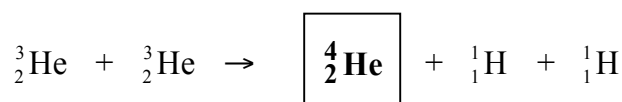
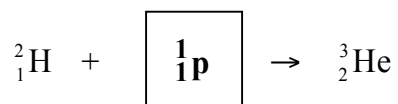
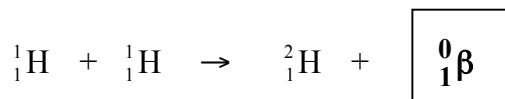


- Balance the following nuclear reactions by identifying the missing nuclear particle or nuclide.

**Marks**  
**4**



Where might these reactions occur naturally?

**In stars**

- The half life of  ${}^{131}\text{I}$  is 8.06 days. Calculate the activity, in Bq, of 12.0 g of pure  ${}^{131}\text{I}$ . Calculate the activity of  ${}^{131}\text{I}$  in  $\text{Ci mol}^{-1}$ .

**3**

The molar activity is given by  $A_{\text{mol}} = \lambda N_{\text{a}}$  where  $\lambda$  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 = 8.06 days or  $8.06 \times 24 \times 3600 \text{ s} = 696384 \text{ s}$ . Hence the molar activity is:

$$A_{\text{mol}} = \left(\frac{\ln 2}{696384}\right) \times (6.02 \times 10^{23}) = 5.99 \times 10^{17} \text{ disintegrations s}^{-1} \text{ mol}^{-1}$$

12.0 g of  ${}^{131}\text{I}$  corresponds to  $12.0 / 131 = 0.092 \text{ mol}$ . The activity of this amount of  ${}^{131}\text{I}$  is therefore  $0.092 \times (5.99 \times 10^{17}) = 5.49 \times 10^{16} \text{ Bq}$

As  $1 \text{ Ci} = 3.70 \times 10^{10} \text{ disintegrations s}^{-1}$ , the molar activity in Curie is:

$$\text{molar activity} = \frac{5.99 \times 10^{17}}{3.70 \times 10^{10}} = 1.62 \times 10^7 \text{ Ci mol}^{-1}$$

Answer:  $5.49 \times 10^{16} \text{ Bq}$

Answer:  $1.62 \times 10^7 \text{ Ci mol}^{-1}$