Chapter 02

# Nuclei

## TOPIC WISE QUESTIONS

### NUCLEUS

**Q.1** The mass number of a nucleus is
(1) always less than its atomic number
(2) always more than its atomic number
(3) equal to its atomic number
(4) sometimes more than and sometimes equal to its atomic number

**Q.2** The stable nucleus that has a radius 1/3 that of $Os^{189}$ is -
(1) ${}_3Li^7$ (2) ${}_2He^4$ (3) ${}_5B^{10}$ (4) ${}_6C^{12}$

**Q.3** 1 amu is equivalent to :
(1) 931 MeV (2) 0.51eV
(3) 9.31 MeV (4) 1.02 MeV

**Q.4** If mass number for an element is M and atomic number is Z, then number of neutrons will be :
(1) M – Z (2) Z –M (3) M + Z (4) Z

**Q.5** When a proton is accelerated through 1V its kinetic energy will be :
(1) 1540 eV (2) 13.6 eV
(3) 1 eV (4) zero

**Q.6** Two substances have different atomic masses and same atomic number. They are :
(1) isotopes (2) isobars
(3) isotones (4) none of these

**Q.7** The mass numbers of nuclei A and B are respectively 135 and 5. The ratio of their radii is:
(1) 1 : 3 (2) 3 : 1
(3) $\sqrt{27}$ : 1 (4) 1 : $\sqrt{27}$

**Q.8** The mass number of a nucleus is equal to the number of
(1) Electrons it contains
(2) Protons it contains
(3) Neutrons it contains
(4) Nucleons it contains

**Q.9** In ${}_{88}Ra^{226}$ nucleus, there are
(1) 138 protons and 88 neutrons
(2) 138 neutrons and 88 protons
(3) 226 protons and 88 electrons
(4) 226 neutrons and 138 electrons

**Q.10** Outside a nucleus
(1) Neutron is stable
(2) Proton and neutron both are stable
(3) Neutron is unstable
(4) Neither neutron nor proton is stable

**Q.11** In helium nucleus, there are
(1) 2 protons and 2 electrons
(2) 2 neutrons, 2 protons and 2 electrons
(3) 2 protons and 2 neutrons
(4) 2 positrons and 2 protons

**Q.12** Isotopes are atoms having
(1) Same number of protons but different number of neutrons
(2) Same number of neutrons but different number of protons
(3) Same number of protons and neutrons
(4) None of the above

**Q.13** A nucleus ruptures into two nuclear parts which have their velocity ratio equal to 2 : 1. What will be the ratio of their nuclear size (nuclear radius)
(1) $2^{1/3}$ : 1 (2) 1 : $2^{1/3}$
(3) $3^{1/2}$ : 1 (4) 1 : $3^{1/2}$

### MASS DEFECT & BINDING ENERGY

**Q.14** Masses of nucleus, neutron and protons are M, $n_m$ and $m_p$ respectively. If nucleus has been divided in to neutrons and protons, then
(1) $M = (A - Z)\, m_n + Zm_p$

(2) $M = Zm_n + (A - Z)\, m_p$
(3) $M < (A - Z)\, m_n + Zm_p$
(4) $M > (A - Z)m_n + Zm_p$

**Q.15** As the mass number A increases, the binding energy per nucleon in a nucleus
(1) increases
(2) decreases
(3) remains the same
(4) varies in a way that depends on the actual value of A.

**Q.16** Which of the following is a wrong description of binding energy of a nucleus?
(1) It is the energy required to break a nucleus into its constituent nucleons.
(2) It is the energy released when free nucleons combine to from a nucleus.
(3) It is the sum of the rest mass energies of its nucleons minus the rest mass energy of the nucleus.
(4) It is the sum of the kinetic energy of all the nucleons in the nucleus.

