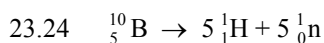
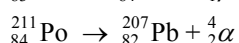
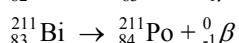
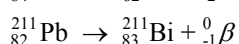
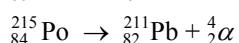
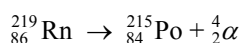
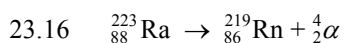
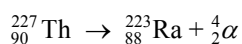
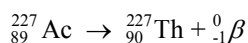
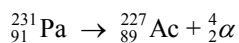
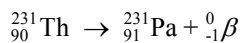
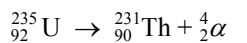


Nuclear Chemistry Homework Answers (Kotz) – Chapter 23

Problems: 14, 16, 24, 28, 32, 36, 40, 46

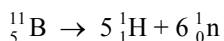
- 23.14 (a) ${}^0_{-1}\beta$ (d) ${}^{226}_{88}\text{Ra}$
 (b) ${}^{87}_{37}\text{Rb}$ (e) ${}^0_{-1}\beta$
 (c) ${}^4_2\text{He}$ (f) ${}^{24}_{11}\text{Na}$



$$\Delta m = [(5 \times 1.00783) + (5 \times 1.00867)] - 10.01294 = 0.06956 \text{ g/mol nuclei}$$

$$E_b = (\Delta m)c^2 = (0.06956 \times 10^{-3} \text{ kg/mol})(3.00 \times 10^8 \text{ m/s})^2 = 6.26 \times 10^{12} \text{ J/mol nuclei} (= 6.26 \times 10^9 \text{ kJ/mol})$$

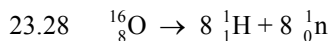
$$\frac{E_b}{n} = \frac{6.26 \times 10^9 \text{ kJ/mol nuclei}}{10 \text{ mol nucleons/mol nuclei}} = 6.26 \times 10^8 \text{ kJ/mol nucleons}$$



$$\Delta m = [(5 \times 1.00783) + (6 \times 1.00867)] - 11.00931 = 0.08186 \text{ g/mol nuclei}$$

$$E_b = (\Delta m)c^2 = (0.08186 \times 10^{-3} \text{ kg/mol})(3.00 \times 10^8 \text{ m/s})^2 = 7.37 \times 10^{12} \text{ J/mol nuclei} (= 7.37 \times 10^9 \text{ kJ/mol})$$

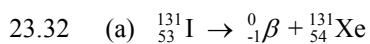
$$\frac{E_b}{n} = \frac{7.37 \times 10^9 \text{ kJ/mol nuclei}}{11 \text{ mol nucleons/mol nuclei}} = 6.70 \times 10^8 \text{ kJ/mol nucleons}$$



$$\Delta m = [(8 \times 1.00783) + (8 \times 1.00867)] - 15.99492 = 0.13708 \text{ g/mol nuclei}$$

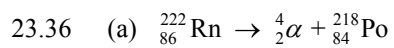
$$E_b = (\Delta m)c^2 = (0.13708 \times 10^{-3} \text{ kg})(3.00 \times 10^8 \text{ m/s})^2 = 1.23 \times 10^{13} \text{ J/mol nuclei} (= 1.23 \times 10^{10} \text{ kJ/mol})$$

$$\frac{E_b}{n} = \frac{1.23 \times 10^{10} \text{ kJ/mol nuclei}}{16 \text{ mol nucleons/mol nuclei}} = 7.71 \times 10^8 \text{ kJ/mol nucleons}$$



(b) $40.2 \text{ d} / 8.04 \text{ d} = 5 \text{ half-lives}$

$$2.4 \mu\text{g} \times \left(\frac{1}{2}\right)^5 = 0.075 \mu\text{g}$$

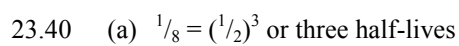


(b) $k = \frac{0.693}{t_{1/2}} = \frac{0.693}{3.82 \text{ d}} = 0.181 \text{ d}^{-1}$

$$\ln \frac{N}{N_0} = -kt$$

$$\ln \frac{20.0}{100.0} = -(0.181 \text{ d}^{-1})t$$

$$t = 8.87 \text{ days}$$



$$(5.27 \text{ y}) \times 3 = 15.8 \text{ y}$$

(b) $k = \frac{0.693}{t_{1/2}} = \frac{0.693}{5.27 \text{ y}} = 0.131 \text{ y}^{-1}$

$$\ln \left(\frac{A}{A_0} \right) = -(0.131 \text{ y}^{-1})(1 \text{ y})$$

$$\frac{A}{A_0} = \text{fraction of activity} = 0.88$$

