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Problem 52.7 (RHK)

We have to calculate approximately the energy difference $E_L - E_M$ for the x-ray atomic energy levels of molybdenum.

Solution:

The atomic number of molybdenum atom is $Z = 42$.

The empirical result on the energy levels of the L and M levels of an atom of nuclear charge Ze , based on Bohr's formula, is

$$E = \frac{1}{2} (m_e c^2) \alpha^2 \frac{(Z-1)^2}{n^2},$$

$$\text{where } \alpha = \frac{e^2}{4\pi\epsilon_0 hc} = \frac{1}{137},$$

$n = 2$, for L – level, and $n = 3$, for M – level.

Thus

$$\begin{aligned} E_L - E_M &= 13.6 \times (41)^2 \left(\frac{1}{2^2} - \frac{1}{3^2} \right) \text{ eV} \\ &= 3.17 \text{ keV.} \end{aligned}$$