

Self-Assessment

Module 1: Are Electrons Present Inside the Nucleus ?

Q.13.1.1 The beta-decay of a nucleus results in

- (A) the splitting up of a heavier nucleus into two lighter nuclei
- (B) the combination of two lighter nuclei into a heavier nucleus
- (C) the conversion of a neutron to a proton with the emission of an electron and an antineutrino
- (D) conversion of a neutron to a proton and an electron.

Q.13.1.2 The emission of an electron by the nucleus of an atom is called

- (A) beta decay
- (B) alpha decay
- (C) gamma decay
- (D) nuclear fission.

Q.13.1.3 The beta decay of a nucleus resulting in the emission of an electron

- (A) increases the mass number of the nucleus by one
- (B) decreases the mass number of the nucleus by one
- (C) decreases the atomic number of the nucleus by one
- (D) increases the atomic number of the nucleus by one.

Q.13.1.4 The beta decay of a nucleus resulting in positron emission

- (A) increases the mass number of the nucleus by one
- (B) decreases the mass number of the nucleus by one
- (C) decreases the atomic number of the nucleus by one
- (D) increases the atomic number of the nucleus by one.

Q.13.1.5 As a result of beta decay, the particles whose number remains unchanged in the nucleus are

- (A) electrons
- (B) protons



- (C) neutrons
- (D) nucleons.

Q.13.1.6 When a nucleus in an atom undergoes a radioactive decay, the electron energy levels of the atom do not change

- (A) after beta decay
- (B) after alpha decay
- (C) after gamma decay
- (D) both (1) and (2).

Q.13.1.7 A nucleus $X(A,Z)$ emits an alpha particle. The daughter nucleus has the configuration:

- (A) $Y(A+2,Z-4)$
- (B) $Y(A+4,Z+2)$
- (C) $Y(A+2,Z+2)$
- (D) $Y(A-4,Z-2)$.

Q.13.1.8 The emission of neutrinos and antineutrinos during β -decay has been postulated to satisfy

- (A) conservation of charge
- (B) conservation of momentum
- (C) conservation of energy
- (D) conservation of angular momentum.

Q.13.1.9 Which of the following is the correct process of β -decay?

- (A) $n \rightarrow p + e^- + \bar{\nu}$
- (B) $n \rightarrow p + e^+ + \nu$
- (C) $n \rightarrow p + e^- + \nu$
- (D) $n \rightarrow p + e^+ + \bar{\nu}$

Q.13.1.10 Which of the following is the correct process of positron-emission?

- (A) $p \rightarrow n + \beta^+ + \nu$

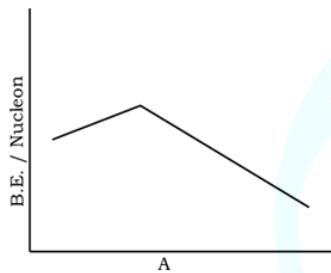
(B) $p \rightarrow n + \beta^- + \bar{\nu}$

(C) $n \rightarrow p + \beta^- + \bar{\nu}$

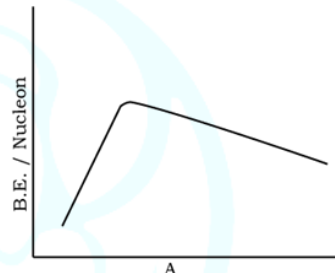
(D) $n \rightarrow p + \beta^- + \nu$

Module 2: Nuclear Binding Energy

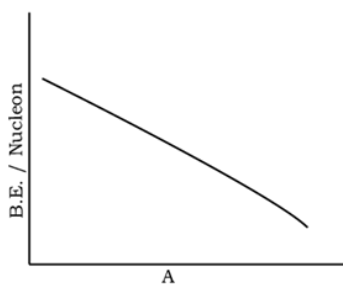
Q.13.2.1 Which of the following curves approximates best to the binding energy curve of nuclei?



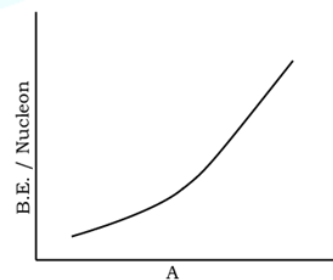
(A)



(B)



(C)



(D)

Q.13.2.2 Most stable nucleus known is that of

Continuous Professional Development

- (A) hydrogen
- (B) helium
- (C) carbon
- (D) iron

Q.13.2.3 Near constancy of binding energy/nucleon in the range $30 \leq A \leq 170$ indicates that

- (A) nuclear forces are long-range forces
- (B) nuclear forces are short range forces
- (C) nuclear forces are charge dependent
- (D) nuclear forces are weaker than the electrostatic forces.

