Exercise - II (Multiple Choice Problems)

1. When a nucleus with atomic number Z and mass number A undergoes a radioactive decay process :
(A) both Z and A will decrease, if the process is α decay
(B Z will decrease but A will not change, if the process is β^+ decay
(C) Z will decrease but A will not change, if the process is β^- decay
(D) Z and A will remain unchanged, if the process is γ decay.

2. When the atomic number A of the nucleus increases
(A) initially the neutron-proton ratio is constant= 1
(B) initially neutron-proton ratio increases and later decreases
(C) initially binding energy per nucleon increases and later decreases
(D) the binding energy per nucleon increases when the neutron-proton ratio increases.

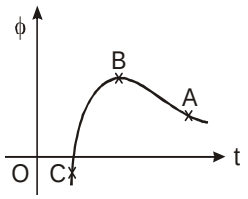
3. Let m_p be the mass of a proton, m_n the mass of a neutron, M_1 the mass of a $^{20}_{10}Ne$ nucleus and M_2 the mass of $a^{40}_{20}Ca$ nucleus. Then

(A) $M_2 = 2M_1$ (B) $M_2 > 2M_1$
(C) $M_2 < 2M_1$ (D) $M_1 < 10\,(m_n + m_p)$

4. Which of the following statement(s) is(are) correct?
(A) The rest mass of a stable nucleus is less than the sum of the rest masses of its separated nucleons.
(B) The rest mass of a stable nucleus is greater than the sum of the rest masses of its separated nucleons.
(C) In nulcear fusion, energy is released by fusion two nuclei of medium mass (approximately 100 amu).
(D) In nulcear fission, energy is released by fragmentation of a very heavy nucleus.

5. The graph shown by the side shows the variation of potential energy ϕ of proton with its distance 'r' from a fixed sodium nucleus, as it approaches the nucleus, placed at origin O. Then the portion.
(A) AB indicates nuclear repulsion
(B) AB indicates electrostatic repulsion
(C) BC indicates nuclear attraction
(D) BC represents electrostatic interation

6. A nitrogen nucleus $_7N^{14}$ absorbs a neutron and can transform into lithium nucleus $_3Li^7$ under suitable conditions, after emitting :
(A) 4 protons and 3 neutrons



(B) 5 protons and 1 negative beta particle
(C) 1 alpha particles and 2 gamma particles
(D) 1 alpha particle, 4 protons and 2 negative beta particles
(E) 4 protons and 4 neutrons

7. The instability of the nucleus can be due to various causes. An unstable nucleus emits radiations if possible of transform into less unstable state. Then the cause and the result can be
(A) a nucleus of excess nucleons is α active
(B) an excited nucleus of excess protons is β^- active
(C) an excited nucleus of excess protons is β^- active
(D) an nucleus of excess neutrons is β^- active

8. In β-decay, the Q-value of the process is E. Then
(A) K.E. of a β-particle cannot exceed E.
(B) K.E. of anti neutrino emitted lies between Zero and E.
(C) N/Z ratio of the nucleus is altered.
(D) Mass number (A) of the nucleus is altered.

9. Consider the following nuclear reactions and select the correct statements from the options that follow.
Reaction I : $n \longrightarrow p + e^- + \bar{\nu}$
Reaction II : $p \longrightarrow n + e^+ + v$
(A) Free neutron is unstable, therefore reaction I is possible
(B) Free proton is stable, therefore reaction II is not possible
(C) Inside a nucleus, both decays (reaction I and II) are possible
(D) Inside a nucleus, reaction I is not possible but reaction II is possible.

10. When the nucleus of an electrically neutral atom undergoes a radioactive decay process, it will remain neutral after the decay if the process is :
(A) α decay (B) β^- decay
(C) γ decay (D) K-capture

11. The decay constant of radio active substance is 0.173 $(years)^{-1}$. Therefore :
(A) Nearly 63% of the radioactive substance will decay in (1/0.173) year.
(B) half life of the radio active substance is (1/0.173) year.
(C) one-forth of the radioactive substance will be left after nearly 8 years.
(D) all the above statements are true.