17.12 (a) $^{74}_{36}Kr \rightarrow ? + ^{0}_{+1}e$

$^{74}_{36}Kr \rightarrow ^{74}_{35}Br + ^{0}_{+1}e$

(b) $^{174}_{72}Hf \rightarrow ? + ^{4}_{2}\alpha$

$^{174}_{72}Hf \rightarrow ^{170}_{70}Yb + ^{4}_{2}\alpha$

(c) $^{98}_{43}Tc \rightarrow ? + ^{0}_{-1}e$

$^{98}_{43}Tc \rightarrow ^{98}_{44}Ru + ^{0}_{-1}e$

(d) $^{41}_{20}Ca + ^{0}_{-1}e \rightarrow ?$

$^{41}_{20}Ca + ^{0}_{-1}e \rightarrow ^{41}_{19}K$

17.22 (a) $^{245}_{98}Cf + ^{12}_{6}C \rightarrow ^{257}_{104}Rf$

(b) $^{209}_{83}Bi + ^{58}_{26}Fe \rightarrow ^{266}_{109}Mt + ^{1}_{0}n$

$^{266}_{109}Mt \rightarrow ^{4}_{2}\alpha + ^{262}_{107}Bh$

$^{262}_{107}Bh$ is the daughter nucleus.

17.28 dis = disintegration(s); dis·s^{-1} = disintegrations per second = dps = Bq

(a) $\text{activity} = \left(\frac{590 \text{ clicks}}{100 \text{ s}}\right)\left(\frac{1000 \text{ dis}}{1 \text{ click}}\right)\left(\frac{1 \text{ Ci}}{3.7 \times 10^{10} \text{ dps}}\right) = 1.6 \times 10^{-7} \text{ Ci}$

(b) $\text{activity} = \left(\frac{2.7 \times 10^{4} \text{ clicks}}{1.5 \text{ h}}\right)\left(\frac{1 \text{ h}}{3600 \text{ s}}\right)\left(\frac{1000 \text{ dis}}{1 \text{ click}}\right)\left(\frac{1 \text{ Ci}}{3.7 \times 10^{10} \text{ dps}}\right)$

$= 1.4 \times 10^{-7} \text{ Ci}$

(c) $\text{activity} = \left(\frac{159 \text{ clicks}}{1.0 \text{ min}}\right)\left(\frac{1 \text{ min}}{60 \text{ s}}\right)\left(\frac{1000 \text{ dis}}{1 \text{ click}}\right)\left(\frac{1 \text{ Ci}}{3.7 \times 10^{10} \text{ dps}}\right)$

$= 7.2 \times 10^{-8} \text{ Ci}$

17.30 dose in rads = $\left(\frac{2.0\ \text{J}}{5.0\ \text{g}}\right)\left(\frac{10^3\ \text{g}}{1\ \text{kg}}\right)\left(\frac{1\ \text{rad}}{10^{-2}\ \text{J}\cdot\text{kg}^{-1}}\right) = 4.0 \times 10^4$ rad

dose equivalent in rems = Q × dose in rads (for α radiation, Q is about 20 rem/rad)

$= \frac{20\ \text{rem}}{1\ \text{rad}} \times 4.0 \times 10^4\ \text{rad} = 8.0 \times 10^5\ \text{rem}$

8.0×10^5 rem ÷ 100 rem/Sv = 8.0×10^3 Sv

17.66 (a) ${}^{234}_{94}\text{Pu} \rightarrow {}^{230}_{92}\text{U} + {}^{4}_{2}\alpha$

$\Delta m = 230.0339\ \text{u} + 4.0026\ \text{u} - 234.0433\ \text{u} =$ -.0068u

$\Delta E = \Delta mc^2 = (-0.0076\ \text{u})\left(\frac{1.661\times10^{-27}\ \text{kg}}{1\ \text{u}}\right)(3.00 \times 10^8\ \text{m·s}^{-1})^2$

$= -1.0 \times 10^{-12}$ J

(b) $\frac{1.00\times10^{-6}\ \text{g}}{234.0433\ \text{g}\cdot\text{mol}^{-1}} = 4.27 \times 10^{-9}\ \text{mol}$

$k = \frac{0.693}{t_{1/2}} = \frac{0.693}{8.8\ \text{h}} = 0.079\ \text{h}^{-1}$

$\frac{N}{N_0} = e^{-(0.070\ \text{h}^{-1})(24\ \text{h})} = 0.15$

If N is 0.15 N_0, then 85% of the sample decayed in the 24 h period.

4.27×10^{-9} mol × 0.85 × 6.02×10^{23} atoms·mol^{-1} = 2.2×10^{15} atoms

total energy released = 2.2×10^{15} atoms × 1.1×10^{-12} J·atom^{-1}

= 2.4×10^3 J, or 2.4 kJ