

$$1) A = \lambda N = \left(\frac{1.71 \times 10^{-17} /s}{1.29 \times 10^9 \text{ y} \times 3.15 \times 10^7 \frac{s}{\text{y}}} \right) N$$

$$N = \left(\frac{0.0117}{100 \text{ K}} \right) \left(\frac{1 \text{ g KCl}}{74.551 \text{ g/mol KCl}} \right) \left(\frac{1 \text{ K}}{1 \text{ KCl}} \right) 6.022 \times 10^{23} / \text{mol}$$

$$N = 9.45 \times 10^{17}$$

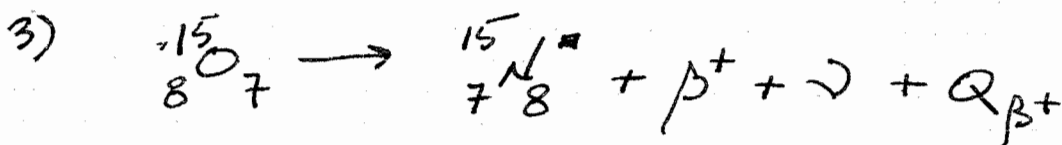
$$A = (1.71 \times 10^{-17} /s) 9.45 \times 10^{17} = 16.1 \text{ Bq}$$

$$2) A = P_A \sigma \phi (1 - e^{-\lambda t}) = 3.0 \times 10^{20} / \text{cm}^2 \left(0.3 \times 10^{-24} \text{ cm}^2 \right) 6 \times 10^{12} /s (1 - e^{-\lambda t})$$

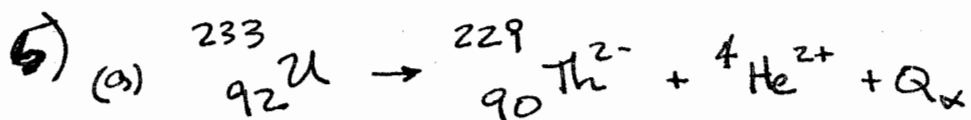
$$1 \text{ barn} = 10^2 \text{ fm}^2 \times \left(10^{-13} \frac{\text{cm}}{\text{fm}} \right)^2 = 10^{-24} \text{ cm}^2$$

$$A = 5.40 \times 10^8 /s \left(1 - e^{-\frac{\ln 2 \times 180 \text{ m}}{109.8 \text{ m}}} \right) = 3.7 \times 10^8 /s$$

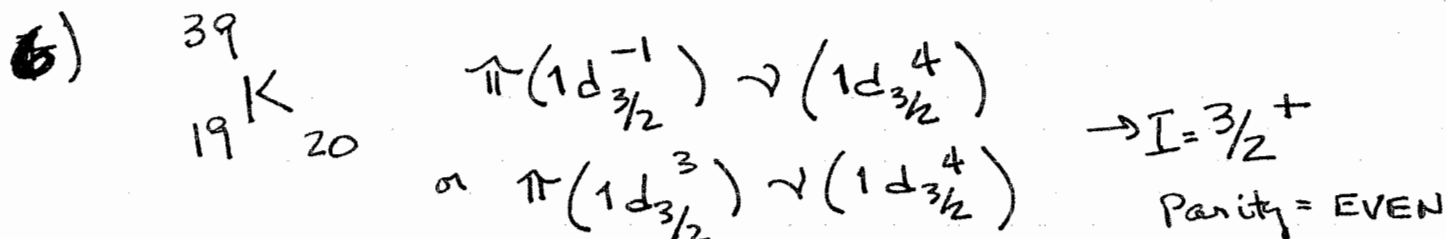
$\underbrace{-1.136}_{0.321}$



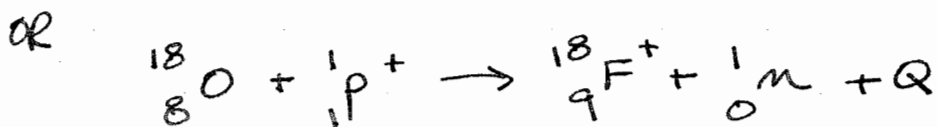
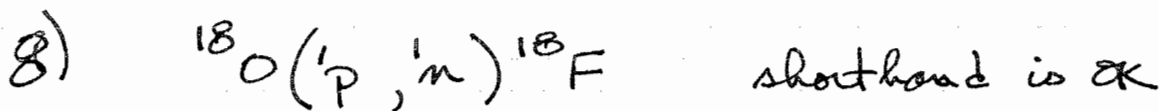
4) Positron emission requires the creation of an electron and a positron with a total energy cost of 1.022 MeV not needed for electron capture decay



$$(b) \text{ reverse rxn } \quad V_{\text{Coul}} = \frac{90 \times 2 \times 1.439 \text{ MeV-fm}}{1.2 \left(\underbrace{229^{1/3}}_{6.12} + \underbrace{4^{1/3}}_{1.59} \right) \text{ fm}} = 28.0 \text{ MeV}$$



7) the low energy neutron cross section is sensitive to the deBroglie wave length of the neutron - this wave length grows ~~as~~ as the kinetic energy drops



$$9) \quad N = \frac{A}{\lambda} \quad , \quad \text{Mass} = \frac{A}{\lambda} \times \frac{mH}{N_A} = \frac{60 \times 10^3 \times 3.7 \times 10^{10} \times 18}{\left(\frac{\ln 2}{109.8 \times 60 \times 10^4} \right) \sqrt{1.05 \times 10^4} \times 6.022 \times 10^{23}}$$

$$\text{Mass} = 6.3 \times 10^{-4} \text{ g} \quad (630 \mu\text{g})$$