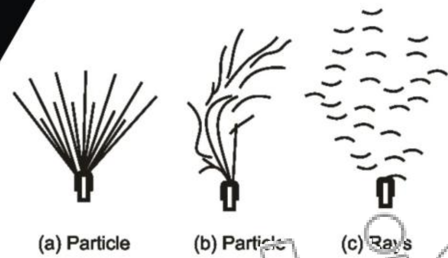

Chapter 21

NUCLEAR PHYSICS

TOPICAL MULTIPLE CHOICE QUESTIONS

Topic: 21.1

Atomic Nucleus

(1) The radius of an atom is ____________ the radius of nucleus

(a) 10^5 times **(b)** 10^4 times
(c) 10^6 times **(d)** 10^2 times

(2) The charge on proton is

(a) 1.6×10^{-9}C **(b)** 1.6×10^{-19}C
(c) 1.6×10^{-12}C **(d)** 1.6×10^{-27}C

(3) The charge on neutron is equal to the charge on

(a) proton **(b)** electron
(c) positron **(d)** atom

(4) Neutron was discovered by

(a) James Thomson **(b)** Curie
(c) James Chadwick. **(d)** Faraday

(5) A nucleus consists of

(a) protons **(b)** neutrons
(c) electrons and protons **(d)** protons and neutrons

(6) The mass of neutron is almost equal to the mass of

(a) proton **(b)** electron
(c) positron **(d)** none of these

(7) 1u is exactly equal to

(a) one eleventh mass of carbon **(b)** one twelveth mass of carbon
(c) one sixteenth mass of carbon **(d)** twelve times mass of carbon

(8) The charge on neutron is

(a) positive **(b)** negative
(c) no charge **(d)** none of these

(9) The number of neutrons present in the nucleus is given by

(a) N = (Z - A) **(b)** N = (A - Z)
(c) A = (Z - N) **(d)** Z = (N - A)

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(10) The number of neutrons in the nucleus is: **LHR-2017 (G-I)**

(a) N = A - Z **(b)** N = A + Z
(c) $N = \frac{A+Z}{2}$ **(d)** $N = \frac{A-Z}{2}$

(11) Mass of proton is **SGD-2017 (G-I)**

(a) 1.67×10^{-27}kg **(b)** 1.6×10^{-19}kg
(c) 1.67×10^{-31}kg **(d)** 9.1×10^{-31}kg

(12) The typical nuclei have diameter less than: **MTN-2019 (G-II)**

(a) 10^{-14} m (b) 10^{-12} m
(c) 10^{-10} m (d) 10^{-8} m

(13) Energy released by conversion of 1 amu of mass is: **LHR-2022 (G-I)**
(a) 1.6×10^{-19} *ev* (b) 1.6×10^{-19} *Mev*
(c) 200 Mev (d) 931 Mev

(14) 0.1 kg mass will be equivalent to the energy. **BWP-2022 (G-I)**
(a) 5×10^{8} Joules (b) 6×10^{19} Joules
(c) 9×10^{15} Joules (d) 9×10^{19} Joules

ENTRY TEST MCQS

(15) Size of nucleus is approximately____________
(a) 10^{-12}m (b) 10^{-11}m
(c) 10^{-10}m (d) 10^{-14}m

Topic 21.2:

Isotopes

(16) A device used to separate the isotopes of an element and to measure the masses of isotopes accurately is called
(a) holograph (b) mass spectrograph
(c) ultra violet spectrograph (d) infra red spectrograph

(17) Both Xenon and cesium each have
(a) 13 isotopes (b) 34 isotopes
(c) 36 isotopes. (d) 10 isotopes

(18) The second isotope of hydrogen is called
(a) tritium (b) Protium
(c) deuterium (d) xetrium

(19) The chemical properties of all isotopes are
(a) different (b) alike
(c) depend upon atomic mass number (d) zero

(20) A particle having the mass equal to the electron and charge of proton is called
(a) meson (b) lepton
(c) photon (d) positron

(21) The most abundant isotope of neon is
(a) neon -21 (b) neon-20
(c) neon -22 (d) neon-23

(22) First isotope of hydrogen is called
(a) ordinary hydrogen (b) protium
(c) tritium (d) both a and b

(23) The chemical behavior of an atom is determined by
(a) atomic number (b) atomic mass number
(c) number of isotopes (d) all of these

(24) The chemical properties of an element depends upon the
(a) number of protons in nucleus
(b) number of electrons inside the nucleus
(c) number of electrons around the nucleus
(d) number of neutrons inside the nucleus

(25) Which of the following method is successful to separate the isotopes of an element
(a) chemical method (b) physical method
(c) both a and b (d) none of these

(26) In mass spectrograph the ions subjected to a perpendicular and uniform magnetic field in a vacuum chamber where they are deflected in

(a) elliptical paths **(b)** circular paths
(c) semicircular paths **(d)** rectangular paths

(27) In mass spectrograph the detector records the number of ions arriving

(a) per minute **(b)** per second
(c) per hour **(d)** per nano second

(28) The neon gas has

(a) 3 isotopes **(b)** 1 isotope
(c) 2 isotopes **(d)** none of these

(29) A device producing ions of high energy is called

(a) A betatron **(b)** a Geiger counter
(c) cyclotron. **(d)** mass spectrograph

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(30) By mass spectrograph we can find the value of mass by using formula: LHR-2019 (G-II)

(a) $m=\left(\frac{e^2r^2}{2V}\right)B^2$ **(b)** $m=\left(\frac{e\,r^2}{2V}\right)B^2$
(c) $m=\left(\frac{eV}{2r^2}\right)B$ **(d)** $m=\left(\frac{eV^2}{2r}\right)B$

(31) The number of isotopes of xenon are SGD-2017 (G-II)

(a) 32 **(b)** 36
(c) 38 **(d)** 33

(32) Xenon has. MTN-2022 (G-II)

(a) 30 isotopes **(b)** 36 isotopes
(c) 10 isotopes **(d)** 12 isotopes

ENTRY TEST MCQS

(33) A mass spectrograph (spectrometer) sorts out _____________

(a) Molecules **(b)** Atoms
(c) Elements **(d)** Isotopes

Topic 21.3:

Mass Defect and Binding Energy

(34) The mass defect is defined as

(a) $\Delta m = Zm_p+(A+Z)m_n-m_{neucleus}$ **(b)** $\Delta m = Zm_p+(A-Z)m_n-m_{neucleus}$
(c) $\Delta m = Zm_p+(A-Z)m_n+m_{neucleus}$ **(d)** $\Delta m = Zm_p+(A+Z)m_n+m_{neucleus}$

(35) The binding energy is defined as

(a) $B.E = Zm_pc^2+(A-Z)m_nc^2-mc^2$ **(b)** $B.E = Zm_pc^2+(A-Z)m_nc^2+mc^2$
(c) $B.E = Zm_pc^2+(A+Z)m_nc^2+mc^2$ **(d)** $B.E = Zm_pc^2+(A+Z)m_nc^2-mc^2$

(36) Einstein energy mass relation is

(a) $E=(\Delta m)c$ **(b)** $E=(\Delta m)c^3$
(c) $E=(\Delta m)c^2$ **(d)** $E=(\Delta m)^2c$

(37) Binding energy of Helium is

(a) 931.5 MeV **(b)** 93.15 MeV

(c) 2.13 MeV (d) 28 MeV

(38) The most stable element is

(a) copper **(b)** uranium
(c) iron. **(d)** cobalt

(39) The binding energy is maximum for

a) copper **(b)** uranium
(c) iron **(d)** cobalt

(40) The mass defect per nucleon is called

(a) binding energy of nucleus **(b)** packing fraction
(c) energy fraction **(d)** binding fraction

(41) The mass defect of hydrogen is

(a) maximum **(b)** minimum
(c) zero **(d)** none of these

(42) The amount of energy equal to 1 u or 1a.m.u is

(a) 93.1MeV **(b)** 9.31MeV
(c) 0.931MeV **(d)** 931MeV

(43) The amount of energy required to break the helium nucleus into two protons and two neutrons is

(a) 931MeV **(b)** 9.31MeV
(c) 82.1MeV **(d)** 28.2MeV

(44) The binding energy per nucleon increases with the

(a) mass number **(b)** number of isotopes
(c) atomic number **(d)** all of these

(45) Mass defect per nucleon is called

(a) B.E of nucleus **(b)** Average energy of nucleus
(c) Packing fraction **(d)** Average energy of reaction

(46) 1 u =

(a) 9.1×10^{-31}kg **(b)** 1.06×10^{-21}kg
(c) 1.66×10^{-27}kg **(d)** 1.66×10^{-17}kg

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(47) The binding energy per nucleon is maximum for **GRW-2019 (G-II)**

