1.-

^{210}Po $\quad \tau = 199'09$ dias.

a) t? $\Rightarrow N = 0'3 N_0$ Desintegranse o 70% quedan o 30%

b) os miligramos de ^{210}P o cabo de dous anos. si inicialmente habia 100 mg.

$$\lambda = \frac{1}{\tau} = \frac{1}{199'09 \text{ dias}} = 5'02.10^{-3} \text{ dias}^{-1}$$

$$\ln \frac{N}{N_0} = -\lambda . t \Rightarrow t = -\frac{\ln N/N_0}{\lambda} = -\frac{\ln 0'3}{5'02.10^{-3} \text{dias}^{-1}} =$$

$t = 240$ dias.

b) $$\cancel{100 \text{ mg de } ^{210}P} \; \frac{10^{-3} \text{ mg de } ^{210}P}{1 \text{ mg } \cancel{\text{de } ^{210}P}} \; \frac{1 \text{ mol de } ^{210}P}{210 g \text{ de } ^{210}P} \; \frac{6'022\, 10^{23} \text{ nucleos de } ^{210}Po}{1 \text{ mol de } ^{210}P} = 2'87\, 10^{20} \text{ nucleos } ^{210}P$$

$\ln N/N_0 = -\lambda . t \Rightarrow$

$$t = 2 \text{ anos} \; \frac{365 \text{ dias}}{1 \text{ ano}} = 730 \text{ dias}.$$

$$N = 2'87\, 10^{20} \exp(-5'02\, 10^{-3} \text{dias} . 730 \text{ dias}) = 7'35\, 10^{18} \text{ nucleos}$$

$$7'35\, 10^{18} \text{ nucleos} \; \frac{1 \text{ mol}}{6'022\, 10^{23} \text{ nucleos}} \; \frac{210 g}{1 \text{ mol}} = 2'56\, 10^{-3} g$$

$$\ln \frac{m}{m_0} = -\lambda t \; ; \; m = m_0 e^{-\lambda t} = 2'56\, 10^{-3} g . ?$$

Por que?

2. $^{131}_{53}I$ $\quad t_{1/2} = 8$ dias $(N = N_0/2)$

a) $N_0 = 1'2\ 10^{21}$ atomos $\quad N = 0'2\ 10^{20}$ atomos. $\quad t?$

b) A $\quad t = 50$ dias

a) $\ln N/N_0 = -\lambda . t$; $\quad \ln 1/2 = -\lambda t_{1/2}$

$$\lambda = -\frac{\ln 1/2}{t_{1/2}} = -\frac{\ln 1/2}{8 \text{ dias}} = 8'66\ 10^{-2} \text{ dias}^{-1}$$

$$\ln \frac{N}{N_0} = -\lambda t \Rightarrow t = -\frac{\ln N/N_0}{\lambda} = -\ln \frac{0'2\ 10^{20}/1'2\ 10^{21}}{8'66 . 10^{-2} \text{dias}^{-1}} =$$

$t = 47'3$ dias.

b) $A_{50} = \lambda . N'$

N': numero de nucleos despois de 50 dias

$N' = N_0\ e^{-\lambda t'} \Rightarrow N' = 1'2 . 10^{21}\ e^{-8'66\ 10^{-2} \text{dias}^{-1} . 50 \text{dias}}$

$N' = 1'58 . 10^{19}$

$$A_{50} = 8'66 . 10^{-2} \text{ dias}^{-1} . 1'58 . 10^{19} = 1'37 . 10^{18} \frac{1}{\text{dias}}$$

$$1'37\ 10^{18} \frac{1}{\text{dias}} \cdot \frac{1 \text{ dia}}{24 h} \cdot \frac{1 h}{3600 s} = 1'58\ 10^{13}\ Bq$$

(3) $^{60}_{27}Co$ $t_{1/2} = 5'3$ anos $N = \frac{N_0}{2}$

a) $N = 70\% N_0$ t ?

b) numero de particulas β/s 10^{-6} g de $^{60}_{27}Co$

(o que pide é a actividade

$$\ln N/N_0 = -\lambda t \; ; \quad \ln 1/2 = -\lambda t_{1/2}$$

$$\lambda = -\frac{\ln 1/2}{t_{1/2}} = 1'31 \cdot 10^{-1} \text{ anos}^{-1}$$

$$\ln \frac{0'7 \cancel{N_0}}{\cancel{N_0}} = -\lambda t \Rightarrow t = -\frac{\ln 0'7}{\lambda} = 2'73 \text{ anos.}$$

b)

$$1 \cdot 10^{-6} g \; ^{60}_{27}Co \; \frac{1 \text{mol de } ^{60}_{27}Co}{60 g \text{ de } ^{60}_{27}Co} \; \frac{6'022 \cdot 10^{23} \text{ atomos de } ^{60}_{27}Co}{1 \text{mol de } ^{60}_{27}Co} = 1'00 \cdot 10^{16}$$

atomos de Co

$$A = \lambda \cdot N = 1'31 \cdot 10^{-1} \frac{1}{\text{anos}} \; \frac{1 \text{ ano}}{365 \text{ dias}} \; \frac{1 \text{ dia}}{24 h} \; \frac{1 h}{3600 s} \cdot 1'00 \cdot 10^{16} \text{ nucleos}$$

$$= 4'17 \cdot 10^{7} \; 1_f.$$

(7.-)

