SECTION (A) : PROPERTIES OF NUCLEUS

A.1 The mass of a netural carbon atom in ground state is
(A) exact 12 u (B) less than 12 u (C) more than 12 u
(D) depends on the form of carbon such as graphite or charcoal.

A.2 The mass number of a nucleus is equal to
(A) the number of neutrons in the nucleus (B) the number of protons in the nucleus
(C) the number of protons in the nucleus (D) none of them

A.3 As compared to ^{12}C atom, ^{14}C atom has
(A) two extra protons and two extra electrons (B) two extra protons but no extra electron
(C) two extra neutorns and no extra electrons (D) two extra neutons and two extra electrons

A.4 The mass number of a nucleus is
(A) always less than its atomic number
(B) always more than its atomic number
(C) equal to its atomic number
(D) sometimes more than and sometimes equal to its atomic number

A.5 The stable nucleus that has a radius 1/3 that of Os^{189} is
(A) Li (B) He (C) B (D) C

SECTION (B) : MASS DEFECT AND BINDING ENERGY

B.1 The minimum energy required to remove a neutron from $^{41}_{20}Ca$ is

[Atomic masses are: $^{40}_{20}Ca$ = 39.962589 u; m_n = 1.008665 u ; $^{41}_{20}Ca$ = 40.962275 u]
(A) 4.3 MeV (B) 8.36 MeV (C) – 4.3 MeV (D) – 8.36 MeV

B.2 As the mass number A increases, the binding energy per nucleon in a nucleus
(A) increases (B) decreases (C) remains the same
(D) varies in a way that depends on the actual value of A.

B.3 Which of the following is a wrong description of binding energy of a nucleus ?
(A) It is the energy required to break a nucleus into its constituent nucleons.
(B) It is the energy made avilable when free nucleons combine to from a nucleus
(C) It is the sum of the rest mass energies of its nucleons minus the rest mass energy of the nucleus
(D) It is the sum of the kinetic energy of all the nucleons in the nucleus

B.4 The energy of the reaction $Li^7 + p \longrightarrow 2\ He^4$ is (the binding energy per nucleon in Li^7 and He^4 nuclei are 5.60 and 7.06 MeV respectively.)
(A) 17.3 MeV (B) – 17.3 MeV (C) 1.46 MeV
(D) depends on binding energy of proton

B.5 The atomic weight of boron is 10.81 and it has two isotopes $^{10}_{5}B$ and $^{11}_{5}B$. The ratio of $^{10}_{5}B$: $^{11}_{5}B$ in nature would be:
(A) 19 : 81 (B) 10 : 11 (C) 15 : 16 (D) 81 : 19

SECTION (C) : RADIOACTIVE DECAY

C.1 The radioactive nucleus $_7N^{13}$ decays to $_6C^{13}$ through the emission of
(A) positron (B) neutron (C) proton (D) electron

C.2 An α-particle is bombarded on ^{14}N. As a result, a ^{17}O nucleus is formed and a particle is emitted. This particle is a
(A) neutron (B) proton (C) electron (D) positron

C.3 In beta decay,
(A) the daughter nucleus has one proton more than the parent nucleus
(B) the parent and the daughter nuclei have the same number of protons
(C) the daughter nucleus has one neutron more than the parent nucleus
(D) the daughter nucleus has one proton less than the parent nucleus.

C.4 In a radioactive decay, neither the atomic number nor the mass number changes. Which of the following particles is emitted in the decay ?
(A) proton (B) neutorn (C) electron (D) photon

C.5 During a negative beta decay,
(A) an atomic electron is ejected
(B) an electron which is already present within the nucleus is ejected
(C) a neutron in the nucleus decays emitted an electron
(D) a proton in the nucleus decays emitting an electron

C.6 In which of the following decays the element does not change ?
(A) α-decay (B) β^+-decay (C) β^--decay (D) γ-decay

C.7 Which of the following are electromagnetic waves ?
(A) α-rays (B) beta-plus rays (C) beta-minus rays (D) gamma rays

C.8 A nucleus raptures into two nuclear parts which have their velocities in the ratio of 2 : 1. What will be the ratio of their nuclear sizes (radii) ?
(A) $2^{1/3}$: 1 (B) 1 : $2^{1/3}$ (C) $3^{1/2}$: 1 (D) 1 : $3^{1/2}$