Q.13.2.4 During fusion of light nuclei, the binding energy per nucleon

- (A) decreases
- (B) increases
- (C) remains unchanged
- (D) increases initially and then decreases

Q.13.2.5 Product nuclei of nuclear fission of a nucleus are

- (A) more stable than the original nucleus
- (B) less stable than the original nucleus
- (C) as stable as the original nucleus
- (D) heavier than the original nucleus.

Q.13.2.6 Spontaneous decay of ^{56}Fe

- (A) is energetically ruled out because its BE/nucleon is the maximum.
- (B) is energetically ruled out because its BE/nucleon is the minimum.
- (C) produces two identical nuclei with mass number 28.
- (D) takes place with the emission of an alpha particle.

Q.13.2.7 One atomic mass unit (amu) is defined by considering

- (A) mass of ^1_1H as 1 amu
- (B) mass of ^1_0H as 1 amu
- (C) mass of $^{12}_6\text{C}$ as 12 amu
- (D) mass of $^{16}_8\text{O}$ as 16 amu

Q.13.2.8 The graph of numbers of neutrons v/s numbers of protons (Fig.Q.13.2.1) for stable nuclide shows more numbers of neutrons compared to numbers of protons. This indicates that more numbers of neutrons are needed

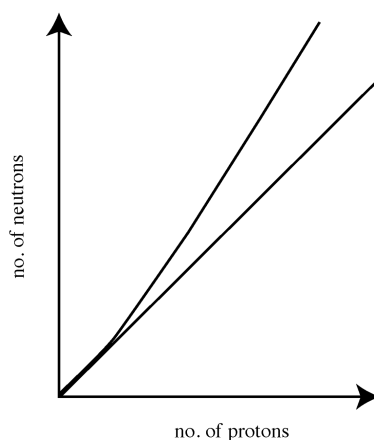


Fig.Q.13.2.1

- (A) for alpha (${}^4_2\text{He}$) decay
- (B) for beta (${}^0_{-1}e$) decay
- (C) to give stability by creating more attraction due to nuclear force for protons.
- (D) as neutrons are electrically neutral.

Q.13.2.9 Refer to graph of BE/A (binding energy per nucleon) vs mass numbers of nuclei (Fig.Q.13.2.2) . The graph as higher value for ${}^{56}\text{Fe}$, but also remains almost flat for a large number of nuclei . This means that

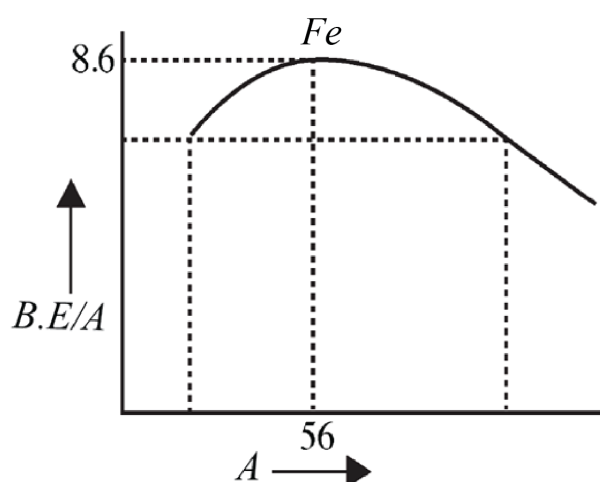


Fig.Q.13.2.2

- (A) nuclear heavier than ${}^{56}\text{Fe}$ can readily undergo fusion
- (B) nuclei lighter than ${}^{56}\text{Fe}$ can readily undergo fission.
- (C) nuclei lighter than ${}^{56}\text{Fe}$ can readily undergo fusion.
- (D) all the nuclei on the plateau would readily undergo fusion.

Q.13.2.10 Which of the following statements is correct regarding nuclear binding energy per nucleon?

- (A) binding energy per nucleon is less for light nuclei than for heavier nuclei (upto $A=56$).

(B) binding energy per nucleon is more for light nuclei than for heavier nuclei (upto $A=56$).

(C) binding energy per nucleon increases steadily for heavier nuclei (upto $A=238$) .

(D) binding energy per nucleon decreases steadily for light nuclei, after which it gradually increases (upto $A=238$).



Development Team

V.B. Bhatia, Former Professor, Delhi University, Delhi

Ish Kumar Gogia, Former PGT, KVS, New Delhi

Review Team

C.K. Ghosh, Former Director, NCIDE, IGNOU, New Delhi

Atul Mody, Former Associate Professor, VES College, Mumbai

Member- Coordinator

Shashi Prabha, Professor, CIET, NCERT, New Delhi

Technical support

Riya Rani, JPF, CIET, NCERT, New Delhi

Bhawana Bhatt, Technical Content Developer, CIET, NCERT, New Delhi