Radioactivity

(1) a. $^{238}_{92}U \xrightarrow{\alpha} {}^{234}_{90}Th \xrightarrow{\beta^-} {}^{234}_{91}Pa \xrightarrow{\beta^-} {}^{234}_{92}U \xrightarrow{\alpha} {}^{230}_{90}Th \xrightarrow{\alpha}$
$^{226}_{88}Ra \xrightarrow{\alpha} {}^{222}_{86}Rn \xrightarrow{\alpha} {}^{218}_{84}Po \xrightarrow{\alpha} {}^{214}_{82}Pb \xrightarrow{\beta^-} {}^{214}_{83}Bi \xrightarrow{\beta^-}$
$^{214}_{84}Po \xrightarrow{\alpha} {}^{210}_{82}Pb \xrightarrow{\beta^-} {}^{210}_{83}Bi \xrightarrow{\beta^-} {}^{210}_{84}Po \xrightarrow{\alpha} {}^{206}_{82}Pb$

b. $^{240}_{94}Pu \xrightarrow{\beta^-} {}^{240}_{95}Am \xrightarrow{\alpha} {}^{236}_{93}Np \xrightarrow{\alpha} {}^{232}_{91}Pa \xrightarrow{\beta^-} {}^{232}_{92}U \xrightarrow{\alpha}$
$^{228}_{90}Bi \xrightarrow{\alpha} {}^{224}_{88}Ra \xrightarrow{\beta^-} {}^{224}_{89}Ac \xrightarrow{\alpha} {}^{220}_{87}Fr \xrightarrow{\alpha} {}^{216}_{85}At \xrightarrow{\alpha}$
$^{212}_{83}Bi \xrightarrow{\beta^-} {}^{212}_{84}Po \xrightarrow{\alpha} {}^{208}_{82}Pb \xrightarrow{\beta^-} {}^{208}_{83}Bi$

(2) (a) $n = \frac{t}{T_{1/2}} = \frac{660}{110} = \underline{6}$

(b) $N = \frac{N_0}{2^n} = \frac{10}{2^6} = \underline{0.16\ g}$

(3) $n = \frac{t}{T_{1/2}} = \frac{28650}{5730} = 5$

$\frac{N}{N_0} = \frac{1}{2^n} = \frac{1}{2^5} = \underline{\frac{1}{32}}$ or $\underline{0.03125}$

(4) $\frac{N_0}{N} = \frac{1}{2^n} = \frac{1}{4}$ $n = 2$

$n = \frac{t}{T_{1/2}}$ $T_{1/2} = \frac{t}{n} = \frac{18}{2} = \underline{9\ months}$