(a) uranium **(b)** platinum
(c) hydrogen **(d)** iron

(48) Binding energy per nucleon is maxim for: **LHR-2021 (G-II)**

(a) Helium **(b)** Iron
(c) Radium **(d)** Polenium

(49) The binding energy for Helium is given by. **SGD-2022 (G-II)**

(a) 30.2MeV **(b)** 2.25MeV
(c) 2.28MeV **(d)** 28.2MeV

(50) 0.1 kg is equivalent to the energy of **DGK-2022 (G-I)**

(a) 9×10^{15}J **(b)** 9×10^{16}J
(c) 6×10^{16}J **(d)** 3×10^{8}J

(51) Binding energy for deuteron nucleus is given by **BWP-2022 (G-II)**

(a) 2.8 MeV **(b)** 2.23 MeV
(c) 2.28 MeV **(d)** 2.25 MeV

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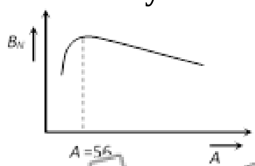
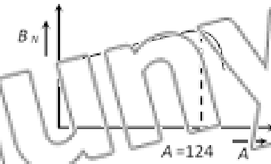
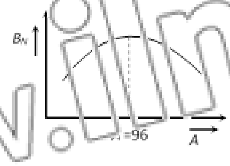
(52) **The dependence of binding energy per nucleon, B_N on the mass number, A, is represented by**



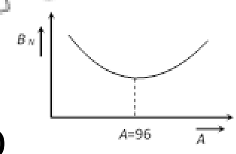
(a)



(b)



(c)



(d)

(53) **A nucleus has a nucleon number *A*, a proton number *Z*, and a binging energy *B*. The masses of the neutron and proton are m_n and m_p, and *c* is the speed of light. The mass of the nucleus is given by the expression**

(a) $(A-Z)m_n + Zm_p - \frac{B}{c^2}$ **(b)** $(A+Z)m_n + Zm_p + \frac{B}{c^2}$

(c) $Am_n + Zm_p - \frac{B}{c^2}$ **(d)** None of these

Topic 21.4:

Radioactivity

(54) **Radioactivity was discovered by**

(a) Huygens **(b)** Henry Becquerel

(c) Marie Curie **(d)** Einstein

(55) **Gamma particles have**

(a) negative charge **(b)** positive charge

(c) no charge. **(d)** both a & b

(56) **The elements showing radioactivity have atomic number 'Z'**

(a) Z >50 **(b)** Z < 82

(c) Z >82. **(d)** Z < 70

(57) **Curie is a unit of**

(a) radioactivity **(b)** resistivity

(c) conductivity **(d)** isotopes

(58) **When nucleus emits alpha particle, its charge number decreases by**

(a) 2 **(b)** 3

(c) 1 **(d)** 4

(59) **Radioactive radiations are of**

(a) 3 types **(b)** 2 types

(c) 1 type **(d)** 4 types

(60) **The elements whose charge number is less than 82 are**

(a) unstable. **(b)** stable

(c) neither stable nor unstable **(d)** none of these

(61) **The beta particles are similar to**

(a) protons **(b)** electrons

(c) neutrons **(d)** positrons

(62) **Helium nuclei are similar to**

(a) alpha particles (b) beta particles
(c) gamma particles (d) all of these

(63) Radioactivity is purely a
(a) nuclear phenomena. (b) chemical phenomena
(c) physical phenomena (d) none of these

(64) The emission of β-particle from polonium-218 results in the formation of
(a) protactinium-143 (b) astatine-218
(c) radon -222 gas (d) thorium-234

(65) α-decay occurs when a ___________ nucleus emits α-particle
(a) stable parent nucleus (b) unstable parent nucleus
(c) stable daughter nucleus (d) unstable daughter nucleus

(66) During nuclear changes which of the following laws remain applicable
(a) law of conservation of energy (b) law of conservation of mass
(c) law of conservation of momentum (d) all of these

(67) β-decay occurs when an unstable parent nucleus emits
(a) a proton and an electron (b) neutron and an electron
(c) a proton and neutron (d) only electrons

(68) During β-emission the charge number of nucleus is
(a) increased by 1 (b) decreased by 1
(c) increased by 2 (d) none of these

(69) Which of the following has positive charge
(a) α-particle (b) β -particle
(c) γ-radiation (d) none of these

(70) Radiations emitted by a radioactive elements are
(a) visible (b) invisible
(c) sometimes visible (d) none of these

(71) The disintegration of nucleus obeys law of
(a) conservation of charge (b) conservation of mass
(c) conservation of momentum (d) all of these

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(72) When a nucleus emits alpha particle its atomic mass decreases by
SGD-2017 (G-I)
(a) –4 (b) –2
(c) –3 (d) –1

(73) By emitting β-particle and γ-particle simultaneously the nucleus changes its charge by **DGK-2017 (G-II)**
(a) –1 (b) +1
(c) –2 (d) +2

(74) In a nuclear transmutation, radium changes into radon, the emitted particle is.
GRW-2022 (G-I)
(a) A neutron (b) A proton
(c) An alpha particle (d) A beta particle

ENTRY TEST MCQS

(75) A radioactive nucleus decays according to following series

$X \xrightarrow{\alpha} X_1 \xrightarrow{\beta} X_2 \xrightarrow{\alpha} X_3 \xrightarrow{\gamma} X_4$

If the atomic number and atomic weight of the parent element X are 72 and 180 respectively, then the atomic number and atomic mass of X_4 are respectively:

(a) 70, 172 **(b)** 69, 171
(c) 69, 172 **(d)** 68, 172

Topic 21.5:

Half Life

(76) The time required for a radioactive material to decrease in activity by one half is called
(a) Half life. **(b)** half time
(c) mean time **(d)** degradation time

(77) The S I unit of decay constant is
(a) m **(b)** m^{-1}
(c) s^{-1} **(d)** ms^{-1}

(78) Half life of uranoium-239 is
(a) 23.5 days **(b)** 23.5 minutes
(c) 23.5 seconds **(d)** 23.5 years

(79) The decay constant can be defined as
(a) $\lambda = -\frac{\frac{\Delta N}{N}}{\Delta t}$ **(b)** $\lambda = -\frac{\frac{N}{\Delta N}}{\Delta t}$
(c) $\lambda = \frac{\frac{N}{\Delta N}}{\Delta t}$ **(d)** $\lambda = \frac{\frac{\Delta N}{N}}{\Delta t}$

(80) The half life of radium-226 is
(a) 1620 years **(b)** 1920 years
(c) 19.20 years **(d)** 19.23 years

(81) The half life of iodine-131 is
(a) 8 days **(b)** 23.5 minutes
(c) 48 days **(d)** 1920 years

(82) The ratio of the fraction of decaying atoms per unit time is called
(a) half life **(b)** decay time
(c) decay constant **(d)** decay element

(83) After two half lives the number of decayed nuclei of an elements are
(a) N **(b)** N/2
(c) $\frac{3N}{4}$ **(d)** N/4

(84) Half life of radioactive element depends upon
(a) temperature **(b)** amount of substance
(c) nature of material **(d)** all of these

(85) The half life of sodium(N_a - 24) is
(a) 6 hours **(b)** 8 days
(c) 60 days **(d)** 15 hours

(86) The half life of iodine (I- 125) is
(a) 6 hours **(b)** 8 days
(c) 60 days **(d)** 15 hours

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(87) The half life of uranium-239 is: **LHR-2021 (G-II)**
(a) 1620 years **(b)** 3.8 days
(c) 2.5 days **(d)** 23.5 minutes

(88) The half life of I^{131} is; **MIRPUR (AJK) 2017**
(a) 6 days **(b)** 7 days
(c) 8 days **(d)** 9 days

(89) Half life of iodine-131 is 8 days and it weighs 20 mg. After 4 half lives, the amount left behind will be: **FSD-2019 (G-I)**
(a) 2.5 mg **(b)** 1.25 mg
(c) 0.625 mg **(d)** 0.312 mg

(90) The unit of decay constant is: **SGD-2022 (G-I)**
(a) second **(b)** $second^{-1}$
(c) m^{-1} **(d)** m.K

(91) Half-life is radioactive isotope of iodine-131 is: **SGD-2022 (G-I)**
(a) 6 days **(b)** 8 days
(c) 10 days **(d)** 12 days

(92) After two half-lives the number of decayed nuclei of an element are. **SGD-2022 (G-II)**
(a) N/4 **(b)** N/2
(c) 3N/4 **(d)** N

(93) The S.I. Unit of Decay Constant is: **BWP-2019 (G-II)**
(a) Second **(b)** Meter
(c) $(Second)^{-1}$ **(d)** $(Meter)^{-1}$

