

CSIR NET Chemical Science Memory Based Question Paper 2023

1. The experimental magnetic moment (3.4 BM) of a hydrated salt of Eu^{3+} at 27°C is significantly different from the calculated value. The difference is due to (Given: atomic number of Eu is 63)

1. population of electrons at higher level(s) via thermal excitation.
2. strong ligand field splitting of t_2 -orbitals
3. strong spin-orbit coupling
4. pairing of electrons in t_2 -orbitals

Ans: 1. population of electrons at higher / level(s) via thermal excitation.

2. Which of the following plots [k vs $1/T$] represent(s) the Arrhenius rate equation, $k = Ae^{A/T}$ with $A = 3 \times 10^4 \text{ s}^{-1} = 3 \times 10^4 \text{ J/mol}$.

Ans: Graph I (curve) and II ($y = mx + c$ format)

3. Which band is called a filled band?

Ans: Valence band

4. What is the value of the commutator at $[\text{H}, P_x]$?

Ans: $i\hbar (\partial V / \partial x)$

5. How many tetrahedral and octahedral voids are there in FCC structure?

Ans: Tetrahedral voids - 2 for each atom, octahedral voids - 1 for each atom

6. What is the magnetic moment of Yb^{3+} ?

Ans: $4.5 \mu_B$

7. Find the uncertainty in the kinetic energy of a particle if its mass has 2% uncertainty and velocity has 3% uncertainty.

Ans: 11%

8. For a rectangular box, $l_x = 2 l_y$ and $E = 10h^2/8ml_y^2$, then find m .

Ans: $m = 145$

9. If $y^2 = 4x$ and if there is 1% error in x , then find the percent error in y .

Ans: Error in $y = 5\%$

10. At what temperature does micelle formation take place?

Ans: Above Kraft temperature.

11. How many nodes are there in 1,3 Butadiene Homo?

Ans: one node and two electrons in the π^2 molecular orbital

12. How many unpaired electrons are there in B_2 ?

Ans: two unpaired electrons

13. Which among the following is the Slater determinant for He?

Ans: $\begin{bmatrix} 1s\alpha(1) & 1s\beta(1) \\ 1s\alpha(2) & 1s\beta(2) \end{bmatrix}$

$\begin{bmatrix} 1s\alpha(2) & 1s\beta(2) \end{bmatrix}$