Time : 125 Mins **PHYSICS TEST 53 ATOMS AND NUCLAI 1** **Marks : 458**

1. A sample of a radioactive element has a mass of 10 g at an instant t = 0. The approximate mass of this element in the sample left after two mean lives is
   a) 1.35 g b) 2.50 g c) 3.70 g d) 6.30 g
2. A mixture consists of two radioactive materials A_1 and A_2 with half lives of 20 s and 10 s respectively. Initially the mixture has 40 g of A_1 and 160 g of A_2. The amount of the two in the mixture will become equal after:
   a) 60s b) 80s c) 20s d) 40s
3. The ratio of the radii of the nuclei $_{13}Al^{27}$ and $_{52}Te^{125}$ is approximately:
   a) 6: 10 b) 13: 52 c) 40: 177 d) 14: 73
4. An ionised H-molecule consists of an electron and two protons. The protons are separated by a small distance of the order of angstrom. In the ground state,
   a) the electron would not move in circular orbits b) the energy would be $(2)^4$ times that of a H-atom
   c) the molecule will soon decay in to a proton and a H-atom d) none of these
5. A 10 kg satellite circles earth once every 2 h in an orbit having a radius of 8000 km. Assuming that Bohr's angular momentum postulate applies to a satellite just as it does to an electron in the hydrogen atom, then the quantum number of the orbit of satellite is
   a) 5.3×10^{40} b) 5.3×10^{45} c) 7.8×10^{48} d) 7.8×10^{50}
6. Assertion: Isotopes of an element can be separated by using a mass spectrometer.
   Reason: Separation of isotopes is possible because of difference in electron number of isotopes.
   a) If both assertion and reason are true and reason is the correct explanation of assertion.
   b) If both assertion and reason are true but reason is not the correct explanation of assertion.
   c) If assertion is true but reason is false. d) If both assertion and reason are false.
7. In the question number 67, find the potential energy of electron (in Joule) in the given state.
   a) -4.36 × 10-14 J b) -4.36×10^{-16} J c) -4.36×10^{-17} J d) -4.36×10^{-18} J
8. The total energy of an electron in an atom in an orbit is 3.4 eV. Its kinetic and potential energies are, respectively:
   a) $-3.4\text{eV}, -6.8\text{eV}$ b) $3.4\text{eV}, -6.8\text{eV}$ c) $3.4\text{eV}, 3.4\text{eV}$ d) $-3.4\text{eV}, -3.4\text{eV}$
9. According to second postulate of Bohr model, the angular momentum (L_n) of n^{th} possible orbit of hydrogen atom is given by
   a) $\frac{h}{2\pi n}$ b) $\frac{nh}{2\pi}$ c) $\frac{2\pi n}{h}$ d) $\frac{2\pi}{nh}$
10. The mass number of He is 4 and that for sulphur is 32. The radius of sulphur nuclei is larger than that of helium by :
    a) $\sqrt{8}$ b) 4 c) 2 d) 8
11. Suppose we consider a large number of containers each contaming initially 10000 atoms of a radioactive material with a half life of 1 year. After 1 year,
    a) all the containers will have 5000 atoms of the material.
    b)
    all the containers will contain the same number of atoms of the material but that number will only be approximately 5000.

c)
the containers will in general have different number of the atoms of the material but their average will be close to 5000.
d) none of containers can have more than 5000 atoms.

12. The de-Broglie wavelength of an electron in the first Bohr orbit is
a) equal to one-fourth the circumference of the first orbit b) equal to half the circumference of first orbit
c) equal to twice the circumference of first orbit d) equal to the circumference of the first orbit.

13. In Rutherford scattering experiment, what will be the correct angle for a-scattering for an impact parameter, b = 0?
a) 90^o b) 270^o c) 0^o d) 180^o

14. For a nuclear fusion process, the suitable nuclei are:
a) any nuclei b) heavy nuclei c) light nuclei d) nuclei lying in the middle of the periodic table

15. When hydrogen atom is in its first excited level, its radius is _____ .
a) Four times, its ground state radius b) Twice, its ground state radius c) Same as its ground state radius
d) Half of its ground state radius

16. Radioactive $^{60}_{27}Co$ is transformed into stable $^{60}_{28}Ni$ by emitting two λ-rays of energies:
a) 1.33 MeV and 1.17 MeV in succession b) 1.17 MeV and 1.33 MeV in succession
c) 1.37 MeV and 1.13 MeV in succession d) 1.13 MeV and 1.37 MeV in succession

