INDIAN SCHOOL AL WADI AL KABIR

Class: XII	**Department: SCIENCE 2020 -21** **SUBJECT : PHYSICS**	**Date of submission:** **29.11.2020**
Worksheet No:07 **WITH ANSWERS**	**Topic: NUCLEI.**	**Note:** **A4 FILE FORMAT**
NAME OF THE STUDENT-	**CLASS & SECTION**	**ROLL NO.**

Multiple choice type questions;

1. If $M(A, Z)$, M_p and M_n denote the masses of the nucleus ${}_ZX^A$, proton and neutron respec- tively in units of U (where $1\ U = 931{\cdot}5\ \text{MeV}/c^2$) and B.E. represents its B.E. in MeV, then
   (a) $M(A, Z) = ZM_p + (A - Z)\ M_n - BE/c^2$
   (b) $M(A, Z) = ZM_p + (A - Z)\ M_n + BE$
   (c) $M(A, Z) = ZM_p + (A - Z)\ M_n - BE$
   (d) $M(A, Z) = ZM_p + (A - Z)\ M_n + BE/c^2$

2. A nucleus ${}_ZX^A$ has mass represented by $M(A, Z)$. If M_p and M_n denote the mass of proton and neutron respectively and B.E., the binding energy in MeV, then
   (a) B.E. $= [Z\,M_p + (A - Z)\ M_n - M(A, Z)]\ c^2$
   (b) B.E. $= [Z\,M_p + A\,M_n - M(A, Z)]\ c^2$
   (c) B.E. $= M(A, Z) - ZM_p - (A - Z)\ Mn$
   (d) B.E. $= [M(A, Z) - ZM_p - (A - Z)\ \text{Mn}]\ c^2$

3. The ratio of size of a hydrogen atom to the size of its nucleus is
   (a) 10^5 (b) 10^{-5} (c) 10^4 (d) 10^{-4}

4. The radii of two nuclei with mass numbers 1 and 8 are in the ratio of
   (a) 1:8 (b)8:1 (c) 1:2 (d)2:1

5. Out of ${}_6C^{14}$, ${}_7N^{13}$, ${}_7N^{14}$ and ${}_8O^{16}$, the pair of isotones is
   (a) ${}_6C^{14}$, ${}_8O^{16}$ (b) ${}_7N^{14}$, ${}_7N^{13}$ (c) ${}_7N^{14}$, ${}_6C^{14}$ (d) ${}_7N^{14}$, ${}_8O^{16}$

1.(a), 2. (a), 3. (a),4. (c),5. (a)

1. The energy equivalent of 1 amu is..... .
2. One electron volt is the.....when accelerated through a..... .
3. Density of nuclear matter is the.....mass of.....and its..... .
4. Isotopes of an element are the atoms.....which have.....but.....
5. Isobars are atoms of.....which have same.....but different.....
6. Isotones are the nuclides which contain..... .

1. 931 MeV
2. energy acquired by an electron; potential difference of 1 V.
3.ratio of; nucleus; volume
4.of an element; same atomic number; different atomic weights.
5. different elements; atomic weight; atomic numbers.
6. same number of neutrons.

Assertion and Reason type questions;

DIRECTIONS. In each of the following questions, read the two statements and choose if

(A) both Assertion and Reason are true and the Reason is correct explanation of the Assertion.

(B) both Assertion and Reason are true, but the Reason is not a correct explanation of the Assertion.

(C) Assertion is true and Reason is false.

(D) both, Assertion and Reason are false.

1. **Assertion**: α-particle is a helium nucleus.

Reason: In α-decay, both the mass number as well as atomic number of the daughter is more than that of parent.

(a) A (b) B (c) C (d) D

2. **Assertion**: Isotopes of an element can be separated by using a mass spectrometer.

Reason: Separation of isotopes is possible because of difference in electron numbers of isotopes.

(a) A (b) B (c) C (d) D

3. **Assertion**: If a heavy nucleus is split into two medium sized parts, each of new nucleus will have more binding energy per nucleon than original nucleus.

Reason: Joining two light nuclei together to give a single nucleus of medium size means more binding energy per nucleon in new nucleus.

(a) A (b) B (c) C (d) D

4. **Assertion**: Density of nuclear matter is same for all nuclei

Reason: Density has nothing to do with mass and size of nucleus.

(a) A (b) B (c) C (d) D

5. **Assertion**: 1 amu = 933 MeV

Reason: It follows from $E = mc^2$

(a) A (b) B (c) C (d) D

6. Assertion: Nuclei of isobars atoms have same size.

Reason: $R = R_0 A^{1/3}$

(a) A (b) B (c) C (d) D

1.(c), 2. (c), 3. (b),4. (c),5. (c), 6. (a)

Short answers type questions;

1. Two nuclei have mass numbers in the ratio 2 : 5. What is the ratio of their nuclear densities ? (CBSE 2009)

Ans. The ratio of their nuclear densities is 1, as nuclear density is constant for all nuclei.

2. What is the nuclear radius of Fe^{125}, if that of Al^{27} is 3·6 fermi. (CBSE 2008)

Ans. As $$\frac{R_1}{R_2} = \left(\frac{A_1}{A_2}\right)^{1/3} = \left(\frac{125}{27}\right)^{1/3} = \frac{5}{3}.$$

$$R_1 = \frac{5}{3}\ R_2 = \frac{5}{3} \times 3{\cdot}6 = \mathbf{6{\cdot}0\ fermi}$$

3. Assuming the nuclei to be spherical in shape, how does the surface area of a nucleus of mass number A_1 compare with that of a nucleus of mass number A_2 ? (CBSE 2008 C)

Ans. $$\frac{A_1}{A_2} = \left(\frac{R_1}{R_2}\right)^2 = \left[\left(\frac{A_1}{A_2}\right)^{1/3}\right]^2 = \left(\frac{A_1}{A_2}\right)^{2/3}$$

4. What is the effect on neutron to proton ratio in a nucleus when (*i*) an electron, (*ii*) a positron is emitted ?

Ans. In emission of an electron, a neutron is converted into a proton. Therefore, number of neutrons decreases and the number of protons increases. The neutron to proton ratio decreases. In the emission of a positron, a proton is converted into a neutron. Hence the ratio increases.

5. Why heavy stable nucleus must contain more neutrons than protons ?

Ans. Coulomb forces between protons are repulsive and nuclear forces are ordinarily attractive. For nuclei to be stable nuclear forces must dominate the repulsive forces. Therefore, number of neutrons must be greater than the number of protons.

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