(94) The percentage of original quantity of radioactive material left after five half-lives is nearly________. **RWP-2022 (G-I)**
(a) 6% **(b)** 5%
(c) 10% **(d)** 3%

ENTRY TEST MCQS

(95) Half-life of radium is 1590 years. In how many years shall the earth loss all its radium due to radioactive decay?
(a) 1590×10^{6} years **(b)** 1590×10^{12} years
(c) 1590×10^{24} years **(d)** Never

(96) Tungsten-176 has a half-life of 2.5 hours. After how many hours will the disintegration rate of a tungsten-176 sample drop to $\frac{1}{16}$ its initial value?
(a) 5 **(b)** 8.3
(c) 10 **(d)** 13

Topic 21.6:

Interaction of Radiation with Matter

(97) The range of particle depends upon the factor:
(a) charge, mass and energy of particle **(b)** density of medium
(c) ionization potential of the atoms **(d)** all of these

(98) The ionization power of beta particle is
(a) equal to alpha particle **(b)** equal to gamma particle
(c) greater than alpha particle **(d)** less than alpha particle

(99) The alpha particle is about ________ than an electron

(a) 7000 times more massive (b) 700 times more massive
(c) 6000 times more massive (d) 70 times more massive

(100) The speed of alpha particle is about
(a) 10^8 ms^{-1} (b) 3×10^8 ms^{-1}
(c) 1×10^8 ms^{-1} (d) 10^7 ms^{-1}

(101) The speed of gamma radiation is about
(a) 10^8 ms^{-1} (b) 3×10^8 ms^{-1}
(c) 1×10^8 ms^{-1} (d) 10^7 ms^{-1}

(102) γ rays are in nature
(a) magnetic waves (b) mechanical waves
(c) longitudinal waves (d) electromagnetic waves

(103) The intensity of γ–rays in air, follows
(a) Lenz law (b) Faraday's law
(c) inverse square law (d) Ampere's law

(104) Fluorescence is the property of absorbing radiant energy of
(a) low frequency (b) high frequency
(c) both a and b (d) none of these

(105) The no. of ions pair produced by Beta particle in air are.
(a) 10^4 (b) 10^9
(c) 10^2 (d) 1

(106) At intermediate energies the dominant process is called
(a) Compton effect (b) Pair production
(c) Photoelectric effect (d) all of these

(107) At higher energy more than 1.02 MeV the dominant process is called
(a) Compton effect (b) Pair production
(c) Photoelectric effect (d) all of these

(108) The intensity I_0 of a beam after passing through a distance x in the medium is reduced to intensity I is given by
(a) $I = I_o e^{-\mu x}$ (b) $I_o = I e^{-\mu x}$
(c) $I = I_o e^{-\mu}$ (d) $I_o = I / e^{-\mu x}$

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(109) Gamma rays emitted from radioactive element have speed: **LHR-2021 (G-I)**
(a) 1×10^7 ms^{-1} (b) 1×10^8 ms^{-1}
(c) 3×10^8 ms^{-1} (d) 4×10^{19} ms^{-1}

(110) Alpha particle carries a charge of: **LHR-2022 (G-I)**
(a) +2e (b) –2e
(c) +e (d) Zero

(111) Beam of electrons is also called: **LHR-2022 (G-I)**
(a) X-rays (b) Alpha rays
(c) Gamma rays (d) Cathode rays

(112) A gamma radiation has an energy of the order of **GRW-2022 (G-I)**
(a) 1 MeV (b) 1keV
(c) 100 eV (d) 1eV

ENTRY TEST MCQS

(113) Which of the following is in the increasing order for penetrating power?
(a) γ, β, α **(b)** γ, α, β
(c) β, α, γ **(d)** α, β, γ

Topic 21.7:

Radiation Detectors

(114) Which of the following is a radiation detector
(a) Wilson cloud chamber **(b)** Geiger Muller counter
(c) Solid state detector **(d)** all of these

(115) A Wilson cloud chamber uses
(a) super heated liquid **(b)** vapors
(c) super saturated vapors **(d)** saturated vapors

(116) Geiger counter is a device to detect
(a) mass of the particles **(b)** momentum of radiation
(c) nuclear radiation **(d)** charge on radiation

(117) Geiger counter is widely used in
(a) optical experiments **(b)** laser experiments
(c) mechanical experiments **(d)** radioactivity experiments

(118) A solid state detector is a specially designed
(a) p-n junction **(b)** p-n-p junction
(c) amplifier **(d)** n-p-n junction

(119) In G.M counter the positive ions take time to reach the cathode is
(a) 10^{-2}sec **(b)** 10^{-4}sec
(c) 10^{-3}sec **(d)** 10^{-1}sec

(120) The potential difference between the top and bottom of a cloud chamber is of the order of
(a) 7 kV **(b)** 10kV
(c) 1kV **(d)** 4kV

(121) In Wilson cloud chamber the alpha particles leave
(a) thick tracks **(b)** straight tracks
(c) continuous tacks **(d)** all of these

(122) Geiger counter is not suitable for
(a) slow counting **(b)** fast counting
(c) average counting **(d)** none of these

(123) Geiger counter can be used to determine the
(a) range of particles **(b)** penetrating power of ionization particles
(c) both a and b **(d)** absorption of ionizing article

(124) Wilson cloud chamber is used for
(a) accelerating positively charged particles **(b)** accelerating negatively charged particles
(c) making path of ionizing particle visible **(d)** all of these

(125) In G.M counter, the counter which provides the power is called
(a) vector **(b)** resistor
(c) scalar **(d)** amplifier

(126) Quenching gas used in G.M counter is
(a) Nobel gas **(b)** Bromine
(c) Argon **(d)** Neon

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(127) The dead time of G.M counter is: LHR-2021 (G-I)

(a) 10^{-3}s (b) 10^{-4}s
(c) 10^{-6}s (d) 10^{-8}s

(128) A device that shows the visible path of ionizing particle is called **DGK-2017 (G-I)**
(a) GM counter (b) solid state detector
(c) scalar (d) Wilson cloud chamber

(129) The dead time of G.M counter is **DGK-2022 (G-II)**
(a) 10^{-3} second (b) 10^{-4} second
(c) 10^{-6} second (d) 10^{-8} second

(130) The dead time of G.M tube is ________. **RWP-2022 (G-II)**
(a) 10^{-3} sec (b) 10^{-6} sec
(c) 10^{-4} sec (d) 10^{-8} sec

ENTRY TEST MCQS

(131) Quenching gas used in G.M counter is
(a) Bromine (b) Helium
(c) Neon (d) All of these

Topic 21.8:

Nuclear Reactions

(132) Mass of $_1^1H$ is
(a) 1.0078 u (b) 16.999u
(c) 4.000u (d) 14.00034 u

(133) Rutherford performed an experiment on the nuclear radiation in
(a) 1900 (b) 1918
(c) 1926 (d) 1912

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(134) In the reaction $X + {}_8^{17}O \rightarrow {}_7^{14}N + {}_2^4H_e$, X is: **RWP-2019 (G-I)**
(a) $_1^1H$ (b) $_1^2H$
(c) $_1^0e$ (d) $_{-1}^0e$

(135) When nitrogen is bombarded by alpha particle, then nitrogen nuclie change into _____nuclei: **BWP-2017 (G-I)**
(a) oxygen (b) carbon
(c) helium (d) beryllium

ENTRY TEST MCQS

Topic 21.9:

Nuclear Fission

(136) The reaction in which a heavy nucleus splits into two nuclei is called
(a) nuclear fusion reaction (b) nuclear fission reaction
(c) both a and b (d) chemical reaction

(137) During the fission reaction the amount of energy released per nucleon is about
(a) 0.9MeV (b) 7.7MeV
(c) 28MeV (d) 200MeV

(138) The types of reactors are
(a) 2 (b) 3

(c) 4 **(d)** 5

(139) In which of the following process are neutron emitted?

(a) inverse beta decay **(b)** nuclear fission
(c) spontaneous fission **(d)** nuclear fusion

(140) Who invented nuclear fission?