17. In the Geiger-Marsden scattering experiment the number of scattered particles detected are maximum and minimum at the scattering angles respectively at
a) 0° and 180° b) 180° and 0° c) 90° and 180° d) 45° and 90°

18. The mass density of a nucleus varies with mass number A as:
a) A^2 b) A c) constant d) $\frac{1}{A}$

19. Alpha-particles are:
a) protons b) positron c) neutrally charged d) ionized helium atoms

20. If $M(A;Z), M_p$ and M_n denote the masses of the nucleus $^A_Z X$, proton and neutron respectively in units of u(1 u = 931.5 MeV / C^2) and BE represents its bonding energy 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) $M(A,Z) = ZM_p + (A-Z)M_n + BE/c^2$

21. O_2 molecule consists of two oxygen atoms. In the molecule, nuclear force between the nuclei of the two atoms:
a) is not important because nuclear forces are short-ranged
b) is as important as electrostatic force for binding the two atoms
c) cancels the repulsive electrostatic force between the nuclei
d) is not important because oxygen nucleus has equal number of neutrons and protons

22. An electron in the hydrogen atom jumps from excited state n to the ground state. The wavelength so emitted illuminates a photosensitive material having work function 2.15 eV. If the stopping potential of the photoelectron is 10 V, the value of n is _____ .
a) 3 b) 4 c) 5 d) 2

23. The first model of atom in 1898 was proposed by
a) Ernst Rutherford b) Albert Einstein c) J. J. Thomson d) Niels Bohr

24. Two H atoms in the ground state collide inelastically. The maximum amount by which their combined kinetic energy is reduced is
a) 10.2 eV b) 20.4 eV c) 13.6 eV d) 27.2 eV

25. In an atom the ratio of radius of orbit of electron to the radius of nucleus is
a) 10^3 b) 10^4 c) 10^5 d) 10^6

26. Solar energy is mainly caused due to :
a) gravitational contraction b) burning of hydrogen in the oxygen c) fission of uranium present in the Sun
d) fusion of protons during synthesis of heavier elements

27. An electron changes its position from orbit n = 2 to the orbit n = 4 of an atom. The wavelength of the emitted radiations is (R = Rydbery's constant)
a) $\frac{16}{R}$ b) $\frac{16}{3R}$ c) $\frac{16}{5R}$ d) $\frac{16}{7R}$

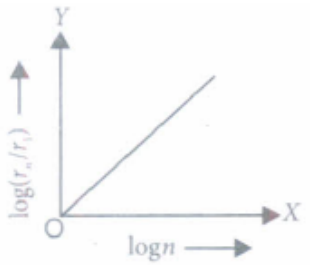
28. Energy is absorbed in the hydrogen atom giving absorption spectra when transition takes place from
a) n = 1 → n' where n' > 1 b) n = 2 → 1 c) n' → n d) n → n' = ∞

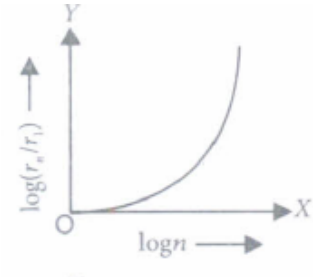
29. The mass number of iron nucleus is 56, the nuclear density is
a) 2.29 x 10^{16}kg m^{-3} b) 2.29 x 10^{17}kg m^{-3} c) 2.29 x 10^{18}kg m^{-3} d) 2.29 x 10^{15}kg m^{-3}

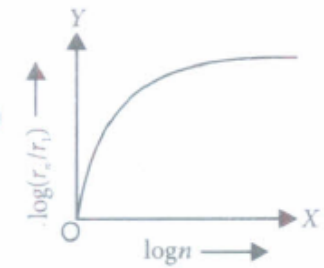
30. The ground state energy of H-atom is 13.6 eV. The energy needed to ionise H-atom from its second excited state:
a) 1.51 eV b) 3.4 eV c) 13.6 eV d) 12.1 eV

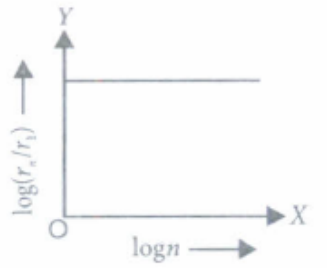
31. **Assertion:** Hydrogen atom consists of only one electron but its emission spectrum has many lines.
Reason : Only Lyman series is found in the absorption spectrum of hydrogen atom whereas in the emission spectrum, all the series are found.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b) If both assertionand reason are true but reason is not the correct explanationof assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