**Q.17** Mass-energy equation $E = mc^2$ was given by
(1) Newton (2) Kepler
(3) Einstein (4) Millikan

**Q.18** For the stability of any nucleus:
(1) binding energy per nucleon will be more
(2) binding energy per nucleon will be less
(3) number of electrons will be more
(4) none of the above

**Q.19** If a $H_2$ nucleus is completely converted into energy, the energy produced will be around
(1) 1 MeV (2) 938 MeV
(3) 9.38 MeV (4) 238 MeV

**Q.20** The mass and energy equivalent to 1 a.m.u. respectively
(1) $1.67 \times 10^{-27}$ gm, 9.30 MeV
(2) $1.67 \times 10^{-27}$ kg, 930 MeV
(3) $1.67 \times 10^{-27}$ kg, 1 MeV
(4) $1.67 \times 10^{-34}$ kg, 1 MeV

**Q.21** The mass defect in a nuclear reaction is 0.3 percent. What amount of energy will be liberated in one kg fusion reaction?
(1) $1.6 \times 10^{13}$ J (2) $3.7 \times 10^{14}$ J
(3) $2.7 \times 10^{14}$ J (4) $0.5 \times 10^{15}$ J

**Q.22** The average binding energy per nucleon of a nucleus is of the order of
(1) 8 eV (2) 8 J (3) 8 keV (4) 8 MeV

## RADIOACTIVITY, GROUP DISPLACEMENT LAW

**Q.23** An $\alpha$-particle is bombarded on $^{14}N$. As a result, a $^{17}O$ nucleus is formed and a particle is emitted. This particle is a
(1) neutron (2) proton
(3) electron (4) positron

**Q.24** A free neutron decays into a proton, an electron and :
(1) A neutrino
(2) An antineutrino
(3) An $\alpha$-particle
(4) A $\beta$-particle

**Q.25** When a $\beta^-$-particle is emitted from a nucleus, the neutron-proton ratio :
(1) is decreased
(2) is increased
(3) remains the same
(4) first (1) then (2)

**Q.26** Consider a sample of a pure beta-active material
(1) All the beta particles emitted have the same energy.
(2) The beta particles originally exist inside the nucleus and are ejected at the time of beta decay.
(3) The antineutrino emitted in a beta decay has zero rest mass and hence zero momentum.
(4) The active nucleus changes to one of its isobars after the beta decay.

**Q.27** A positron of 1MeV collides with an electron of 1 MeV and gets annihilated and the reaction produces two $\gamma$-ray photons. If the effective mass of each photon is 0.0016 amu, then the energy of each $\gamma$-ray photon is about-
(1) 1.5 MeV (2) 3 MeV
(3) 6 MeV (4) 2 MeV

**Q.28** Alpha particles are :
(1) 2 free protons
(2) helium atoms
(3) singly ionized helium atoms
(4) doubly ionized helium atoms

**Q.29** In one $\alpha$ and $2\beta$ -emissions :
(1) mass number reduces by 2
(2) mass number reduces by 6
(3) atomic number reduces by 2
(4) atomic number remains unchanged

**Q.30** Which ray contain (+Ve) charge particle: -
(1) $\alpha$-rays (2) $\beta$-rays
(3) $\gamma$-rays (4) X-rays

**Q.31** A nucleus ${}_nX^m$ emits one $\alpha$ particle and one $\beta$ particle. The mass number and atomic number of product nucleus, are:
(1) (m – 4), n (2) (m – 4), (n – 1)
(3) (m – 3), n + 1 (4) (m – 3), (n – 1)

**Q.32** Which of the following particle has similar mass to electron?
(1) Proton (2) Neutron
(3) positron (4) Neutrino

**Q.33** Positron was discovered in the year:
(1) 1898 (2) 1902
(3) 1925 (4) 1932

**Q.34** In the nucleus of an atom, neutrons are in excess, then emitted particles are :
(1) neutron (2) electron
(3) proton (4) positron

**Q.35** Which of the followings is a correct statement?
(1) beta rays are same as cathode rays.
(2) gamma rays are high energy neutrons.
(3) alpha particles are singly-ionized helium atoms.
(4) protons and neutrons have exactly the same mass.

