Ravi Maths Tuition Centre

Time : 1 Mins **ATOMS AND NUCLAI 1** **Marks : 1379**

1. 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
2. A radio isotope X with a half life 1.4 x 10^9 years decays to Y which is stable. A sample of the rock from a cave was found to contain X and Y in the ratio 1:7. The age of the rock is::
   a) 4.20 x 10^9 years b) 8.40 x 10^9 years c) 1.96 x 10^9 years d) 3.92 x 10^9 years
3. The ratio of the speed of the electron in the ground state of hydrogen atom to the speed of light in vacuum is
   a) $\frac{1}{2}$ b) $\frac{2}{237}$ c) $\frac{1}{137}$ d) $\frac{1}{237}$
4. A nucleus represented by the symbol $\frac{A}{Z}X$ has _____ .
   a) A protons and (Z-A) neutrons b) Z neutrons and (A-Z) protons
   c) Z protons and (A-Z) neutrons d) Z protons and A neutrons
5. 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
6. The radius of a spherical nucleus as measured by electron scattering is 3.6 fm. What is the mass number of the nucleus most likely to be?
   a) 27 b) 40 c) 56 d) 120
7. **Assertion:** The trajectory traced by an incident particle depends on the impact parameter of collision.
   Reason: The impact parameter is the perpendicular distance of the initial velocity vector of the incident particle from the centre of the target nucleus.
   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.
8. Assertion: Binding energy per nucleon is nearly constant for element in the range A = 30 to A = 170.
   Reason: The nuclear force between two nucleons falls rapidly to zero as their distance is more than a few femtometres.

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.

9. The ionization energy of L^{++} is equal to
   a) 9 hcR b) 6 hcR c) 2 hcR d) hcR
10. The count rate of a Geiger Muller counter for the radiation of a radioactive material of half life 30 min decreases to $5s^{-1}$ after 2h, The initial count rate was _____ .
    a) 10 s^{-1} b) 25 s^{-1} c) 80 s^{-1} d) 625 s^{-1}
11. 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
12. Mass numbers of the elements A, B, C and D are 30, 60, 90, and 120 respectively. The specific binding energy of them are 5 MeV, 8.5 MeV, 8 MeV and 7 MeV respectively. Then, in which of the following reaction/s energy is released?
    (1) $D \rightarrow 2B$
    (2) $C \rightarrow B + A$
    (3) $B \rightarrow 2A$
    a) only in (1) b) in (2), (3) c) in (1), (3) d) in (1), (2) and (3)
13. At a given instant, there are 25% undecayed radioactive nuclei in a sample. After 10 seconds the number of undecayed nuclei reduces to 12.5%, the mean life of the nuclei is
    a) 10.21 s b) 14.43 s c) 5.31 s d) 7.43 s
14. 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.
15. Rutherford's experiment on scattering of particles showed for the first time that the atom has:
    a) Electrons b) Protons c) Nucleus d) Neutrons
16. 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) $_{92}\mathrm{U}^{235}$
17. 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
18. The half life of polonium is 140 days. In what time will 15 g of polonium be disintegrated out of its initial mass of 16 g?
    a) 230 days b) 560 days c) 730 days d) 160 days
19. From quantisation of angular momentum, one gets for hydrogen atom, the radius of the nth orbit as

$$r_n = \left(\frac{n^2}{m_e}\right)\left(\frac{h}{2\pi}\right)^2\left(\frac{4\pi^2\varepsilon_0}{e^2}\right)$$

For a hydrogen like atom of atomic number Z,

a) the radius of the first orbit will be the same b) r_n will be greater for larger Z values

c) r_n will be smaller for larger Z values d) none of these

20. In question number 7, for Z = 79 if initial energy is 10 MeV the impact parameter (in fm) of which the scattering angle is 90° is

a) 22 b) 44 c) 11 d) zero

21. In the Bohr model of the hydrogen atom, the lowest orbit corresponds to

a) infinite energy b) maximum energy c) minimum energy d) zero energy

22. 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

23. In the nucleus of $_{11}\mathrm{Na}^{23}$, the number of protons, neutrons and electrons are:

a) 11,12,0 b) 23,12,11 c) 12,11,0 d) 23,11,12

24. If muonic hydrogen atom is an atom in which a negatively charged muon (μ) of mass about 207 m_e revolves around a proton, then first Bohr radius of this atom is (r_e = 0.53 $\times$ 10^{-10} m)

a) 2.56 $\times$ 10^{-10} m b) 2.56 $\times$ 10^{-11} m c) 2.56 $\times$ 10^{-12} m d) 2.56 $\times$ 10^{-13} m

