Q_4 : • radioisotopic dating
(a) (radiocarbon dating) ; $t_{1/2} = 5730$ yrs.

If $t = 50,000$ yrs

$$\ln\left(\frac{N_t}{N_0}\right) = -kt$$

$$\ln\left(\frac{N_t}{N_0}\right) = -\left(\frac{\ln 2}{5730}\right)(50000)$$

$$= -6.048$$

$$\frac{N_t}{N_0} = 0.0024 \ (\sim 0.2\%)$$

So after 50,000 years, the specific activity of the C-14 is only about 0.2% compared to the original activity. So the accuracy of the method falls off (less accurate).

• Concentration of C-14 is not stable because of atomic bomb testing by certain countries.

$Q_4(b)$ (i) $^{82}_{35}Br \longrightarrow {}^{82}_{36}Kr + {}^{0}_{-1}e$

The decay product : $^{82}_{36}Kr$

(ii) $2H\,{}^{82}_{35}Br \longrightarrow H_2 + 2\,{}^{82}_{36}Kr + 2\,{}^{0}_{-1}e$

$Q_4(c)$ (i) $^{222}_{86}Rn \longrightarrow {}^{218}_{84}Po + {}^{4}_{2}He$

(ii) $t_{1/2} = 3.82$ days
$N_0 = C_0$
$N_t = \left(\frac{10}{100}\right)C_0 = 0.1\,C_0$

$$\ln\left(\frac{N_0}{N_t}\right) = kt$$

$$\ln\left(\frac{C_0}{0.1\,C_0}\right) = \left(\frac{\ln 2}{3.82d}\right)t$$

$$(\ln 10)(3.82) = (0.6931)t$$

$$\therefore t = 12.7 \text{ days. (Ans)}$$

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Sem 1 (2004/05) : Nuclear Reaction.

Q_4 (d)

(i) Nuclear fusion :

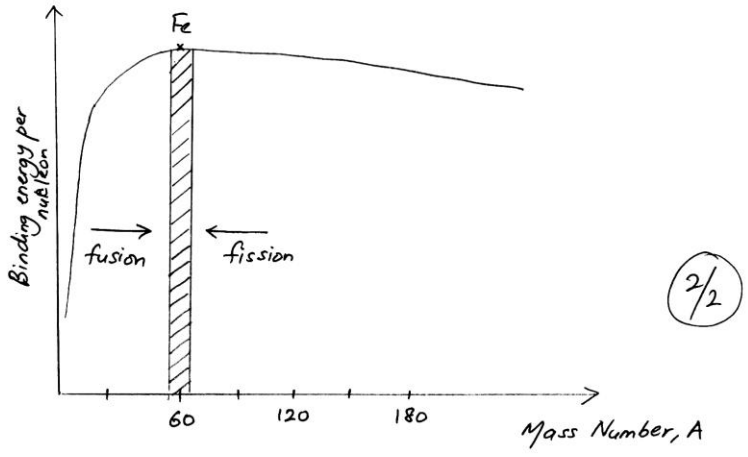
- Lighter nuclei can combine to form a heavier one (closer to $A \approx 60$) by undergoing fusion. The product is more stable than the reactants, and energy is released
- Nuclear fusion is the ultimate source of nearly all the energy on earth because nearly all other sources depend directly or indirectly on the energy produced by nuclear fusion in the sun. All the elements larger than hydrogen were formed in fusion.

$$ {}_{1}^{2}D + {}_{1}^{3}T \longrightarrow {}_{2}^{4}He + {}_{0}^{1}n $$

(ii) Nuclear fission :

- A heavier nucleus can split into lighter ones (closer to $A \approx 60$) by undergoing fission. The product nuclei have greater binding energy per nucleon (are more stable).
- Nuclear power plants generate energy through fission as do atomic bombs.

$$ {}_{92}^{235}U + {}_{0}^{1}n \longrightarrow {}_{36}^{92}Kr + {}_{56}^{141}Ba + 3\,{}_{0}^{1}n + \text{energy} $$



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