**Q.36** A nuclear reaction given by
${}_zX^A \longrightarrow {}_{z+1}Y^A + {}_{-1}e^0 +$ represents
(1) $\beta$-decay (2) $\gamma$-decay
(3) fusion (4) fission

**Q.37** An $\alpha$ – particle is bombarded on, ${}_7N^{14}$ As. a result, a ${}_8O^{17}$ -nucleus is formed and a particle X is emitted. The particle X is :
(1) neutron (2) proton
(3) electron (4) positron

**Q.38** In the reaction ${}_{92}X^{234} \longrightarrow {}_{87}Y^{222}$ How many $\alpha$-particles and $\beta$-particles are emitted ?
(1) 3 and 5 (2) 5 and 3
(3) 3 and 3 (4) 3 and 1

**Q.39** A nucleus of mass number 232 and z = 90. After many disintegrations of $\alpha$ and $\beta$ radiations, decays into other nucleus whose mass number is 220 and atomic number is 86. The numbers of $\alpha$ and $\beta$ radiations will be :
(1) 4, 0 (2) 3, 6 (3) 3, 2 (4) 2, 1

**Q.40** The $\beta$-particles are emitted by:
(1) atom (2) orbit
(3) nucleus (4) none of these

**Q.41** Which word equation represents $\beta^+$ decay?
(1) Proton $\rightarrow$ neutron + electron + antineutron
(2) proton $\rightarrow$ neutron + electron + electron neutorn
(3) proton $\rightarrow$ neutron + positron + electron antineutron
(4) proton $\rightarrow$ neutron + positron + electron neutron

**Q.42** in radioactive decay process the negatively charged emitted $\beta$ – particles are
(1) the electrons present inside the nucleus
(2) the electrons produced inside as a result of the decay of nautrons inside the nucleus
(3) the electrons produced as a result of collisions between atoms
(4) the electrons orbiting around the nucleus

**Q.43** In gamma ray emission from a nucleus
(1) both the neutron number and the proton number change
(2) there is no change in the proton number and the neutron number
(3) only the neutron number changes
(4) only the proton number changes

**Q.44** Which of the following cannot be emitted by radioactive substances during the plates of a capacitor the capacitor
(1) Protons
(2) Neutrinos
(3) Helinum nuclei
(4) Electrons

**Q.45** If the disintegration series
$^{238}_{92}U \xrightarrow{\alpha} X \xrightarrow{\beta^-} {}^{A}_{Z}Y$
the values of Z and A respectively will be :
(1) 92, 236 (2) 88, 230
(3) 90, 234 (4) 91, 234

## NUCLEAR FORCE

**Q.46** Two protons are kept at a separation of 50Å. $F_n$ is the nuclear force and $F_e$ is the electrostatic force between them, then
(1) $F_n >> F_e$ (2) $F_n = F_e$
(3) $F_n << F_e$ (4) $F_n \approx F_e$

Q.47 For effective nuclear forces, the distance should be
(1) $10^{-10}$ m (2) $10^{-13}$ m
(3) $10^{-15}$ m (4) $10^{-20}$ m

Q.48 Nuclear forces are
(1) Short ranged attractive and charge independent
(2) Short ranged attractive and charge dependent
(3) Long ranged repulsive and charge independent
(4) Long ranged repulsive and charge dependen

## NUCLEAR FISSION AND FUSSION

**Q.49** If mass of the fissionable material is less than the critical mass, then
(1) fission and chain reactions both are impossible.
(2) fission is possible but chain reaction is impossible.
(3) fission is impossible but chain reaction is possible.
(4) fission and chain reaction both are possible.

**Q.50** Which of the following materials is used for controlling the fission?
(1) heavy water (2) graphite
(3) cadmium (4) Berillium oxide

**Q.51** Atomic reactor is based on
(1) controlled chain reaction
(2) uncontrolled chain reaction
(3) nuclear fission
(4) nuclear fusion

**Q.52** Thermal neutron means
(1) neutron being heated
(2) the energy of these neutrons is equal to the energy of neutrons in a heated atom.
(3) these neutron have energy of a neutron in a nucleus has at normal temperature.
(4) such neutrons gather energy released in the fission process.