(a) Rutherford **(b)** Otto Hahn
(c) Hans Bethe **(d)** Marie Curie

(141) If the mass of uranium is much greater than the critical mass, then the chain reaction proceeds at a

(a) rapid speed **(b)** slow speed
(c) random speed **(d)** negligible speed

(142) The most important and vital part of a reactor is called

(a) core **(b)** moderator
(c) condenser **(d)** turbine

(143) The moderator used in nuclear reactor is

(a) aluminium **(b)** sodium
(c) carbon **(d)** none of these

(144) The temperature of the core of nuclear reactor rises to about

(a) 300°C **(b)** 1200°C
(c) 500°C **(d)** 1300°C

(145) The mass of uranium in which one neutron, out of all neutrons produced in one fission reaction produces further fission reactions is called

(a) atomic mass **(b)** terminal mass
(c) critical mass **(d)** none of these

(146) In nuclear reactors the heavy water used as

(a) heat transfer **(b)** moderator
(c) coolant source **(d)** all of these

(147) In fast reactors which of the following is used as fuel

(a) U=238 **(b)** U-239
(c) Pu-239 **(d)** Np-239

(148) The reactor in which neutrons slowed down to thermal energy to produce further fission is called

(a) fast reactor **(b)** thermal reactor
(c) power reactor **(d)** slow reactor

(149) In Karachi nuclear power plant, which of the following used as a moderator

(a) cadmium rods **(b)** heavy water
(c) boron rods **(d)** graphite rod

(150) The core of fast reactors consist of a mixture of

(a) plutonium **(b)** uranium dioxide
(c) both a and b **(d)** none of these

PAST PAPER MCQS

(151) The average number of neutrons produced per fission of uranium-235 atom is. **GRW-2022 (G-I)**

(a) 2.5 **(b)** 3
(c) 2 **(d)** 4

(152) Which of the following is not needed in fast nuclear reactor? **GRW-2022 (G-II)**

(a) Moderator **(b)** Control rods
(c) Turbine **(d)** Heat exchanger

(153) The moderator used in a nuclear reactor is. **MTN-2022 (G-II)**
(a) aluminum **(b)** sodium
(c) calcium **(d)** graphite

(154) Energy given out per nucleon per fission of heavy element like uranium is: **LHR-2022 (G-II)**
(a) 200 MeV **(b)** 208 MeV
(c) 5 MeV **(d)** 0.9 MeV

(155) The average number of neutrons produced per fission of uranium-235 atom is. **GRW-2022 (G-I)**
(a) 2.5 **(b)** 3
(c) 2 **(d)** 4

(156) Which of the following is not needed in fast nuclear reactor? **GRW-2022 (G-II)**
(a) Moderator **(b)** Control rods
(c) Turbine **(d)** Heat exchanger

(157) Slow neutron can cause fission in **DGK-2022 (G-I)**
(a) Uranium-235 **(b)** Uranium-238
(c) Neptonium **(d)** Lithium

(158) Slow Neutrons can cause Fission in. **BWP-2022 (G-I)**
(a) Uranium - 235 **(b)** Uranium - 238
(c) Plutonium - 239 **(d)** Thorium – 234

(159) Which of the following is used as moderator is nuclear reactor? **RWP-2022 (G-I)**
(a) heavy water **(b)** boron
(c) cadmium **(d)** aluminum

(160) Slow neutrons can cause fission in _______. **RWP-2022 (G-II)**
(a) uranium-238 **(b)** uransium-235
(c) neptunium **(d)** lithium

ENTRY TEST MCQS

(161) Which of the following isotopes is normally fissionable?
(a) ${}^{238}_{92}U$ **(b)** ${}^{239}_{93}Np$
(c) ${}^{235}_{92}U$ **(d)** ${}^{4}_{2}He$

Topic 21.10:

Fusion Reaction

(162) Such reaction in which two light nuclei merge to form a heavy nucleus is called
(a) fusion reaction. **(b)** fission reaction
(c) emission reaction **(d)** diffusion reaction

(163) The sun is composed primarily of
(a) aluminium **(b)** hydrogen
(c) plutonium **(d)** carbon

(164) In sun the energy is released due to fusion reaction called
(a) p-reaction **(b)** n-reaction
(c) p-p reaction **(d)** p-n reaction

(165) The temperature at the surface of the sun is
(a) 7000 degree Celsius **(b)** 5 million degree Celsius
(c) 3400 degree Celsius **(d)** 6000 degree Celsius

(166) In p-p chain reaction the amount of energy given out is

(a) 200MeV **(b)** 25.7MeV
(c) 1MeV **(d)** 6.4 MeV

(167) In p-p chain reaction the amount of energy obtained per nucleon is
(a) 200MeV **(b)** 25.7MeV
(c) 1MeV **(d)** 6.4 MeV

(168) The number of protons take part in nuclear reaction of sun are
(a) 4 **(b)** 6
(c) 2 **(d)** 3

PAST PAPER MCQS

(169) The temp. of core of sun is about **DGK-2022 (G-II)**
(a) 50 M ºC **(b)** 40 M ºC
(c) 20 M ºC **(d)** 10 M ºC

ENTRY TEST MCQS

(170) Which of the following is a fusion reaction?
(a) ${}_0n^1 + {}_7N^{14} \longrightarrow {}_6C^{14} + {}_1H^1$ **(b)** ${}_1H^3 \longrightarrow {}_2He + {}_1B^0$
(c) ${}_1H^2 + {}_1H^2 \longrightarrow {}_2He^4$ **(d)** None of these

Topic 21.11:

Radiation Exposure

(171) The cosmic radiation consists of
(a) high energy particles **(b)** electromagnetic radiation
(c) both a & b **(d)** low energy charged particles

(172) A smoker inhales
(a) toxic smoke **(b)** hazardous radiation
(c) both a & b **(d)** none of these

ENTRY TEST MCQS

(173) Example of somatic effects are:
(a) Skin burn **(b)** Loss of hair
(c) Drop in the white blood cells **(d)** All of these

Topic 21.12:

Biological Effects of Radiation

(174) 1 rem =
(a) 0.01 Sv **(b)** 0.09 Sv
(c) 1.01Sv **(d)** 0.0001Sv

(175) 1 Sv =
(a) 1 Gy × RBE **(b)** 2 Gy × RBE
(c) 1 Gy/RBE **(d)** RBE/1 Gy

(176) The effect of radiation on a body absorbing it relates to a quantity called
(a) radiated dose **(b)** absorbed dose
(c) ionized dose **(d)** integrated dose

(177) Doses of __________ will cause radiation burns to the skin
(a) 2Sv **(b)** 3Sv
(c) 4Sv **(d)** 5Sv

(178) 1 Curie is equal to __________ disintegration per second
(a) 3.7×10^{10} **(b)** 5.7×10^{10}

(c) 3.7×10^{20} (d) 3.7×10^{13}

(179) Absorbed dose is defined as

(a) D = E/m **(b)** D = m/ E
(c) D = Em **(d)** D = 1/mE

(180) 1 rad is equal to

(a) 0.01 Gy **(b)** 0.09 Gy
(c) 1.01 Gy **(d)** 0.001 Gy

(181) An old unit, the rem is equal to

(a) 0.1 Sv **(b)** 0.01 Sv
(c) 1Sv **(d)** none of these

PAST PAPER MCQS

(182) The S.I. unit of radiation dose is **GRW-2019 (G-II)**

(a) roentgen **(b)** curie
(c) grey **(d)** rem

(183) 1 rem is equal to: **MTN-2019, 2022 (G-I)**

(a) 0.1 Sv **(b)** 0.01 Sv
(c) 10 Sv **(d)** 100 Sv

(184) Absorbed Dose is defined as. **BWP-2022 (G-I)**

(a) M × E **(b)** $\frac{M}{E}$
(c) $\frac{E}{M}$ **(d)** $\frac{E}{C}$

ENTRY TEST MCQS

(185) What is the absorbed dose D of a sample of 2 kg which is given an amount of 100 J of radioactive energy?

(a) 200 Gy **(b)** 50 Gy
(c) 102 Gy **(d)** 98 Gy

Topic 21.13:

Biological and Medical Uses of Radiation

(186) Radioactive iodine can be used to check person's ______ is working properly

(a) cancer **(b)** skin cancer
(c) lungs **(d)** thyroid gland

(187) cobalt-60 is used for treatment of

(a) cancer **(b)** kidneys
(c) lungs **(d)** thyroid

(188) The gamma rays radiographs are used in

(a) agriculture used **(b)** medical diagnosis
(c) support industry **(d)** all of these

(189) Which of the following has high energy

(a) gamma radiation **(b)** alpha radiation
(c) cosmic radiation **(d)** all of these

(190) Which of the following used in the medical field

(a) tracers **(b)** G.M counters
(c) Solid state detectors **(d)** all of these

(191) Phosphorus-32 is used for

(a) blood cancer **(b)** skin cancer
(c) bone cancer **(d)** all of these

PAST PAPER MCQS

(192) In radiation therapy, the thyroid cancer treatment is done with **GRW-2022 (G-II)**
(a) Sodium-24 (b) Iodine-131
(c) Carbon-14 (d) Cobalt-60

(193) Iodine – 131 is used for the treatment of: **MTN-2019 (G-II)**
(a) Thyroid glands (b) Bones
(c) Lungs (d) Eyes