32. In a hydrogen atom, the radius of n^{th} Bohr orbit is r_n, The graph between log(rn/rl) and logn will be

a) 

b) 

c) 

d) 

33. Assertion: Naturally, thermonuclear fusion reaction is not possible on earth.
Reason: For thermonuclear fusion to take place, extreme condition of temperature and pressure are required.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b) If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

34. Plutonium decays with half life of 24000 years. If plutonium is stored for 72000 years, the fraction of it that remains is
a) 1/8 b) 1/3 c) 1/4 d) 1/2

35. In which of the following Bohr's orbit (n) a hydrogen atom emits the photons of lowest frequency?
a) n = 2 to n = 1 b) n = 4 to n = 2 c) n = 4 to n = 1 d) n = 4 to n = 3

36. An electron of a stationary hydrogen atom passes from the fifth energy level to the ground level. The velocity that the atom acquired as a result of photon emission will be:
(m is the mass of the electron, R, Rydberg constant and h Planck's constant)
a) $\frac{24hR}{25m}$ b) $\frac{25hR}{24m}$ c) $\frac{25m}{24hR}$ d) $\frac{24m}{25hR}$

37. The nuclei of which one of the following pairs of nuclei are isotones?
a) $34\mathrm{Se}^{74}, {}_{31}\mathrm{Ga}^{71}$ b) ${}_{38}\mathrm{Sr}^{84}, {}_{38}\mathrm{Sr}^{86}$ c) ${}_{42}\mathrm{Mo}^{92}, {}_{40}\mathrm{Zr}^{92}$ d) ${}_{20}\mathrm{Ca}^{40}, {}_{16}\mathrm{S}^{32}$

38. The ratio of wavelengths of the last line of Balmer series and the last line of Lyman series is:
a) 1 b) 4 c) 0.5 d) 2

39. If the nuclear radius of ^{27}A1 is 3.6 Fermi, the approximate nuclear radius of ^{64}Cu in Ferm is:
    a) 2.4 b) 1.2 c) 4.8 d) 3.6

40. Let $E_n = \frac{-me^4}{8\varepsilon_0^2 n^2 h^2}$ be the energy of the nth level of H-atom. If all the H -atoms are in the ground state and radiation of frequency (E_2 - E_1)/h falls on it, then
    a) it will not be absorbed at all b) some of atoms will move to the first excited state
    c) all atoms will be excited to the n = 2 state d) all atoms will make a transition to the n = 3 state

41. Which of the following statements is true for hydrogen atom?
    a) Angular moment $\infty \frac{1}{n}$ b) Linear moment $\infty \frac{1}{n}$ c) Radius $\infty \frac{1}{n}$ d) Energy $\infty \frac{1}{n}$

42. Which of the following postulates of the Bohr model led to the quantization of energy of the hydrogen atom?
    a) The electron goes around the nucleus in circular orbits.
    b) The angular momentum of the electron can only be an integral multiple of h/2π.
    c) The magnitude of the linear momentum of the electron is quantized
    d) Quantization of energy is itself a postulate of the Bohr model.

43. Pick out the incorrect statement from the following.
    a) β^- from the nucleus is always accompanied with a neutrino.
    b) The energy of the α-particle emitted from a given nucleus is always constant.
    c) γ-ray emission makes the nucleus more stable d) Nuclear force is charge-independent.

44. In a hydrogen atom the total energy of electron is
    a) $\frac{e^2}{4\pi\varepsilon_0 r}$ b) $\frac{-e^2}{4\pi\varepsilon_0 r}$ c) $\frac{-e^2}{8\pi\varepsilon_0 r}$ d) $\frac{e^2}{8\pi\varepsilon_0 r}$

45. Heavy water is used as a moderator in a nuclear reactor. The function of the moderator is :
    a) to control energy released in the reactor b) to absorb neutrons and stop chain reaction
    c) to cool the reactor d) to slow down the neutrons to thermal energies.