$^{3}_{1}H \quad t_{1/2} = 12'5$ anos

a) t? $\quad A = \frac{75}{100} A_0$ | b) A? . 10^{-6} g $^{3}_{1}H$

a)

$A = \lambda N_0$
$A = 0'75 \lambda N$ | $N = 0'75 N_0$

$\ln \frac{0'7 N_0}{N_0} = -\lambda . t$

para calcular a constante radiactiva

$\ln \frac{N}{N_0} = -\lambda t \Rightarrow \ln \frac{1/2 N_0}{N_0} = -\lambda t_{1/2}$

$\ln 1/2 = -\lambda t_{1/2} \Rightarrow \lambda = -\frac{\ln 1/2}{12'5 \text{ anos}} = 5'54 \cdot 10^{-2} \text{ anos}^{-1}$

$\Rightarrow t = -\frac{\ln 0'7}{\lambda} = -\frac{\ln 0'75}{5'54 \cdot 10^{-2} \text{ anos}^{-1}} = 5'19$ anos

b)

$1 \cdot 10^{-6} \text{ g } ^{3}_{1}H \frac{1 \text{ mol de } ^{3}_{1}H}{3 \text{ g de } ^{3}_{1}H} \frac{6'022 \cdot 10^{23} \text{ átomos de } ^{3}_{1}H}{1 \text{ mol de } ^{3}_{1}H} = 2'00 \cdot 10^{17}$ átomos

$A = \lambda . N = 5'54 \cdot 10^{-2} \text{ anos}^{-1} . 2'00 \cdot 10^{17} \text{ nucleos} = 1'11 . 10^{16} \frac{1}{\text{anos}}$

$1'11 \cdot 10^{16} \frac{\text{desintegraciós}}{\text{anos}} \frac{1 \text{ ano}}{365 \text{ días}} \frac{1 \text{ día}}{24 \text{ h}} \frac{1 \text{ h}}{3600 \text{ s}} = 3'53 \cdot 10^{8} \frac{\text{desintegraciós}}{\text{s}}$

(5) $N_0 = 10^{15}$ | $t = 8$ dias.
$N = 10^9$

a) λ? e $t_{1/2}$ b) $A_{20 dias}$ $N_0 = 10^{15}$ nucleos
$t = 0$ dia

a)

$$\ln \frac{N}{N_0} = -\lambda t \Rightarrow \lambda = -\frac{\ln N/N_0}{t}$$

$$\lambda = -\frac{\ln 10^9/10^{15}}{8 \text{ dias}} = -\frac{\ln 10^{-6}}{8 \text{ dias}} = \frac{-1'38 \cdot 10^1}{8 \text{ dias}} = 1'73 \text{ dias}^{-1}$$

$$1'73 \frac{1}{\text{dias}} \frac{1 \text{ dia}}{24 h} \frac{1 h}{3600 s} = 2 \cdot 10^{-5} s^{-1}$$

$$\ln N/N_0 = -\lambda t \Rightarrow \ln 1/2 = -\lambda t_{1/2}$$

$$t_{1/2} = -\frac{\ln 1/2}{\lambda} = -\frac{\ln 1/2}{2 \cdot 10^{-5} s^{-1}} = 3'46 \cdot 10^4 s$$

b)

$$N = N_0 e^{-\lambda 20 \text{ dias}}$$

$$N = 10^{15} e^{-1'73 \text{ dias} \cdot 20 \text{ dias}^{-1}} = 9'41 \cdot 10^{-1} \text{ nucleos}$$

$$A_{20 dias} = 9'41 \cdot 10^{-1} \cdot 2 \cdot 10^{-5} s^{-1} = 1'88 \cdot 10^{-5} \frac{\text{desintegr.}}{s}$$

(6) ^{14}C ; $t_{1/2} = 5730$ anos ; $A = 6 \cdot 10^8 \frac{desintegracions}{minuto}$

a) m_0? (masa inicial)

b) A dentro de 5000 anos

$dN = -\lambda N \cdot dt$; $\frac{dN}{dt} = -\lambda \cdot dt \Rightarrow \int_{N_0}^{N} \frac{dN}{N} = -\lambda \int_0^t dt$

$\ln N/N_0 = -\lambda \cdot t$; a actividade $A = \left| \frac{dN}{dt} \right| = \lambda N$

valor absoluto.

$$\left.\begin{array}{l} t_{1/2} \; ; \; N = N_0/2 \\ \ln \frac{N_0/2}{\cancel{N_0}} = -\lambda \, t_{1/2} \end{array}\right\} \ln 1/2 = -\lambda \cdot t_{1/2}$$