(194) In radiation therapy, the thyroid cancer treatment is done with _______GRW-2022 (G-II)
(a) sodium - 24 (b) iodine - 131
(c) carbon - 14 (d) cobalt – 60

(195) Radio therapy is generally done with γ-rays emitted from **DGK-2022 (G-I)**
(a) Sodium-24 (b) Cobalt-60
(c) Iodine-131 (d) Stronium-90

ENTRY TEST MCQS

(196) Various types of cancer are treated by _____________
(a) Cobalt-60 (b) Strontium-90
(c) Carbon-14 (d) Nickel-63

Topic 21.14:

Basic Forces Of Nature

(197) The weak nuclear force is of
(a) long range (b) short range
(c) no range (d) none of these

(198) Electromagnetic and weak forces were unified by
(a) Weinberg (b) Glashow
(c) Abdus Salam (d) Faraday and Maxwell

(199) Dr. Abdus Salam was awarded noble prize in
(a) 1979 (b) 1987
(c) 1969 (d) 1962

(200) The electromagnetic force is
(a) short range (b) long range
(c) moderate range (d) no range

PAST PAPER MCQS

(201) The force which is responsible for the breaking up of the radioactive elements is: **GRW-2019 (G-I)**
(a) strong nuclear force (b) gravitational force
(c) electromagnetic force (d) weak nuclear force

(202) The particles which do not experience strong nuclear force are called: **MTN-2019 (G-II)**
(a) Hadrons (b) Baryons
(c) Leptons (d) Mesons

ENTRY TEST MCQS

(203) Nuclear forces exist between _____________
(a) Proton-proton (b) Proton-neutron
(c) Neutron-neutron (d) All of the above

Topic 21.15:

Building Blocks of Matter

(204) Subatomic particles are divided in
(a) 2 groups (b) 3 groups
(c) 4 groups (d) 5 groups

(205) The particles that experience the strong nuclear force are
(a) quarks (b) leptons
(c) hadrons. (d) positrons

(206) The types of quarks are
(a) 2 (b) 4
(c) 6 (d) 5

(207) A pair of quark and anti quark is called
(a) leptons (b) baryons
(c) mesons (d) quarks

(208) The particles lighter than protons are called
(a) leptons (b) baryons
(c) mesons (d) quarks

(209) Which of the following are leptons
(a) electron (b) muons
(c) neutrinos (d) all of these

(210) The particles equal in mass or greater than mass of protons are called
(a) leptons (b) baryons
(c) mesons (d) quarks

(211) The particles which do not experience strong nuclear force
(a) electrons (b) muons
(c) neutrons (d) both a and b

(212) Three quarks make up a
(a) lepton (b) baryon
(c) meson (d) quark

PAST PAPER MCQS

(213) Types of quark are: **LHR-2017 (G-I)**
(a) 2 (b) 4
(c) 6 (d) 8

(214) A pair of quark and antiquark make a: **GRW-2019 (G-I)**
(a) meson (b) hadron
(c) lepton (d) baryon

(215) A pair of quark and anti quark makes a; **MIRPUR (AJK) 2017**
(a) proton (b) neutron
(c) electron (d) meson

(216) Which group belongs to Hadrons? **FSD-2019 (G-I)**
(a) Protons and neutrons (b) Mesons and neutrons
(c) Photons and electrons (d) Positrons and electrons

(217) Which pair belongs to hadrons **DGK-2017 (G-I)**
(a) protons and neutrons (b) neutrons and electrons
(c) photons and electrons (d) positrons and electrons

(218) Which pair of particles belongs to the hadrons: **BWP-2017 (G-I)**
(a) photons and electrons (b) positron and electrons
(c) protons and neutrons (d) photons and positrons

(219) Subatomic particles are divided into: **MTN-2019 (G-I)**
(a) Six group **(b)** Five groups
(c) Four groups **(d)** Three groups

(220) Charge on up down and strange combination of quark is: **MTN-2022 (G-II)**
(a) e **(b)** –e
(c) 0 **(d)** 2e

(221) Two quark combination forms: **LHR-2022 (G-II)**
(a) Mesons **(b)** Baryons
(c) Leptons **(d)** No composite particle

(222) Electrons are **BWP-2022 (G-II)**
(a) Hadron **(b)** Leptons
(c) Quarks **(d)** Baryons

ENTRY TEST MCQS

(223) The quark named strange (s) having the charge of
(a) + 2/3 **(b)** –2/3
(c) + 1/3 **(d)** – 1/3

ANSWER KEYS

(Topical Multiple Choice Questions)

1	A	21	B	41	C	61	B	81	A	101	B	121	D	141	A	161	C	181	B	201	D	221	A
2	B	22	B	42	D	62	A	82	C	102	D	122	B	142	A	162	A	182	C	202	C	222	B
3	D	23	A	43	D	63	A	83	C	103	C	123	C	143	C	163	B	183	B	203	D	223	D
4	C	24	C	44	A	64	B	84	C	104	B	124	C	144	C	164	C	184	C	204	B		
5	D	25	B	45	C	65	B	85	D	105	C	125	C	145	C	165	D	185	B	205	C		
6	A	26	C	46	C	66	D	86	C	106	A	126	B	146	B	166	B	186	D	206	C		
7	B	27	B	47	D	67	D	87	D	107	B	127	B	147	A	167	D	187	A	207	C		
8	C	28	A	48	B	68	A	88	C	108	A	128	D	148	B	168	B	188	B	208	C		
9	B	29	C	49	D	69	A	89	B	109	C	129	B	149	B	169	C	189	C	209	D		
10	A	30	B	50	A	70	B	90	B	110	A	130	C	150	C	170	C	190	A	210	B		
11	A	31	B	51	B	71	D	91	B	111	D	131	A	151	A	171	C	191	B	211	D		
12	A	32	B	52	A	72	A	92	C	112	A	132	A	152	C	172	C	192	B	212	B		
13	D	33	D	53	A	73	B	93	C	113	D	133	B	153	D	173	D	193	A	213	C		
14	C	34	B	54	B	74	C	94	D	114	D	134	A	154	A	174	A	194	B	214	A		
15	D	35	A	55	C	75	C	95	D	115	C	135	A	155	A	175	A	195	B	215	D		
16	B	36	C	56	C	76	A	96	C	116	C	136	B	156	C	176	B	196	A	216	A		
17	C	37	D	57	A	77	C	97	D	117	D	137	A	157	A	177	B	197	B	217	A		
18	C	38	C	58	A	78	B	98	D	118	A	138	A	158	A	178	A	198	D	218	C		
19	B	39	C	59	A	79	A	99	A	119	B	139	B	159	A	179	A	199	A	219	D		
20	D	40	B	60	B	80	A	100	D	120	C	140	C	160	B	180	A	200	B	220	C		

KIPS TOPICAL SHORT QUESTIONS

21.1 ATOMIC NUCLEUS

(1) Find the number of neutrons and protons in ${}^{238}_{92}U$

Ans: In ${}^{238}_{92}U$

A = 238 and Z = 92

N = ?

No. of protons = ?

As N = A-Z

$\Rightarrow$ N = 146

and No. of protons = Z = 92

PAST PAPER SHORT QUESTIONS

(1) Why are heavy nuclei unstable?
LHR-2021 (G-I&II), MTN-2022 (G-I&II), DGK-2022 (G-II), BWP-2022 (G-I), RWP-2022 (G-I)

(2) Heavy nuclei are unstable. Why? **LHR-2022 (G-I)**

(3) Show that IU = 931MeV **MTN-2022 (G-II)**

(4) Why are heavy nuclear unstable? Explain briefly **DGK-2022 (G-I)**

(5) What will be resultant neutron is absorbed in and particle emitted? **MTN-2022 (G-I)**

21.2 ISOTOPES

(6) What are isotopes? Write some uses of isotopes? LHR-2012

Ans: Isotopes are such nuclei of an element that have the same charge number Z, but have different mass number A. The nucleus of such as element has same number of protons but the number of neutrons are different.

USES:

Circulation of blood:

A similar method can be used to study the circulation of blood using radioactive isotope sodium –24.

Radioactive iodine-131

It is used to combat cancer of the thyroid gland. Since iodine tends to collect in the thyroid gland, radioactive isotopes lodge where they can destroy the malignant cells.

Skin Cancers:

For skin cancers, phoshorous-32 or strontium-90 may be used. These produce β-radiation.

PAST PAPER SHORT QUESTIONS

(7) Define the term "Isotopes" and give one example. Write some uses.
LHR-2012, GRW-2019 (G-II)

(8) Describe a brief account of interaction of various types of radiations with matter.
MIRPUR (AJK) 2017

(9) How can you use a magnetic field to separate isotopes of chemical element? **BWP-2022 (G-I)**

21.3 MASS DEFECT AND BINDING ENERGY

(10) Which element has maximum binding energy per nucleon value and what this value is?

