5. Atomic density of Al

$$= \frac{\rho}{M} * N_A * 0.9$$

$$= \frac{3.4 * 0.9}{26.9815} * 6.023 \times 10^{23} = 6.83 \times 10^{22} \text{ Atom/cm}^3$$

7.

$$\alpha = \alpha_0 \exp(-\lambda t) + R[1 - \exp(-\lambda t)]$$

Given $\alpha_0 = 0$

$$\alpha = R[1 - \exp(-\lambda t)] \quad \text{---- (1)}$$

to find α_{max}, differentiate with respect to t.

$$\frac{d\alpha}{dt} = \lambda R \exp(-\lambda t)$$

For α_{max} $\frac{d\alpha}{dt} = 0 \Rightarrow \lambda R \exp(-\lambda t) = 0$

$\exp(-\lambda t) = 0$ when $t \to \infty$

i.e α_{max} happens when $t = \infty$

$$\therefore \alpha_{max} = R[1 - \exp(-\lambda \infty)] \Rightarrow \alpha_{max} = R$$

to find the time at which $\alpha = 0.75 \alpha_{max} = 0.75 R$

Substitute in (1)

$$0.75 R = R[1 - \exp(-\lambda t_{0.75})]$$

$$\exp(-\lambda t_{0.75}) = 1 - 0.75$$

$$-\lambda t_{0.75} = \ln 0.25 \Rightarrow \boxed{t_{0.75} = \frac{1.39}{\lambda}}$$

6:- (a) radiative capture (b) charged particle reaction (transmutation)

(c) charged particle reaction (transmutation)

(d) charged particle reaction (transmutation)