Principles of Engineering Physics 2 1st edition Khan Solutions Manual

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CHAPTER-3

X-RAYS

2.1 $\frac{hc}{\lambda} = \Delta E \Rightarrow \lambda = \frac{hc}{\Delta E} = \frac{6.626 \times 10^{-34} \times 3 \times 10^{8}}{16000 \times 1.6 \times 10^{-19}} m = 7.76 \times 10^{-11} m = 0.78 \overset{o}{A}$

2.2 $v = 50000V$

$$\frac{1}{2} m v_m^2 = qV$$

$$v_m = \sqrt{\frac{2qV}{m}} = \sqrt{\frac{2 \times 1.6 \times 10^{-19} \times 50000}{9.11 \times 10^{-31}}} m/s = 1.32 \times 10^{8} m/s$$

$$\lambda_{min} = \frac{12400}{V} \overset{o}{A} = \frac{12400}{50000} \overset{o}{A} = 0.25 \overset{o}{A}$$

2.3 $\lambda_{min} = 0.5 \overset{o}{A}$

$$V = \frac{12400}{\lambda_{min}} = \frac{12400}{0.5} V = 24.8kV$$

2.4 $\lambda_{1swl} - \lambda_{2swl} = 0.2 \overset{o}{A}, \frac{V_2}{V_1} = 3$

$$\lambda_{swl} = \frac{12400}{V} \overset{o}{A} \Rightarrow \frac{\lambda_{1swl}}{\lambda_{2swl}} = \frac{V_2}{V_1} = 3 \Rightarrow \lambda_{1swl} = 3\lambda_{2swl}$$

$$\lambda_{1swl} - \lambda_{2swl} = 0.2 \overset{o}{A} \Rightarrow \lambda_{1swl} - \frac{\lambda_{1swl}}{3} = 0.2 \overset{o}{A}$$

$$\frac{2\lambda_{1swl}}{3} = 0.2 \overset{o}{A} \Rightarrow \lambda_{1swl} = 0.3 \overset{o}{A}$$

2.5 $Heat = VI - VI \times 1\% = VI - \frac{VI}{100} = \frac{99VI}{100} = \frac{99 \times 80 \times 10}{100} J = 792J$

2.6 $\lambda_{swl} = \frac{12400}{V} = \frac{12400}{40000} \overset{o}{A} = 0.31kV$

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2.7 $\mu = 13.9 / \text{cm}$, x=5mm=0.5cm

The percentage of the intensity

$$= \frac{I}{I_O} \times 100 = e^{-\mu x} \times 100 = e^{-13.9 \times 0.5} \times 100 = 0.096\%$$

2.8 $K_\alpha = 0.1542\text{nm}$, $K_{\alpha(\text{impurity1})} = 0.1441\text{nm}$, $K_{\alpha(\text{impurity2})} = 0.1666\text{nm}$, $\sigma = 1$

$$\lambda = \frac{4}{3R(Z-1)^2}$$

$$Z = 1 + \sqrt{\frac{4}{3R\lambda}} \text{ with } R = 1.0973731 \times 10^7 \text{m}^{-1}$$

$$Z = 1 + \frac{3.48571 \times 10^{-4}}{\sqrt{\lambda}} = 1 + \frac{3.48571 \times 10^{-4}}{\sqrt{0.1441 \times 10^{-9}}} = 30 \Rightarrow \text{Zn}$$

$$Z = 1 + \frac{3.48571 \times 10^{-4}}{\sqrt{\lambda}} = 1 + \frac{3.48571 \times 10^{-4}}{\sqrt{0.1666 \times 10^{-9}}} = 28 \Rightarrow \text{Ni}$$