12. $N = N_0 e^{-\lambda t}$ => $N_0 = \frac{N}{e^{-\lambda t}}$

	U-234	U-235	U-238
Abundance today (N)	0.0055%	0.720%	99.28%
Half-life	2.44×10^{5} y	7.05×10^{8} y	4.47×10^{9} y
λ	2.84×10^{-6} y^{-1}	9.85×10^{-10} y^{-1}	1.55×10^{-10} y^{-1}
N_0 (3×10^{9} y ago)	≈0	13.81	158.0867
Abundance 3×10^{9} y ago	≈0	**8.0%**	91.2%

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13. Weight K-40 in body: $70\times10^{3}\times 0.002 \times 0.000117$= 16.38 milligram

Amount K-40 in body = 16.38×10^{-3} / 39.1 = 4.19×10^{-4} mol = 2.523×10^{20} atoms.

$t_{½}$ = 1.28×10^{9} y => λ = 5.42×10^{-4} y^{-1}

A= Nλ = 1.37×10^{11} decays per year.

11% of the decays give Argon. Life-time of human being assumed to be 80 years

Ar-40 produced during 80 years = $1.37\times10^{11}\times 0.11 \times 80 = 1.20\times10^{12}$ Argon atoms = 2×10^{-12} mol Ar

P = 100 kPa; R=8.314 J/mol,K; T = 310 K (or whatever T & p you choose. You will not lose any points as long as you specify the temperature and pressure you use)

$$V = \frac{nRT}{p} = \frac{2\times10^{12}\times8.314\times310}{100000} = 5.15\times10^{-11}\,dm^3$$

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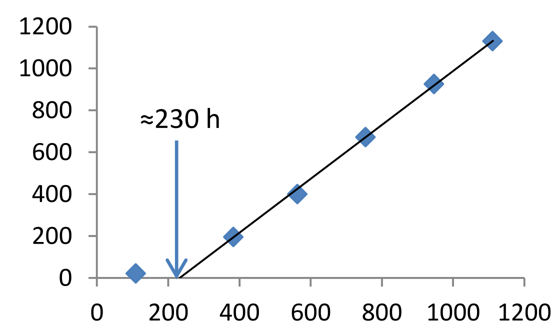
14. Since the half-life is much shorter than the experiment time you need to adjust the Activity to the corresponding A_0; $A_0 = \frac{A}{e^{-\lambda t}}$ $\lambda = \frac{\ln 2}{8.02\times 24} = 3.60\times10^{-3}\ h^{-1}$

Time [h]	Spec A	Spec A0
110	13.74	20.4
384	48.97	195.2
563	52.62	399.6
755	44.26	671.1
947	30.56	925.2
1112	20.6	1129.8



t_e ≈ 230 h = 828 000 s

$$Da = \frac{L^2}{6t_e} = \frac{0.01^2}{6\times828\,000} = \boxed{2\times10^{-11} m^2/s}$$