1. (A) $_zX^A \rightarrow {}_{z-2}Y^{A-4} + {}_2He^4 + Q_1$

(B) $_zX^A \rightarrow {}_{z-1}Y^A + {}_{+1}e^0 + Q_2$

(C) $_zX^A \rightarrow {}_{z+1}Y^A + {}_{-1}e^0 + Q_3$

(D) $_zX^A \rightarrow {}_zY^A + {}_z\gamma^0 + Q_4$

2. A, C

Initially

$A = m_p + m_n$

$A = \frac{m_p}{m_n} = 1$

$\frac{(B.E.)_1}{A_1} > \frac{(B.E.)_2}{A_2}$

A_1 is lesser initially then

$A_2 \uparrow \quad (B.E.)_2 \downarrow$

3. C

$m_1^1 = 10 \times m_p + (20-10)m_n$

$m_1^1 = 10m_p + 10m_n = 10(m_p + m_n)$

&

$m_2^1 = 20m_p + (40-20)m_n$

$m_2^1 = 20(m_p + m_n)$

$m_2^1 = 2m_1^1$

$M_{observed} < M_{expected}$

But observed relation $m_2 < 2m_1$

4. Rest mass $\Rightarrow$ E = mc²

State nucleus has to release energy.

A $\Rightarrow$ B+C

$E_1 < E_2 + E_3$.

$m_1 < (m_2 + m_3)$

5. $AB \rightarrow r \downarrow PE \uparrow$ due to electrostatic repulsion.

BC $\rightarrow$ nuclear force dominate & nuclear forces are always attractive in nature.

6. $^{14}_7N + n \rightarrow {}^7_3Li + He_2^4 + 4n + 2\beta$

$^{14}_7N + n \rightarrow {}^7_3Li + 4p + 4n$

7. excess neutrons = α active and β^- active

excess proton = β^+ active

8. $_zX^A \rightarrow {}_{Z+1}Y^A + {}_+\beta^0 + E$

KE of β particle can not exceed E.

$T_e = \frac{my}{m_e + m_y} Q < Q$

N/2 ratio becomes $\frac{N-1}{Z+1}$

9. A,B,C

10. C,D

11. A,C

Given

$\lambda = 0.173 (year)^{-1}$

$t_{½} = \frac{0.693}{0.173}$ $N = N_0 e^{-0.173 \times \frac{1}{0.173}}$

(A) $N = \frac{N_0}{e} \Rightarrow N = 0.63\ N_0$