46. The gravitational force between a H -atom and another particle of mass m will be given by Newton's law: F = $G\frac{M.m}{r^2}$where ris in km and
    a) M is not related to the mass of the hydrogen atom.
    b) M = m_{proton} + $m_{electron}$ $-\frac{|V|}{C^2}$ ($|V|$ =magnitude of the potential energy of electron in the H-atom).
    c) M= m_{proton} + $m_{electron}$ d) M = m_{proton} + $m_{electron}$$-\frac{B}{C^2}$ (B=13.6eV)

47. The equivalent energy of 1 g of substance is:
    a) 9 x 10^{13}J b) 6 x 10^{12}J c) 3 x 10^{13}J d) 6 x 10^{13}J

48. Two samples X and Y contain equal amount of radioactive substances. If $\frac{1}{16}^{th}$ of the sample X and $\frac{1}{256}^{th}$ of the sample Y, remain after 8 hours, then the ratio of half life periods of X and Y is:
    a) 2: 1 b) 1: 2 c) 1: 4 d) 4: 1

49. The count rate from 100 cm^3 of a radioactive liquid is c. Some of this liquid is now discarded. The count rate of the remaining liquid is found to be c/10 after three half-lives. The volume of the remaining liquid, in cm^3, is
    a) 20 b) 40 c) 60 d) 80

50. The activity of a radioactive sample is measured as 9750 counts per minute at t = 0 and as 975 counts per minute at t = 5 minutes. The decay constant is approximately:
    a) 0.922 per minute b) 0.691 per minute c) 0.461 per minute d) 0.230 per minute

51. In the question number 63, the frequency of emitted photon due to the given transition is (h = 6.64 $\times$ 10^{-34} J s, 1 eV = 1.6 $\times$ 10^{-19} J)
    a) 2.46 $\times$ 10^{10} Hz b) 2.46 $\times$ 10^{12} Hz c) 2.46 $\times$ 10^{15} Hz d) 2.46 $\times$ 10^{18} Hz

52. What is the respective number of α and β-particles emitted in the following radiactive decay $^{200}X_{90}{}^{3/4} \rightarrow 168Y_{80}$?
    a) 6 and 8 b) 6 and 6 c) 8 and 8 d) 8 and 6

53. The half-life of a radioactive isotope 'X' is 20 years. It decays to another element 'Y' which is stable. The two elements 'X' and 'Y' were found to be in the ratio 1:7 in a sample of a given rock. The age of the rock is estimated to be :
    a) 40 years b) 60 years c) 80 years d) 100 years

54. The total energy (E_n) of the electron in the stationary states in the n_{th} orbit of the hydrogen atom is
    a) $\frac{-13.6}{n}eV$ b) $\frac{-13.6}{n^2}eV$ c) $\frac{-136}{n}eV$ d) $\frac{-136}{n^2}eV$

55. The ground state energy of hydrogen atom is 13.6 eV. When its electron is in the first excited state, its excitation energy is _____ .
    a) 3.4 eV b) 6.8 eV c) 10.2 eV d) 0

56. If in a nuclear fusion reaction, mass defect is 0.3%, then energy released in fusion of 1 kg mass
    a) 27 x 10^{10}J b) 27 x 10^{11}J c) 27 x 10^{12}J d) 27 x 10^{13}J

57. The value of ionisation energy of the hydrogen atom is
    a) 3.4 eV b) 10.4 eV c) 12.09 eV d) 13.6 eV

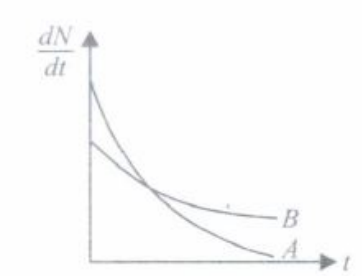
58. Fusion reaction takes place at high temperature because:
    a) Nuclei break up at high temperature b) Atoms gets ionised at high temperature
    c) Kinetic energy is high enough to overcome the coulomb repulsion between nuclei
    d) Molecules break up at high temperature

59. The number of beta particles emitted by a radioactive substance is twice the number of alpha particles emitted by it. The resulting daughter is an:
    a) Isotope of parent b) Isobar of parent c) Isomer of parent d) Isotone of parent

60. A set of atoms in an excited state decays:
    a) in general to any of the states with lower energy
    b) into a lower state only when excited by an external electric field
    c) all together simultaneously into a lower state d) to emit photons only when they collide

61. In the question number 5, if α = $2N_o\lambda$, calculate the number of nuclei of A after one half-life of A, and also the limiting value of N as
    a) $2N_o, \frac{5}{2}N_o$ b) $3N_o, 2N_o$ c) $4N_o, 2N_o$ d) $\frac{3}{2}N_o, 2N_o$

62. The variation of decay rate of two radioactive samples A and B with time is shown in figure.



    Which of the following statements is/are true?
    a) Decay constant of A is greater than that of B, hence A always decays faster than B.
    b) Decay constant of A is greater than that of B, but it does not always decays faster than B.
    c)
    Decay constant of B is smaller than that of A but still its decay rate becomes equal to that of A at a later instant.
    d) Both (b) and (c).