**Q.53** $_{92}U^{235}$ nucleus absorbs a slow neutron and undergoes fission into $_{54}X^{139}$ and $_{38}Sr^{94}$ nuclei. The other particles porduced in this fission process are
(1) 1 $\beta$ and 1 $\alpha$
(2) 2 $\beta$ and 1 neutron
(3) 2 neturons
(4) 3 neutrons

**Q.54** Choose the statement which is true.
(1) The energy released per unit mass is more in fission than in fusion.
(2) The energy released per atom is more in fusion than in fission.
(3) The energy released per unit mass is more in fusion and that per atom is more in fission.
(4) Both fission and fusion produce same amount of energy per atom as well as per unit mass.

**Q.55** Fusion reaction is possible at high temperature because -
(1) atoms are ionised at high temperature

(2) molecules break-up at high temperature
(3) nuclei break-up at high temperature
(4) kinetic energy is high enough to overcome repulsion between nuclei.

**Q.56** ${}_1H^1 + {}_1H^1 + {}_1H^2 \rightarrow X + {}_1e^0$ + energy. The emitted particle is -
(1) Neutron (2) Proton
(3) $\alpha$-particle (4) Neutrino

**Q.57** In the following equation, particle X will be
${}_6C^{11} \rightarrow {}_5B^{11} + \beta^+ + X$
(1) neutron (2) antineutrino
(3) neutrino (4) proton

**Q.58** Best moderator for neutron is -
(1) berillium oxide (2) pure water
(3) heavy water (4) graphite

**Q.59** The functions of mederators in nuclear reacter is:
(1) decrease the speed of neutrons
(2) Increase the speed of neutrons
(3) decrease the speed of electrons
(4) decrease the speed of electrons

**Q.60** A chain reaction in fission of uranium is possible, because:
(1) two intermediate sized nuclear fragments are formed
(2) three neutrons are given out in each fission
(3) fragments in fission are radioactive
(4) large amont of energy is released

**Q.61** Nuclear fusion is common to the pair:
(1) thermonuclear rector, uranium based nuclear reactor
(2) energy production in sun, uranium based nuclear reactor
(3) energy production of heavy nuclei hydrogen bomb
(4) disintegration of heavy nuclei hydrogen bomb

**Q.62** The operation of a nuclear reactor is said to be critical, if the multiplication factor (k) has a value
(1) 1 (2) 1.5 (3) 2.1 (4) 2.5

**Q.63** Fission of nuclei is possible because the binding energy per nucleon in them
(1) Increases with mass number at high mass numbers
(2) Decreases with mass number at high mass numbers
(3) Increases with mass number at low mass numbers
(4) Decreases with mass number at low mass numbers

# ANSWER KEY

## TOPIC WISE QUESTIONS

| Que. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ans. | 4 | 1 | 1 | 1 | 3 | 1 | 2 | 4 | 2 | 3 | 3 | 1 | 2 | 3 | 4 |
| **Que.** | **16** | **17** | **18** | **19** | **20** | **21** | **22** | **23** | **24** | **25** | **26** | **27** | **28** | **29** | **30** |
| Ans. | 4 | 3 | 1 | 2 | 2 | 3 | 4 | 2 | 2 | 1 | 4 | 1 | 4 | 4 | 1 |
| **Que.** | **31** | **32** | **33** | **34** | **35** | **36** | **37** | **38** | **39** | **40** | **41** | **42** | **43** | **44** | **45** |
| Ans. | 2 | 3 | 4 | 2 | 1 | 1 | 2 | 4 | 3 | 3 | 4 | 2 | 2 | 1 | 4 |
| **Que.** | **46** | **47** | **48** | **49** | **50** | **51** | **52** | **53** | **54** | **55** | **56** | **57** | **58** | **59** | **60** |
| Ans. | 3 | 3 | 1 | 2 | 3 | 1 | 3 | 4 | 3 | 4 | 3 | 3 | 3 | 1 | 2 |
| **Que.** | **61** | **62** | **63** | | | | | | | | | | | | |
| Ans. | 3 | 1 | 2 | | | | | | | | | | | | |