Ans: Iron having the greatest value of binding energy per nucleon and its value is 8.8 MeV.

(11) Define mass defect and binding energy.

Ans: **Mass defect:**

The mass of the nucleus is always less than the totals mass of the protons and neutron that make up the nucleus. The difference of the two masses is called mass defect.

Binding energy:

The missing mass is converted to energy in the formation of the nucleus and is called the binding energy. The energy required to break a nucleus into its constituent particles (Protons + neutrons).

(12) How much energy is released when 1 amu is converted into energy? GRW-2014

OR

By using $E = \Delta mc^2$, show that $1.66\times10^{-27}\,kg = 931\,Mev$. GRW-2013

Ans: By using $E = mc^2$

When 1 amu is converted into energy

$E = 1.66 \times 10^{-27} \times (3\times10^8)^2$ joule

$= 1.49 \times 10^{-10}$ joule

$$= \frac{1.49\times10^{-10}}{1.6\times10^{-19}}\,eV$$

$$= \frac{1.49}{1.6}\times10^{9}$$

$$= 0.93125\times10^{9}$$

Divide and multiply by mega ($1M=10^6$)

= 931MeV is released.

PAST PAPER SHORT QUESTIONS

(13) Define mass defect and binding energy.
LHR-2012, GRW-2014, 2019 (G-I), SWL-2016, DGK-2016 (G-I & G-II), 2017 (G-I), BWP-2019 (G-II), LHR-2021 (G-I), BWP-2022 (G-II),

(14) Define the terms "mass defect" and "binding energy". **GRW-2022 (G-II)**

(15) What is B.E curve? In which part of the curve Binding energy maximum?**MTN-2022 (G-II)**

(16) What is the mass defect? **BWP-2022 (G-II)**

21.4 RADIOACTIVITY

(17) Rn^{222} decays to a new element 'y' by two alpha and two β-emissions. What you can say about new element?

Ans: After the emission of two alpha particles

$$_{86}Rn^{222} \longrightarrow {}_{82}Y^{214} + 2\left({}_{2}He^{4}\right)$$

After two β-emissions

$$_{82}Y^{214} \longrightarrow {}_{84}Y^{214} + 2\left({}_{-1}e^{0}\right)$$

Hence, new element will be $_{84}Y^{214}$.

(18) What is the use of α, β and γ-radiation?

Ans: **α-particles**

They are used to treat skin cancer because their penetrating power is small.

β-particles

They are used to treat the tumors under the skin due to their large penetration power

γ-particles

They are used to treat the infection in interior parts of the body clue to their longest penetration power.

(19) What do you understand by background radiation? State two sources of this radiation.

Ans: The radiations present in the space near a radioactive radiation detector such as Geiger tube are called back ground radiations

Following are the two sources of this radiation.

a. The cosmic rays entering the earth from the upper atmosphere along with the sunlight.

b. The presence of radioactive materials in the upper atmosphere or the presence of radioactive wastes of nuclear reactors etc.

(20) What is the difference between an electron and β-particles?

Ans: β-particle is negatively charged particle emitted from the nucleus of radioactive element. An electron is negatively charge particle which revolves around the nucleus.

(21) How do γ rays differ from X-rays?

Ans: **(i)** X-rays are produced by stopping high energy electrons on heavy metals such as tungsten. γ-rays are produced of radioactive decay of nuclei.

(ii) Spectrum of X-ray is continuous for a certain range of wavelength depending upon the voltage of X-ray tube.

Spectrum of γ-rays is discrete or line spectrum with wavelength depending upon the nature of radioactive nuclide.

(22) $^{139}_{56}$Ba emits a β-particle and lanthanum La is formed. Write its nuclear reaction.

LHR-2014

Ans: $^{139}_{56}\text{Ba} \rightarrow {}^{139}_{57}La + {}^{0}_{-1}e$

PAST PAPER SHORT QUESTIONS

(23) If $^{233}_{92}U$ decays twice by α-emission, what is the resulting isotope? **BWP-2022 (G-I)**

(24) How can radioactivity help in the treatment of cancer? **RWP-2022 (G-II)**

21.5 HALF LIFE

(25) After four half-lives, what %age of an element remains?

Ans: No. of atoms left behind after four half-lives $= \left(\frac{1}{2}\right)^n N_o = \left(\frac{1}{2}\right)^4 N_o = \frac{1}{16} N_o$

% age of sample $= \frac{N_o/16}{N_o} \times 100 = 6.25\%$

(26) What fraction of a radioactive sample decays after two half lives have elapsed?

Ans: Let N_o be the original number of radioactive atom at any instant then

Number of atoms decayed after first half life T = $T_{1/2} = \frac{1}{2} N_o$

Number of atoms decayed after 2nd half life = $2T_{1/2} = \frac{1}{2}\ \frac{1}{2} N_o = \frac{1}{4} N_o$

Total number of atoms decayed after two half-lives = $\frac{1}{2}\ N_o + \frac{1}{4} N_o$

$$\text{Fractional of sample decayed} = \frac{\frac{3}{4}N_o}{N_o} \times 100 = \frac{3}{4} \times 100$$

$$= 75\ \%\ \text{Ans}$$

Note:- (25% will be left undecayed).

(27) Define half life of radioactive element.

Ans: The half life $T_{1/2}$ of a radioactive element is that period in which half of the atoms of this parent element decay.

Half- life can be given as:

$$T_{1/2} = 0.693/\lambda$$

Where λ is called decay constant depends upon nature of material.

(28) What do you mean by decay constant of an element? Give its unit.

Ans: **Decay Constant "λ"**

Fraction of the decaying atoms per unit time is called decay constant

$$\lambda = \frac{-\frac{\Delta N}{N}}{\Delta t}$$

OR "Activity per unit time is called decay constant."

S.I Unit is per second $\equiv s^{-1}$

PAST PAPER SHORT QUESTIONS

(29) Define half life of a radioactive element and write its formula. **SGD-2015 (G-II), 2017 (G-I)**

(30) Define radioactivity and half-life. **SGD-2017 (G-II)**

(31) What fraction of a radioactive sample decays after two half-lives has elapsed? **RWP-2014, 2016 (G-I), MIRPUR (AJK) 2017, GRW-2022 (G-I)**

(32) What fraction of radioactive sample decays after two half lives have elapsed? **BWP-2012, MTN-2012, 2015 (G-II), SWL-2016, DGK-2014, 2015, 2017 (G-II)**

(33) Define decay constant and write its unit. **SWL-2019**

21.6 INTERACTION OF RADIATION WITH MATTER

(34) How do alpha and beta ionize an atom?

Ans: Alpha does ionize an atom by coulomb's attraction, and beta does ionize an atom by coulomb's repulsion.

(35) What is fluorescence? **SWL-2013**

Ans: Fluorescence is the property of absorbing radiant energy of the high frequency and re-emitting energy of low frequency in the visible region of electromagnetic spectrum.

PAST PAPER SHORT QUESTIONS

(36) Explain how α and β particles may ionize an atom without directly hitting the electrons. What is the difference in the action of the two particles for producing ionization? **LHR-2017 (G-I)**

(37) A particle which produces more ionization is less penetrating. Why? **FSD-2012, 2014, MIRPUR (AJK) 2015, SGD-2012, 2013, 2017 (G-I & G-II), LHR-2022 (G-I), MTN**

(38) If someone accidently swallows an α-source and a β-source, which would be the money dangerous to him? Explain why? **GRW-2022 (G-I)**

(39) If U decays twice by α-emission, what is the resulting isotope? **GRW-2022 (G-I), FSD-2022 (G-I)**

(40) If you swallowed an α-source and a β-source, which would be the more dangerous to you? Explain why? **GRW-2022 (G-I), BWP-2022 (G-I)**

(41) Explain how α and β-particles may ionizer an atom an atom without directly hittings the electron? **DGK-2022 (G-II)**

(42) If someone accidently swallows an α-source and a β-source which would be more dangerous to him? **DGK-2022 (G-II)**

(43) What do you understand by Background Radiation? State two sources of this radiation **BWP-2022 (G-II)**

21.7 RADIATION DETECTORS

(44) For what purpose, alcohol or bromine is mixed with principal gas in Geiger tube

Ans: When positive ions strike the cathode, secondary electrons are emitted from the surface. These electrons would be accelerated to give further spurious counts. This is prevented by mixing a small amount of quenching (i.e. alcohol or bromine) gas with the principal gas (argon) in Geiger tube.

(45) What do you mean by the "dead time" of a Geiger counter?

