12 Radon-222 ($^{222}_{86}Rn$) is a radioactive element found in atmospheric air.
The decay constant of radon-222 is $2.1 \times 10^{-6}\,s^{-1}$.

(a) (i) Define radioactive *half-life*.

.....

.....

..... [2]

(ii) Show that the half-life $t_{\frac{1}{2}}$ is related to the decay constant λ by the expression

$$\lambda t_{\frac{1}{2}} = 0.693.$$

[2]

(b) Radon-222 is considered to be an unacceptable health hazard when the activity of radon-222 is greater than 200 Bq in $1.0\,m^3$ of air.

Calculate the minimum mass of radon-222 in $1.0\,m^3$ of air above which the health hazard becomes unacceptable.

mass = ... kg [4]

[Total: 8]

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