UNIT 8 Atomic and Nuclear physics

The ratio of the wavelengths for the transition from $n = 2$ to $n = 1$ in Li^{++}, He^{+} and H is

(a) 1: 2: 3 (b) 1: 4: 9

(c) 3:2:1 (d) 4: 9: 36

The electric potential between a proton and an electron is given by $V = V_0 \ln\left(\frac{r}{r_0}\right)$, where r_0 is a constant. Assume that Bohr atom model is applicable to potential, then variation of radius of n^{th} orbit r_n with the principal quantum number n is

(a) $r_n \propto \frac{1}{n}$ (b) $r_n \propto n$

(c) $r_n \propto \frac{1}{n^2}$ (d) $r_n \propto n^2$

If the nuclear radius of ^{27}Al is 3.6 fermi, the approximate nuclear radius of ^{64}Cu is

(a) 2.4 (b) 1.2

(c) 4.8 (d) 3.6

The nucleus is approximately spherical in shape. Then the surface area of nucleus having mass number A varies as

(a) $A^{2/3}$ (b) $A^{4/3}$

(c) $A^{1/3}$ (d) $A^{5/3}$

The mass of a $^{7}_{3}Li$ nucleus is 0.042 u less than the sum of the masses of all its nucleons. The binding energy per nucleon of $^{7}_{3}Li$ nucleus is nearly

(a) 46 MeV (b) 5.6 MeV

(c) 3.9MeV (d) 23 MeV

M_p denotes the mass of the proton and M_n denotes mass of a neutron. A given nucleus of binding energy B, contains Z protons and N neutrons. The mass M(N,Z) of the nucleus is given by(where c is the speed of light)

(a) $M(N,Z) = NM_n + ZM_p - Bc^2$

(b) $M(N,Z) = NM_n + ZM_p + Bc^2$

(c) $M(N,Z) = NM_n + ZM_p - B/c^2$

(d) $M(N,Z) = NM_n + ZM_p + B/c^2$

A radioactive nucleus (initial mass number A and atomic number Z) emits 2α and 2 positrons. The ratio of number of neutrons to that of proton in the final nucleus will be

(a) $\frac{A-Z-4}{Z-2}$ (b) $\frac{A-Z-2}{Z-6}$

(c) $\frac{A-Z-4}{Z-6}$ (d) $\frac{A-Z-12}{Z-4}$

The half-life period of a radioactive element A is same as the mean life time of another radioactive element B. Initially both have the same number of atoms. Then

(a) A and B have the same decay rate initially

(b) A and B decay at the same rate always

(c) B will decay at faster rate than A

(d) A will decay at faster rate than B.

A system consists of N_0 nucleus at t=0. The number of nuclei remaining after half of a half-life (that is, at time $t = \frac{1}{2}T_{\frac{1}{2}}$)

(a) $\frac{N_0}{2}$ (b) $\frac{N_0}{\sqrt{2}}$

(c) $\frac{N_0}{4}$ (d) $\frac{N_0}{8}$

Suppose an alpha particle accelerated by a potential of V volt is allowed to collide with a nucleus whose atomic number is Z, then the distance of closest approach of alpha particle to the nucleus is

(a) $14.4\frac{Z}{V}$ Å (b) $14.4\frac{V}{Z}$ Å

(c) $1.44\frac{Z}{V}$ Å (d) $1.44\frac{V}{Z}$ Å

In a hydrogen atom, the electron revolving in the fourth orbit, has angular momentum equal to

(a) h (b) $\frac{h}{\pi}$

(c) $\frac{4h}{\pi}$ (d) $\frac{2h}{\pi}$

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Atomic number of H-like atom with ionization potential 122.4 V for $n = 1$ is

(a) 1 (b) 2 (c) 3 (d) 4

The ratio between the first three orbits of hydrogen atom is

(a) 1:2:3 (b) 2:4:6

(c) 1:4:9 (d) 1:3:5

The charge of cathode rays is

(a) positive (b) negative

(c) neutral (d) not defined

In J.J. Thomson e/m experiment, a beam of electron is replaced by that of muons (particle with same charge as that of electrons but mass 208 times that of electrons). No deflection condition is achieved only if

(a) B is increased by 208 times

(b) B is decreased by 208 times

(c) B is increased by 14.4 times

(d) B is decreased by 14.4 times