$\lambda = -\frac{\ln 1/2}{t_{1/2}} = 1'21 \cdot 10^{-4} \text{ anos}^{-1} \left(\frac{1}{anos}\right)$

- $A = \lambda \cdot N \Rightarrow N = \frac{A}{\lambda}$

$A = 6 \cdot 10^8 \frac{desintegracions}{minuto} \cdot \frac{365 \times 24 \times 60 \text{ minutos}}{1 \text{ ano}} = 3'15 \cdot 10^{14} \frac{desint.}{ano}$

$\Rightarrow N = \frac{3'15 \cdot 10^{14} \text{ desint/ano}}{1'21 \cdot 10^{-4} \text{ anos}^{-1}} = 2'61 \cdot 10^{18}$ nucleos

$2'61 \cdot 10^{18} \text{ nucleos} \cdot \frac{1 \text{ mol de nucleos}}{6'022 \cdot 10^{23} \text{ nucleos}} \cdot \frac{14 g \text{ de } ^{14}C}{1 \text{ mol de nucleos}} =$

$= 6'06 \cdot 10^{-5} g$

b/ $A = \lambda . N$

núcleos despois de 5.000 anos

$\ln N/N_0 = -\lambda t \Rightarrow N = N_0\, e^{-\lambda t}$

$N = 2'6 . 10^{18}$ núcleos $e^{-[1'21 10^{-4} anos^{-1} . 5000\ anos]} =$

$= 1'42 . 10^{18}$ núcleos

$A' = 1'21 . 10^{-4}\ anos^{-1} . 1'42\ 10^{18}$ núcleos $= 1'72\ 10^{14}\ \frac{\text{núcleos}}{\text{ano}}$

o número de núcleos que se rompen cada ano, a actividade no S.I. exprésase en Becquerelios (Bq) s^{-1}, desintegracións por s.

$1'72\ 10^{14}\ \frac{\text{desint.}}{\text{ano}}\ \frac{1\ \text{ano}}{365\ \text{días}}\ \frac{1\ \text{día}}{24\ \text{h}}\ \frac{1\ \text{h}}{3600\ \text{s}} = 5'45\ 10^{6}\ \frac{\text{desin}}{\text{s}}$ (Bq).

(7) ^{14}C ; $A = 2'8 . 10^{8}\ \frac{\text{desintegracións}}{\text{s}}$; $t_{1/2} = 5730$ anos

a) m_0 ? b) A' para $t = 2000$ anos

a) $\ln N/N_0 = -\lambda t$ para $N = N_0/2 \Rightarrow t = t_{1/2}$

$\ln 1/2 = -\lambda t_{1/2} \Rightarrow \lambda = -\frac{\ln 1/2}{t_{1/2}} = \frac{\ln 1/2}{5730\ \text{anos}} =$

$= 1'21\ 10^{-4}\ anos^{-1}$

a actividade no instante inicial $A = \lambda N_0$

$N_0 = \frac{A}{\lambda} = \frac{2'8 \cdot 10^8 \text{ desin/s}}{?}$

$\lambda = 1'21 \cdot 10^{-4} \frac{1}{\text{años}} \frac{1 \text{ año}}{365 \times 24 \times 3600 \text{ s}} = 3'84 \cdot 10^{-12} \text{ s}^{-1}$

$N_0 = \frac{2'8 \cdot 10^8 \text{ des/s}}{3'84 \cdot 10^{-12} \text{ s}^{-1}} = 7'29 \cdot 10^{19} \text{ nucleos}$

$7'29 \cdot 10^{19} \text{ nucleos} \frac{1 \text{ mol de nucleos}}{6'022 \cdot 10^{23} \text{ nucleos}} \frac{14 \text{ g de } ^{14}C}{1 \text{ mol de nucleos}} =$

$= 1'70 \cdot 10^{-3} \text{ g de } ^{14}C$

b) A' $t = 2000$ años

$A' = \lambda N'$ nucleos para $t = 2000$ años.

$N' = N_0 \, e^{-\lambda t} \Rightarrow N' = 7'29 \cdot 10^{14} e^{-1'21 \cdot 10^{-4} \text{años}^{-1} \cdot 2000 \text{ años}} =$

$= 5'72 \cdot 10^{14}$ nucleos

$A' = \lambda N' = 5'72 \cdot 10^{-14} \text{ nucleos} \cdot 3'84 \cdot 10^{-12} \text{ s}^{-1} = 2'20 \cdot 10^8 \text{ dy}$

c)

$m' = 5'72 \cdot 10^{19} \text{ nucleos} \frac{1 \text{ mol}}{6'022 \cdot 10^{23} \text{ nucleos}} \frac{14 \text{ g de C}}{1 \text{ mol de } ^{14}C} = 1'33 \cdot 10^{-3} \text{ g}$