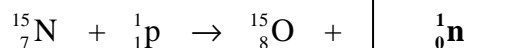
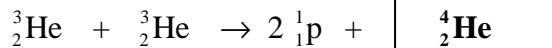
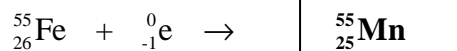


- Balance the following nuclear reactions by identifying the missing nuclear particle or nuclide.

Marks
3



- Calculate the atomic mass of lead from the isotope information provided.

2

Isotope	Mass of isotope (a.m.u.)	Relative abundance
${}^{204}\text{Pb}$	203.97304	1.40%
${}^{206}\text{Pb}$	205.97446	24.10%
${}^{207}\text{Pb}$	206.97589	22.10%
${}^{208}\text{Pb}$	207.97664	52.40%

The relative atomic mass of lead is the weighted average of the masses of its isotopes:

$$\text{atomic mass} = \left(203.97304 \times \frac{1.40}{100} \right) + \left(205.97446 \times \frac{24.10}{100} \right) + \left(206.97589 \times \frac{22.10}{100} \right) + \left(207.97664 \times \frac{52.40}{100} \right) = 207.2$$

(The relative abundances are given to 4 significant figures and limit the accuracy of the answer.)

Answer: **207.2**

- Calculate the molar activity of ${}^{11}\text{C}$ (in curie), given its half-life of 20.3 minutes.

3

The molar activity is given by $A_{\text{mol}} = \lambda N_{\text{a}}$ where λ is the decay constant which is related to the half life $t_{1/2}$ by $\lambda = \frac{\ln 2}{t_{1/2}}$.

The half life = 20.3 minutes or $20.3 \times 60 \text{ s} = 1218 \text{ s}$. Hence the molar activity is:

$$A_{\text{mol}} = \left(\frac{\ln 2}{1218} \right) \times (6.022 \times 10^{23}) = 3.427 \times 10^{20} \text{ Bq} = \frac{3.427 \times 10^{20}}{3.70 \times 10^{10}} \text{ Ci} = 9.26 \times 10^9 \text{ Ci}$$

Answer: **$9.26 \times 10^9 \text{ Ci}$**