Ans: The dead time (10^{-4}s) of Geiger counter is the time during which further incoming particles cannot be counted.

(46) Describe the principle of operation of a solid state detector of ionization radiation in terms of generation and detection of charge carriers. LHR-2017 (G-I)

Ans: A solid state detector is a specially designed p-n Junction, operating under a reversed bias in which electron-hole pairs produced by the incident radiation to cause a current pulse to flow through the external circuit.

(47) Write down two advantages of Solid State Detector. LHR-2019 (G-II)

Ans: Two advantages of Solid State Detector are given as;

1. It is much smaller in size than any other detector.

2. It operates at low voltage.

(48) Briefly give the uses of Wilson Cloud Chamber and G.M. Counter. GRW-2012

Ans: **Wilson Cloud Chamber**

It shows the visible path of an ionizing particle.
For alpha particles, the tracks is thick, straight and continuous.
For beta particles, thin and discontinuous tracks.
For gamma particles, Leave no definite tracks along their path.

G.M. Counter

Geiger counter can be used to determine the range or penetration power of ionizing particles. The reduction in the count rate by inserting metal plates of varying thickness between the source and the tube helps to estimate the penetration power of the incident radiation.

(49) What is meant by quenching? Explain. MTN-2015 (G-II)

Ans: When positive ions strike the cathode secondary electrons are emitted from the surface. These electrons would be accelerated to give further spurious counts. The spurious counts is prevented by mixing a small amount of quenching gas with the principal gas. This process of mixing is called quenching.

PAST PAPER SHORT QUESTIONS

(50) Write down two advantages of Solid-State Detector. **LHR-2019 (G-II), FSD-2022 (G-I)**

(51) What do you mean by dead time in Geiger-Muller Counter? **LHR-2022 (G-II)**

(52) Define fluorescence. **DGK-2022 (G-I)**

(53) Define self-quenching. **RWP-2022 (G-I)**

21.8 & 21.9 NUCLEAR REACTIONS & NUCLEAR FISSION

(54) Briefly explain how heat is produced in a nuclear reactor?

Ans: The eq. of fission reaction of U-235 is written as:

$$^{235}_{92}U + ^{1}_{0}n \longrightarrow ^{141}_{56}Ba + ^{92}_{36}Kr + 3^{1}_{0}n + Q$$

Where Q is the amount of energy released and it is nearly equal to 200 Mev. This energy is appeared in the form of heat.

(55) Why does water is used to slow down the neutrons rather than lead?

Ans: When neutrons collide with lead nuclei, they are bounced back. While lead atoms remain at rest due to their greater mass. But, in case of water, collision b/w neutrons and hydrogen nuclei, present in water is perfectly elastic. In this collision, neutrons are slowed down, while proton starts moving.

Hence, water may be used efficiently to slow down the neutrons rather than lead.

(56) What is the principle of Nuclear Reactor?

Ans: The environment of fissioning nuclei is controlled in such a way that only one neutron out 2.5 neutrons released on the average is used to induce fission in another atom. In this way, the rate of energy generation is maintained at a constant level. Thus, controlled chain reaction is the principle of nuclear reactor.

(57) What is fission chain reaction?

Ans: We know that when $^{235}_{92}U$ absorbs a neutron, it breaks into two nuclei almost of equal masses along with two or three neutrons and release or energy. This fission reaction can be maintained continuously by proper use of the neutrons emitted during fission reaction of $^{235}_{92}U$. Such a process is called Fission chain reactions.

(58) What are the main parts of nuclear reactor?

Ans: A reactor usually has four important parts. These are:

- Core
- Moderators
- Heavy water
- Control rods

(59) What are "thermal reactors". SGD-2012

Ans: The thermal reactors are called "thermal" because the neutrons must be slowed down to "thermal energies" to produce further fission. They use natural uranium or slightly enriched uranium as fuel. Enriched uranium contains a greater percentage of $^{235}_{92}U$ than natural uranium does. There are several designs of thermal reactors.

(60) What is the function of moderators in a nuclear reactor? GRW-2016 (G-I)

Ans: **Moderators:**

The fuel rods are placed in a substance of small atomic weight, such as water, heavy water, carbon or hydrocarbon etc. These substances are called moderators. The function of these moderators is to slow down the speed of the neutrons produced during the fission process and to direct them towards the fuel. Heavy water is used as a moderator in nuclear reactor.

(61) What do you mean by critical mass and critical volume? RWP-2013

Ans: Such a mass of uranium in which one neutron, out of all the neutrons produced in one fission reaction, produces further fission is called critical mass.

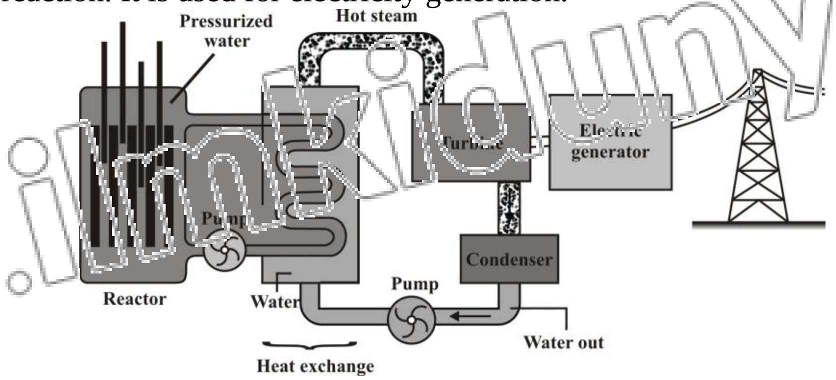
The volume of this mass of uranium is called critical volume.

(62) Explain the working of control rods in a nuclear reactor. SGD-2016 (G-I)

Ans: The control rods, made of cadmium or boron are moved in or out of the reactor core to control the neutrons that can initiate further fission reaction. In case of emergency for repair purposes control rods are allowed to fall back into the reactor and this stops the chain reaction and shuts down the reactor.

(63) What is used of nuclear reactor and draw its diagram? **SWL-2019**

Ans: Nuclear reactor is a device which is used to initiate and control a self-sustained nuclear chain reaction. It is used for electricity generation.



PAST PAPER SHORT QUESTIONS

(64) What do mean by term "Critical mass".
LHR 2012, 2013, GRW-2012, 2013, 2016 (G-I), 2019 (G-II), FSD-2022 (G-I, II)

(65) Distinguish between nuclear fission and fusion reaction **DGK-2017 (G-I)**

(66) What is use of nuclear reactor and draw its diagram? **SWL-2019**

(67) What factor make a fusion reaction difficult to achieve? **LHR-2022 (G-II)**

(68) What are the functions of "moderator" and "control rods" in a nuclear reactor? **GRW-2022 (G-II)**

(69) What is Chain Reaction? **MTN-2022 (G-II)**

(70) Define nuclear reactor also write down two main types of reactor. **DGK-2022 (G-I)**

(71) Discuss the advantages and disadvantages of nuclear power as compare to the use of fossil fuel generate power. **DGK-2022 (G-I)**

(72) What fraction of a radioactive sample Decays after two half-lives have elapsed? **BWP-2022 (G-I)**

(73) Distinguish between a thermal reactor and a fast reactor. **RWP-2022 (G-I)**

(74) Define nuclear fission and nuclear fusion. **RWP-2022 (G-II)**

21.10 FUSION REACTION

(75) Why it is more difficult to start a fusion reaction rather than fission reaction?

Ans: Because, in bringing two nuclei closer to each other, great work has to be done against repulsive forces of nuclei. Hence, more energy is needed. On the other hand fission may be proceeded with slow neutrons.

(76) What is fusion reaction?

Ans: "Such a nuclear reaction in which two light nuclei merge to form a heavy nucleus is called fusion reaction"

(1) When two deuterons are merged to form a helium nucleus, 24 MeV energy is released during this process i.e,

$$^{2}_{1}H + ^{2}_{1}H \longrightarrow ^{4}_{2}He + 24\,MeV$$

(2) If $^{2}_{1}H$ and $^{3}_{1}H$ are forced to fuse then 17.6 MeV energy is obtained i.e.,

$$^{2}_{1}H + ^{3}_{1}H \longrightarrow ^{4}_{2}He + ^{1}_{0}n + 17.6\,MeV$$

(77) Distinguish between nuclear fission and fusion reaction

Ans:

Nuclear fission reaction	Nuclear Fusion reaction
"Such a reaction in which a heavy nucleus like that of uranium splits up into two nuclei of roughly equal size along with the	"Such a nuclear reaction in which two light nuclei merge to form a heavy nucleus is called fusion reaction"

emission of energy during the reaction is called fission reaction”	
${}^{235}_{92}U + n^1_0 \longrightarrow {}^{141}_{56}Ba + {}^{92}_{36}Kr + 3{}^1_0n + Q$	${}^2_1H + {}^3_1H \rightarrow {}^4_2He + {}^1_0n + 17.6\,MeV$

(78) Describe steps of p-p reactions of nuclear fusion in sun. RWP-2012

Ans: During this process two hydrogen nuclei or two protons fuse to form deuteron. This reaction takes place as

$$ {}^1_1H + {}^1_1H \longrightarrow {}^2_1H + {}^0_1e + \text{Energy} $$

With the fusion reaction of deuteron with proton, ${}^3_2He$ isotope of helium is formed i.e.,

$$ {}^2_1H + {}^1_1H \longrightarrow {}^3_2He + \gamma\text{-radiation} + \text{Energy} $$

In the last stage the two nuclei of ${}^3_2He$ react in the following manner

$$ {}^3_2He + {}^3_2He \longrightarrow {}^4_2He + {}^1_1H + {}^1_1H + \text{Energy} $$

In this reaction six protons take part and finally a helium nucleus and two protons are formed.

