2$ is _____. **[JEE - Main 2022]**