63. If the nucleus of $_{13}AI^{27}$ has a nuclear radius of about 3.6fm, then $_{52}Te^{125}$ would have its radius approximately as
    a) 9.6 fm b) 12 fm c) 4.8 fm d) 6 fm

64. The mass of $^{7}_{3}Li$ is 0.042 amu less than the sum of masses of its constituents. The binding energy per nucleon is
    a) 2.433 MeV b) 3.739 MeV c) 5.586 MeV d) 10.522 MeV

65. A nucleus with mass number 220 initially at rest emits an α particle. If the Q value of the reaction is 5.5 MeV, the kinetic energy of the α particle is
    a) 4.4 MeV b) 5.4 MeV c) 5.6 MeV d) 6.5 MeV

66. In a given reaction,
$Z^{X^A 3/4 \rightarrow}{}_{Z+1}Y^{\mathrm{A}}3/4 \rightarrow {}_{Z-1}K^{A} \quad 43/4 \rightarrow_{Z-1} K^{A-4}$
Radioactive radiations are emitted in the sequence of:
a) a, b, g b) g, a, b c) b, a, g d) g, b, a

67. The energy required to break one bond in DNA is 10^{-20} J. This value in eV is nearly:
a) 0.006 b) 6 c) 0.6 d) 0.06

68. A radioactive element x with half life 2 h decays giving a stable element Y. After a time t, ratio of X and Y atoms is 1: 16. Time t is
a) 6h b) 4h c) 8h d) 16h

69. The Balmer series for the H -atom can be observed
a) if we measure the frequencies of light emitted when an excited atom falls to the ground state
b)
if we measure the frequencies of light emitted due to transitions between excited states and the first excited state
c) in any transition in a H-atom d) none of these

70. The ground state energy of hydrogen atom is -13.6eV. The kinetic energy of the electron in this state is
a) 2.18×10^{-14}J b) 2.18×10^{-16}J c) 2.18×10^{-18}J d) 2.18×10^{-19}J

71. **Assertion:** Atoms of each element are stable and emit characteristic spectrum.
Reason: The spectrum provides useful information about the atomic structure.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b) If both assertionand reason are true but reason is not the correct explanationof assertion
c) If assertion is true but reason is false d) If both assertion and reason are false.

72. 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)?
a) $2^{1/3}$: 1 b) 1: $2^{1/3}$ c) $3^{1/2}$: 1 d) 1: $3^{1/2}$

73. The Binding energy per nucleon of ${}^{7}{}_{3}\mathrm{Li}$ and ${}^{4}{}_{2}\mathrm{He}$ nuclei are 5.60 MeV and 7.06 MeV, respectively. In the nuclear reaction ${}_{3}\mathrm{Li}^{7} + {}_{1}\mathrm{H}^{1} \rightarrow {}_{2}\mathrm{He}^{4} + {}_{3}\mathrm{He}^{4} + Q$ the value of energy Q released is :
a) 8.4 MeV b) 17.3 MeV c) 19.6 MeV d) - 2.4 MeV

74. Consider 3^{rd} orbit of $\mathrm{He}^{+}(Helium)$, using non-relativistic approach, the speed of electron in this orbit will be [given $K = 9 \times 10^{9}$ constant, Z=2 and h (Plank's Constant) $= 6.6 \times 10^{-34}\ \mathrm{J\ s^{-1}}$]
a) $1.46 \times 10^{6}\ \mathrm{m/s}$ b) $0.73 \times 10^{6}\ \mathrm{m/s}$ c) $3.0 \times 10^{8}\ \mathrm{m/s}$ d) $2.92 \times 10^{6}\ \mathrm{m/s}$

75. In a sample of radioactive material, what fraction of the initial number of active nuclei will remain undisintegrated after half of the half life of the sample?
a) $\frac{1}{4}$ b) $\frac{1}{2\sqrt{2}}$ c) $\frac{1}{\sqrt{2}}$ d) $\sqrt{2}-1$

76. In a nuclear reactor, moderators slow down the neutrons which come out in a fission process. The moderator used have light nuclei. Heavy nuclei will not serve the purpose because
a) they will break up. b) elastic collision of neutrons with heavy nuclei will not slow them down.
c) the net weight of the reactor would be unbearably high.
d) substances with heavy nuclei do not occur in liquid or gaseous state at room temperature.