C.9 A free neutron decays into a proton, an electron and :
(A) A neutrino (B) An antineutrino (C) An α-particle (D) A β-particle

SECTION (D) : STATISTICAL LAW OF RADIOACTIVE DECAY

D.1 In one average-life
(A) half the active nuclei decay (B) less than half the active nuclei decay
(C) more than half the active nuclei decay (D) all the nuclei decay

D.2 A freshly prepared radiocative source of half-life 2 h emits radiation of intensity which is 64 times the permissible safe level. The minimum time after which it would be possible to work safely with this source is
(A) 6 h (B) 12 h (C) 24 h (D) 128 h

D.3 The decay constant of a radoactive sample is λ. The half-life and the average-life of the sample are respectively
(A) $1/\lambda$ and $(\ln 2/\lambda)$ (B) $(\ln 2/\lambda)$ and $1/\lambda$
(C) $1(\ln 2)$ and $1/\lambda$ (D) $\lambda/(\ln 2)$ and $1/\lambda$

D.4 The activity of a certain preparation decreases by 75% after 7.0 days. The half life of the sample is
[take ln (0.4) = – 0.916]
(A) 2.9 days (B) 5.3 days (C) 3.5 days (D) 6 days

D.5 The half life of $_{92}U^{238}$ against alpha decay is 4.5×10^9 years. The time taken in years for the decay of 15/16 part of this isotope is
(A) 9.0×10^9 (B) 1.8×10^{10} (C) 4.5×10^9 (D) 2.7×10^{10}

D.6 Two isotopes P and Q of atomic weight 10 and 20, respectively are mixed in equal amount by weight. After 20 days their weight ratio is found to be 1 : 4. Isotope P has a half-life of 10 days. The half-life of isotope Q is
(A) zero (B) 5 days (C) 20 days (D) inifinite

D.7 Ten grams of ^{57}Co kept in an open container beta-decays with a half-life of 270 days. The weight of the material inside the container after 540 days will be very nearly
(A) 10 g (B) proton (C) electron (D) positron

D.8 The half-life of a radioactive substance is 10 days. This means that :
(A) the substance completely disintegrates in 20 days
(B) the substance completely disintegrates in 40 days
(C) 1/8 part of the mass of the substance will be left intact at the end of 40 days
(D) 7/8 part of the mass of the substance disintegrates in 30 days

D.9 The half-life of a radioactive substance depends upon :
(A) its temperature (B) the external pressure on it
(C) the mass of the substance
(D) the strength of the nuclear force between the nucleons of its atom

D.10 During a nuclear fission reaction,
(A) a heavy nucleus breaks into two fragments by itself
(B) a light nucleus bombarded by thermal neutrons break up
(C) a heavy nucleus bombarded by thermal neutrons breaks up
(D) two light nuclei combine to give a heavier nucleus and possibly other products.

D.11 A fusion reaction of the type given below $^2_1D + {}^2_1D \longrightarrow {}^3_1T + {}^1_1p + \Delta E$, is most promising for the production of power. Here D & T stand for deuterium & tritium, respectively. Assuming the efficiency of the process to be 50 %, the mass of deuterium required per day for a power output of 10^9 W is (Given: mass of ^2_1D = 2.01458 amu; mass of ^3_1T = 3.01605 amu; mass of ^1_1p = 1.00728 amu & 1 amu = 930 MeV/c^2)
(A) 0.66 Kg/ day (B) 2.64 kg/ day (C) 132 gm/day (D) 1.32 kg/day

Answer Key

Section A

Que.	A.1	A.2	A.3	A.4	A.5
Ans.	A	C	C	D	A

Section B

Que.	B.1	B.2	B.3	B.4	B.5
Ans.	B	D	D	A	A

Section C

Que.	C.1	C.2	C.3	C.4	C.5	C.6	C.7	C.8	C.9
Ans.	A	B	A	D	C	D	D	B	B

Section D

Que.	D.1	D.2	D.3.	D.4	D.5	D.6	D.7	D.8	D.9	D.10
Ans.	C	B	B	B	B	D	A	D	D	C
Que.	D.11									
Ans.	D									