P # I

Ch 29 - Worksheet

a) For alpha decay: $\alpha = {}^{4}_{2}He$

$${}^{212}_{84}Po \rightarrow \ ? \ + {}^{4}_{2}He$$

$$\boxed{{}^{212}_{84}Po \rightarrow {}^{208}_{82}Pb + {}^{4}_{2}He}$$

b) $V_{\alpha} = 2.02 \times 10^{17}$ m/s

$m_{Pb} \approx 208$ u
$m_{\alpha} \approx 4$ u

$$m_1 \cdot v_1 = m_2 \cdot v_2$$

$$(4\,u)\cdot(2.02 \times 10^{7}\,m/s) = (208\,u)\cdot v_2$$

$$\boxed{V_{Pb} = 388{,}500\ m/s}$$

c) $m_{Pb} \approx 208\,u \cdot \frac{1.66 \times 10^{-27}\,kg}{1\,u} = 3.45 \times 10^{-25}$ kg

$m_{\alpha} \approx 4\,u \cdot \frac{1.66 \times 10^{-27}\,kg}{1\,u} = 6.64 \times 10^{-27}$ kg

$$KE = KE_{Pb} + KE_{\alpha} = \frac{1}{2} m_{Pb} \cdot V_{Pb}^2 + \frac{1}{2} m_{\alpha} \cdot V_{\alpha}^2$$

$$= \frac{1}{2}\cdot(3.45 \times 10^{-25}\,kg)(388{,}500\,m/s)^2 + \frac{1}{2}(6.64 \times 10^{-27}\,kg)(2.02 \times 10^{7})^2$$

$$= 2.61 \times 10^{-14}\,J + 1.35 \times 10^{-12}\,J$$

$$\boxed{KE = 1.38 \times 10^{-12}\ J}$$