77. The inverse square law in electrostatics is $\left|\vec{F}\right| = \frac{e^2}{(4\pi\varepsilon_0).r^2}$ for the force between an electron and a proton. The $\left(\frac{1}{r}\right)$ dependence of $\left|\vec{F}\right|$ can be understood in quantum theory as being due to the fact that the 'particle' of light (photon) is massless. If photons had a mass m_p, force would be modified to $\left|\vec{F}\right| = \frac{e^2}{(4\pi\varepsilon_0)r^2}\left[\frac{1}{r^2} + \frac{\lambda}{r}\right].exp(-\lambda r)$ where $\lambda = m_p c/h$ and $h = \frac{h}{2\pi}$. The change ion the ground state energy (eV) of a H-atom if m_p were 10^{-6} times the mass of an electron. (r_B = Bohr's radius)
a) 18.6 λ r_B b) -27.2 c) 27.2 λ r_B d) -λr_B

78. The ratio of longest wavelengths corresponding to Lyman and Balmer series in hydrogen spectrum is _____ .
a) $\frac{3}{23}$ b) $\frac{7}{29}$ c) $\frac{9}{31}$ d) $\frac{5}{27}$

79. The excitation energy of Lyman last line is
a) the same as ionisation energy b) the same as the last absorption line in Lyman series c) both (a) and (b)
d) different from (a) and (b)

80. In the Auger process an atom makes a transition to a lower state without emitting a photon. The excess energy is transferred to an outer electron which may be ejected by the atom. (This is called an Auger electron). Assuming the nucleus to be massive, the kinetic energy (in keV) of an n = 4 Auger electron emitted by Chromium by absorbing the energy from a n = 2 to n = 1 transition is
a) 4.6 b) 7.5 c) 5.38 d) 3.36

81. Deuterium was discovered in 1932 by Harold Urey by measuring the small change in wavelength for a particular transition in ^1H and ^2H. This is because, the wavelength of transition depend to a certain extent on the nuclear mass. If nuclear motion is taken into account then the electrons and nucleus revolve around their common centre of mass. Such a system is equivalent to a single particle with a reduced mass μ, revolving around the nucleus at a distance equal to the electron-nucleus separation. Here $\mu = m_eM/(m_e + M)$ where M is the nuclear mass and m_e is the electronic mass. Estimate the percentage difference in wavelength for the 1st line of the Lyman series in ^1H and ^2H. (Mass of ^1H nucleus is 1.6725×10^{-27} kg, Mass of ^2H nucleus is 3.3374×10^{-27} kg, Mass of electron = $9.10^9 \times 10^{-31}$ kg.)
a) 2.7×10^{-1} % b) 2.7×10^{-2}% c) 3.5×10^{-2}% d) 3.5×10^{-1}%

82. The radius of hydrogen atom in its ground state is 5.3×10^{-11} m. After collision with an electron it is found to have a radius of 21.2×10^{-11} m. What is the principal quantum number n of the final state of the atom?
a) n = 4 b) n = 2 c) n = 16 d) n = 3

83. The radius of n^{th} orbit r_n in terms of Bohr radius (a_0) for a hydrogen atom is given by the relation
a) na_0 b) $\sqrt{n}a_0$ c) $n^2 a_0$ d) n^3a_0

84. Fission of nuclei is possible because the binding energy per nucleon in them
a) increases with mass number at low mass numbers.
b) decreases with mass number at low mass numbers.
c) increases with mass number at high mass numbers.
d) decreases with mass number at high mass numbers.

85. In nuclear reactors, the control rods are made of
a) cadmium b) graphite c) krypton d) plutonium

86. Tritium is an isotope of hydrogen whose nucleus triton contains 2 neutrons and 1 proton. Free neutrons decay into p + $\overline{e} + \overline{v}$. If one of the neutrons in triton decays, it would transform into He^3 nucleus. This does not happen. This is because
a) Triton energy is less than that of a He^3nucleus.
b) the electron created in the beta decay process cannot remain in the nucleus.
c)
both the neutrons in triton have a decay simultaneously resulting in a nucleus with 3 protons, which is not a He^3 nucleus.
d) because free neutrons decay due to external perturbations which is absent in a triton nucleus.