PAST PAPER SHORT QUESTIONS

(79) What factors makes a fusion reaction difficult to achieve?
LHR-2021 (G-I), DGK-2022 (G-II), LHR-2022 (G-I), GRW-2022 (G-II), SWL-2017, LHR-2017 (G-I)

(80) Discuss the advantages and disadvantages of fusion power from the point of safety, pollution and resources. **SGD-2017 (G-II)**

(81) In Uranium fission reaction, the estimated energy is where as in fusion P-P Chain reaction 25.7 why fusion is more energetic than fission? **MTN-2022 (G-I)**

21.11 & 21.12 RADIOACTIVE EXPOSURE &BIOLOGICAL EFFECTS OF RADIATION

(82) Define: (a) Curie (b) Becquerel

Ans: **Becquerel**: The strength of the radiation source is indicated by its activity measured in Becquerel (Bq). One Becquerel is one disintegration per second.

Curie: A large unit of radiation is curie (Ci) which equals 3.7×10^{10} disintegrations per second.

(83) What is meant by absorbed dose, also write down the units of absorbed dose?

Ans: It is defined as the energy E absorbed from ionizing radiation per unit mass m of the absorbing body.
The effect of radiation on a body absorbing it relates to a quantity called absorbed dose D.

$$ D = \frac{E}{m} \text{ ----------(1)} $$

Its Si unit is gray (Gy) defined as one joule per kilogram. 1 Gy = $\frac{J}{kg}$

An old unit is rad, an short form for radiation absorbed dose.

1 rad = 0.01Gy.

PAST PAPER SHORT QUESTIONS

(84) What do you understand by background radiations? State two sources of this radiation. **RWP-2022 (G-II), FSD-2022 (G-II), SGD-2017 (G-II), SWL-2017, 2017 (G-I)**

(85) What is meant by absorbed dose, also write down the units of absorbed dose? **SWL-2017**

(86) Define absorbed dose (D) and write its SI units. **MTN-2019 (G-II)**
(87) Define (a) Absorbed dose (b) Gray **GRW-2022 (G-I), FSD-2022 (G-II)**
(88) What do you understand by back ground radiations? State any two sources of radiation. **RWP-2022 (G-II)**

21.13 BIOLOGICAL AND MEDICAL USES OF RADIATION

(89) Give the uses of nuclear radiation in Radiation Therapy.

Ans: USES:

(i) High energy radiations like X-rays and γ-rays can penetrate into human body. They can be focused on the cancerous tumors to destroy them.

(ii) The tumors which are not effectively attacked by γ-rays are treated with neutron therapy.

(iii) Artificial Co-60 is used for treatment of various kinds of cancer. This isotope provides high energy γ-rays.

(iv) Iodine-131 is taken inside the body to treat thyroid cancer the radiation emitted by it destroys the cancerous cells.

(v) Radioactive radon gas in small gold capsule, known as radon seeds, is employed to destroy the cancerous cell.

(90) How a radioisotope be used to determine the effectiveness of fertilizer?

Ans: Radioactive phosphorus or nitrogen used as a tracer in agriculture, provide information about the best fertilizer to supply to a particular crop and soil. Due to their use, varieties of crops such as rice, wheat and cotton have improved. Moreover, plants have shown more resistance to disease and give better yield and grain quality.

(91) How can radioactivity help in the treatment of Cancer?

Ans: Radioactivity & Treatment of Cancer: Cancerous cells are always weak as compared to the normal cells, and hence are destroyed by firing β-radiation or γ-radiation from radioactive source. Sometimes encapsulated "seeds" made from radioactive source are implanted in the malignant tissues for local and short ranged treatment.

For example:

- γ-rays from Co-60 in general
- Iodine–131 for treatment of cancer of thyroid gland.
- Phosphorus–32 or strontium–90 may be used for skin cancers.

PAST PAPER SHORT QUESTIONS

(92) How can radioactivity help in the treatment of cancer?
SGD-2017 (G-I), RWP-2017 (G-I), RWP-2022 (G-I), FSD-2022 (G-I)
(93) Write any two uses of radiography. **FSD-2019 (G-I)**
(94) Differentiate between mass defect and binding energy. **RWP-2022 (G-II)**

21.14 BASIC FORCES OF NATURE

(95) What are the basic forces of nature?

Ans:

i) Gravitational force ii) Magnetic force iii) Electric force
iv) Weak Nuclear force v) Strong nuclear force

PAST PAPER SHORT QUESTIONS

(96) What are the basic forces of nature?

LHR-2017 (G-I), MIRPUR (AJK) 2017, FSD-2022 (G-II)

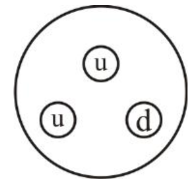
(97) Enlist the basic force of nature. **LHR-2022 (G-I)**

21.15 BUILDING BLOKS OF MATTER

(98) Protons and neutrons are formed what type of quarks? Show by diagram.

Ans: Protons and neutrons are formed of "up" type and "down" type of quarks.

- A proton is formed by two "up" quarks and one "down" quark as shown below.



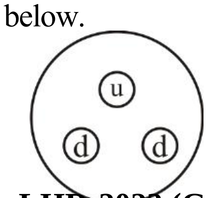
Charge = $\frac{2}{3}e + \frac{2}{3}e - \frac{1}{3}e$

Change = +e

- A neutron is formed by two "down" quarks and one "up" quark as shown below.

Charge = $\frac{2}{3}e - \frac{1}{3}e - \frac{1}{3}e$

Charge = 0



PAST PAPER SHORT QUESTIONS

(99) Differentiate between hadrons and leptons. Also give example of each. **LHR-2022 (G-I)**

(100) Differentiate between Baryons and Mesons. **BWP-2022 (G-I)**

(101) What are quarks? Explain.

Ans: **Quarks:** "A quark is a type of elementary particle carrying a fractional electric charge and a fundamental constituent of matter." Quark is combine to form composite particles caused hadrons.

They come in three generations (d, u), (s, c), (b, t) where

Charge of charm quarks "c" is $= +\frac{2}{3}e$

Charge of "up" quarks "u" is = $+\frac{2}{3}e$

Charge of "top" quark "t" is $= +\frac{2}{3}e$

And charge of strange quark "s" is $= -\frac{1}{3}e$

And charge of bottom quark "b" is $= -\frac{1}{3}e$

And charge of down quark "d" is $= -\frac{1}{3}e$

Each quark has its anti-quark with opposite charge.

(102) What are hadrons and leptons? **LHR-2015**

Ans: **HADRONS**

Hadrons are particles that experience the strong nuclear force. In addition to protons, neutrons and mesons are hadrons.

LEPTONS

Leptons are particles that do not experience strong nuclear force. Electron, muons and neutrinos are leptons.

(103) Give the names and charges of any four quarks. **MTN-2013**

Ans:

Name	Symbol	Charge
Up	u	$+\frac{2}{3}e$
Down	d	$-\frac{1}{3}e$
Strange	s	$-\frac{1}{3}e$
Charm	c	$+\frac{2}{3}e$
Top	t	$+\frac{2}{3}e$
Bottom	b	$-\frac{1}{3}e$

(104) What are the subatomic particles? **DGK-2015 (G-II)**

Ans: Subatomic particles are particles which are much smaller than atom.
For example, electron, proton, neutron, neutrino, muon, etc.….

PAST PAPER SHORT QUESTIONS

(105) What are hadrons? Give examples. **LHR-2021 (G-I)**

(106) Differentiate between Baryons and Measons. **LHR-2021 (G-II)**

(107) Define and differentiate between Hadrons and leptons.**RWP-2019 (G-I), FSD-2019 (G-I)**