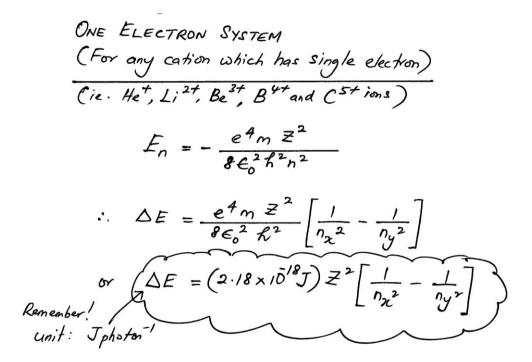
Inorganic Chemistry 1 QUANTUM THEORY BOHR THEORY

PSEUDO-HYDROGEN ATOM / ONE-ELECTRON SYSTEM CATION (HYDROGEN-LIKE ATOM)



Problem-solving Example 18

How much energy does a B^{4+} ion lose when its electron move from n = 4 to n = 2. What is the wave number of the photon emitted.



Solution

$$\begin{split} \mathcal{N}_{\chi} &= 2 ; \ \mathcal{N}_{y} = 4 \quad \left(\text{Remember } ! \ \mathcal{N}_{\chi} < \mathcal{N}_{y} \right) \\ \mathcal{Z} &= 5 \text{ for Boron, B atom (Sproton in the nucleus)} \\ \therefore \quad \Delta E = \left(2 \cdot 18 \times 10^{18} \text{J} \right) \left(5^{2} \right) \left[\frac{1}{2^{2}} - \frac{1}{4^{2}} \right] \\ &= 1 \cdot 02 \times 10^{-18} \text{ Jphoton}^{-1} \ (\text{Ans}) \\ \Delta E &= \frac{hc}{\lambda} = hc^{2} \\ \therefore \quad \overline{\mathcal{V}} &= \frac{\Delta E}{hc} = \left[\frac{1 \cdot 02 \times 10^{-17}}{(6 \cdot 626 \times 10^{-34} \text{Js})(2 \cdot 998 \times 10^{8} \text{ms}^{-1})} \right] m^{-1} \\ &= 5 \cdot 135 \times 10^{7} m^{-1} \ (\text{Ans}) \end{split}$$

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