87. Assertion: There occurs a chain reaction when uranium is bombarded with slow neutrons.
Reason: When uranium is bombarded with slow neutrons more neutrons are produced.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b) If both assertion and reason are true but reason is not the correct explanation of assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

88. The wavelength of radiation emitted is λ_0 when an electron jumps from the third to second orbit of hydrogen atom. For the electron jumping from the fourth to the second orbit of the hydrogen atom, the wavelength of radiation emitted will be
a) $(16/25)\lambda_0$ b) $(20/27)\lambda_0$ c) $(27/20)\lambda_0$ d) $(25/16)\lambda_0$

89. When a uranium isotop $^{235}_{92}\mathrm{U}$ is bombareded with a neutron, it generates $^{89}_{36}\mathrm{Kr}$, three neutrons and:
a) $^{103}_{36}\mathrm{Kr}$ b) $^{144}_{56}\mathrm{Ba}$ c) $^{91}_{40}\mathrm{Zr}$ d) $^{101}_{36}\mathrm{Kr}$

90. A fraction f_1 of a radioactive sample decays in one mean life, and a fraction f_2 decays in one half life. Then
a) $f_1 > f_2$ b) $f_1 2$ c) $f_1 = f_2$ d) either of (a), (b) or (c) depending on the values of the mean life and half life.

91. Which of the following is used as a moderator in nuclear reactors?
a) Plutonium b) Cadmium c) Heavy water d) Uranium

92. According to Bohr's theory, the wave number of last line of Balmer series is ($R = 1.1 \times 10^7\ m^{-1}$)
a) $5.5 \times 10^5\ m^{-1}$ b) $4.4 \times 10^7\ m^{-1}$ c) $2.75 \times 10^6\ m^{-1}$ d) $2.75 \times 10^8\ m^{-1}$

93. When an electron jumps from L to K shell :
a) Energy is absorbed b) Energy is released c) Energy is sometimes absorbed and sometimes released
d) Energy is neither absorbed nor released

94. The decay constant, for a given radioactive sample, is $0.3465\ day^{-1}$. What percentage of this sample will get decayed in a period of 4 days?
a) 100% b) 50% c) 75% d) 10%

95. When a hydrogen atom is raised from the ground state to an excited state:
a) PE decreases and KE increases b) PE increases and KE decreases c) Both KE and PE decrease
d) Absorption spectrum

96. The fission properties of $^{239}_{94}Pu$ are very similar to those of $^{235}_{92}U$. The average energy released per fission is 180 MeV If all the atoms in 1 kg of pure $^{239}_{94}Pu$ undergo fission, then the total energy released in MeV is
a) 4.53×10^{26}MeV b) 2.21×10^{14}MeV c) 1×10^{13}MeV d) 6.33×10^{24}MeV

97. Carbon dating is best suited for determining the age of fossils, if their age in years is of the order of
a) 10^3 b) 10^4 c) 10^5 d) 10^6

98. An alpha nucleus of energy $1/2mv^2$ bombards a heavy nuclear target of charge Ze. Then the distance of closest approach for the alpha nucleus will be proportional to :
a) 1/Ze b) ν^2 c) 1/m d) $1/\nu^2$

99. **Assertion:** In alpha particle scattering number of alpha particle undergoing head on collision is small.
Reason : Small fraction of the number of incident particles rebound back.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b) If both assertionand reason are true but reason is not the correct explanationof assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

100. A sample has 4×10^{16} radioactive nuclei of half life 10 days. The number of atoms decaying in 30 days is:
a) 3.9×10^{16} b) 5×10^{15} c) 10^{16} d) 3.5×10^{16}

101. A freshly prepared radioactive 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) 128 h b) 24 h c) 6 h d) 12 h

102. In a Geiger-Marsden experiment. Find the distance of closest approach to the nucleus of a 7.7 MeV a-particle before it comes momentarily to rest and reverses its direction. (Z for gold nucleus = 79)
a) 10 fm b) 20 fm c) 30 fm d) 40 fm

103. **Assertion:** Bohr's postulate states that the electrons in stationary orbits around the nucleus do not radiate.
Reason: According to classical physics, all moving electrons radiate.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b) If both assertionand reason are true but reason is not the correct explanationof assertion.
c) If assertion is true but reason is false. d) If both assertion and reason are false.

