Basic Physical Chemistry I

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Q21

Summarize the principle of synchrotron-radiation beam generation.

Q22

Prove the Fermi's golden rule.

Q23

Estimate the energy splitting under the spin-orbit coupling ξ between $j = l + \frac{1}{2}$ and $j = l - \frac{1}{2}$.

Q24

Summarize the principle of photoemission spectroscopy.

Q25

Explain the origin of chemical shift in XPS.

Q26

Draw the C 1s XPS line shapes in CH_3COOCH_3 and CH_3-$CHCl$-CHI-CH_2-CH_3.

Q27

Absorption spectra of $[Cr(H_2O)_6]^{n+}$ ions are shown in Figure. Determine crystal field splitting Δ and Coulomb interaction energy B by using Tanabe-Sugano diagram for d^3.
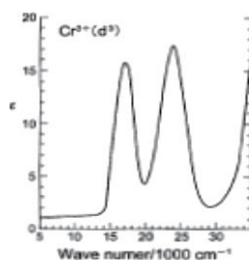

Fig: Electron absorption spectroscopy of Cr complexes.

Q28

Explain the reason why Coulomb potential in O_h symmetry is written as follows. Here, $A = \frac{6Ze^2}{a}$ and $D = \frac{35Ze^2}{4a^5}$ are defined using the distance a, electron number in center ions Z, and electron charge e.

$$U = A + D\left(x^4 + y^4 + z^4 - \frac{3}{5}r^4\right)$$

(Summation of symmetric six kinds of sites and spherical harmonic functions are necessary for the calculation.)