104. If E is the energy of n^{th} orbit of hydrogen atom the energy of n^{th} orbit of He atom will be
a) E b) 2E c) 3E d) 4E

105. In a Rutherford scattering experiment when a projectile of charge Z_1 and mass M_1 approaches a target nucleus of charge Z_2 and mass M_2, the distance of closest approach is r_0. The energy of the projectile is

a) Directly proportional to $Z_1 Z_2$ b) Inversely proportional to Z_1 c) Directly proportional to mass M_1
d) Directly proportional to $M_1 \times M_2$

106. The energy of hydrogen atom in nth orbit is E_n, then the energy in nth orbit of single ionised helium atom will be _____ .
a) $4E_n$ b) $E_n/4$ c) $2E_n$ d) $E_n/2$

107. A free neutron decays into a proton, an electron and:
a) a beta particle b) an alpha particle c) an anti-neutrino d) a neutrino

108. If the wavelength of the first line of the Balmer series of hydrogen is 6561 $\overset{o}{A}$, the wavelength of the second line of the series should be
a) l3122$\overset{o}{A}$ b) 3280 $\overset{o}{A}$ c) 4860 $\overset{o}{A}$ d) 2187 $\overset{o}{A}$

109. Which of the following cannot be emitted by radioactive substances during their decay?
a) Neutrinos b) Protons c) Electrons d) Helium nuclei

110. In the question number 79, what would be the angular momentum of H_γ photon if the angular momentum of the system is conserved
a) h b) 2 h c) 3 h d) 4 h

111. Ratio of longest wave lengths corresponding to Lyman and Balmer series in hydrogen spectrum is:
a) 5/27 b) 3/23 c) 7/29 d) 9/3

112. Hydrogen atom emits light when it changes from n = 5 energy level to n = 2 energy level. Which colour oflight would the atom emit?
a) red b) yellow c) green d) violet

113. The binding energy per nucleon in deuterium and helium nuclei are 1.1 MeV and 7.0 MeV, respectively. When two deuterium nuclei fuse to form a helium nucleus the energy released in the fusion is:
a) 30.2 MeV b) 23.6 MeV c) 2.2 MeV d) 28.0 MeV

114. An electron emitted in beta radiation originates from:
a) inner orbits of atom b) free electrons existing in the nuclei c) decay of a neutron in a nuclei
d) photon escaping from the nucleus

115. The ionization energy of L^{++} is equal to
a) 9 hcR b) 6 hcR c) 2 hcR d) hcR

116. The binding energy per nucleon is maximum in case of _____ .
a) ${}_2\mathrm{He}^4$ b) ${}_{26}\mathrm{Fe}^{56}$ c) ${}_{56}\mathrm{Ba}^{141}$ d) ${}_{92}\mathrm{U}^{235}$

117. For a radioactive material, half-life is 10 minutes. If initially there are 600 number of nuclei, the time taken (in minutes) for the disintegration of 450 nuclei is:
a) 30 b) 10 c) 20 d) 15

118. The natural boron of atomic weight 10.81 is found to have two isotopes ^{10}B and ^{11}B. The ratio of abundance of isotopes of natural boron should be
a) 11:10 b) 81:19 c) 10:11 d) 19:81

119. Fast neutrons can easily be slowed down by
a) the use of lead shielding b) passing them through water c) elastic collisions with heavy nuclei
d) applying a strong electric field.

120. The half life of radium is about 1600 years. Of 100 g of radium existing now, 25 g will remain unchanged after _____ .
a) 3200 years b) 4800 years c) 6400 years d) 2400 years

121. Hydrogen atom in ground state is excited by a monochromatic radiation of $1 = 975\ \overset{\circ}{A}$. Numbér of spectral lines in the resulting spectrum emitted will be _____ .
a) 3 b) 2 c) 6 d) 10

122. The volume occupied by an atom is greater than the volume of the nucleus by a factor of about:
a) 10^{15} b) 10^1 c) 10^5 d) 10^{10}

123. In Balmer series of emission spectrum of hydrogen, first four lines with different wavelength H_α'H_β,H_γ and H_8 are obtained. Which line has maximum
frequency out of these?
a) H_α b) H_β c) H_γ d) H_8

124. How long can an electric lamp of 100 W be kept glowing by fusion of 2.0 kg of deuterium? Take the fusion reaction as ${}^2_1H + {}^2_1H \rightarrow {}^3_2He + n + 3.27$MeV
a) 2.4 x 10^6 years b) 7.4 x 10^4 years c) 1.6 x 10^6 years d) 4.9 x 10^4 years

125. Half-lives of two radioactive substances A and B are respectively 20 minutes and 40 minutes. Initially, the samples of A and B have equal number of nuclei. After 80 minutes the ratio of remaining 'numbers of A and B nuclei is :
a) 1: 16 b) 4: 1 c) 1: 4 d) 1: 1