25. If there are N atoms in a source of Laser light and each atom is emitting light with intensity I, then the total intensity produced by it is

a) NI b) N^2I c) N^3I d) N^4I

26. A nucleus $_nX^m$ emits one a and two b-particles. The resulting nucleus is:

a) $_nX^{m-4}$ b) $_{n-2}X^{m-4}$ c) $_{n-4}Z^{m-4}$ d) None of these

27. Hydrogen atom in ground state is excited by a monochromatic radiation of $1 = 975\ \mathring{A}$. Numbér of spectral lines in the resulting spectrum emitted will be _____ .

a) 3 b) 2 c) 6 d) 10

28. 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}

29. The total energy of an electron in the first excited state of hydrogen atom is about -3.4 eV. Its kinetic energy in this state is _____ .

a) 3.4 eV b) 6.8 eV c) -3.4 eV d) -6.8 eV

30. The valence electron in alkali metal is a _____ .

a) f-electron b) p-electron c) s-electron d) d-electron

31. A fission reaction is given by $^{236}_{92}U \rightarrow ^{140}_{54}Xe + ^{94}_{38}Sr + x + y$, where x and y are two particles. Considering $^{236}_{92}U$ to be at rest, the kinetic energies of the products are denoted by K_{xe},K_{sr}, K_x (2 MeV) and K_y (2 MeV), respectively. Let the binding energies per nucleon of $^{236}_{92}U$,$^{140}_{54}Xe\ are\ ^{94}_{38}Sr$ be 7.5 MeV, 8.5 MeV and 8.5 MeV, respectively. Considering different conservation laws, the correct option(s) is(are)

a) x = n, y = n, K_{sr} = 129 MeV, K_{Xe}= 86 MeV b) x = p,y =$\bar{e}$, K_{sr} = 129 MeV, K_{Xe} = 86 MeV

c) x = p, y = n, K_{Sr} = 129 MeV, K_{Xe} = 86 MeV d) x = n, y = n, K_{Sr} = 86 MeV, K_{Xe}= 129 MeV

32. For which one of the following, Bohr model in not valid?

a) Singly ionised helium atom $\left(He^{+}\right)$ b) Deuteron atom
c) Singly ionised neon atom $\left(Ne^{+}\right)$ d) Hydrogen atom

33. 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)

34. 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

35. 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

36. Which of the following statements is true for nuclear forces?
a) They obey the inverse square law of distance
b) They obey the inverse third power law of distance c) They are short range forces
d) They are equal in strength to electromagnetic forces

37. The ratio of kinetic energy to the total energy of an electron in a Bohr orbit of the hydrogen atom, is _____ .
a) 2:-1 b) 1:-1 c) 1: 1 d) 1:-2

38. 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) $\frac{2\pi}{nh}$

39. If an electron in a hydrogen atom jumps from the 3rd orbit to the 2nd orbit, it emits a photon of wavelength λ. When it jumps from the 4th orbit to the 3rd orbit, the corresponding wavelength of the photon will be :
a) (16/25)λ b) (9/16)λ c) (20/7)λ d) (20/13)λ

40. In the Bohr's model of a hydrogen atom, the centripetal force is furnished by the Coulomb attraction between the proton and the electron. If a_0 is the radius of the ground state orbit, m is the mass and e is the charge on the electron, e_0 is the vacuum permittivity, the speed of the electron is _____ .
a) zero b) $\frac{e}{\sqrt{\varepsilon_0 a_0 m}}$ c) $\frac{e}{\sqrt{4\pi\varepsilon_0 a_0 m}}$ d) $\frac{\sqrt{4\pi\varepsilon_0 a_0 m}}{e}$

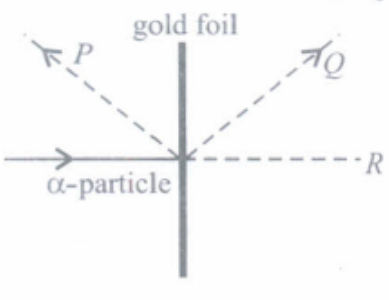
41. The decay constant of a radioactive isotope is λ . If A_1 and A_2 are its activities at times t_1 and t_2 respectively, then the number of nuclei which have decayed during the time (t_1 - t_2)
a) $A_1t_1 - A_2t_2$ b) $A_1 - A_2$ c) $(A_1 - A_2)/\lambda$ d) $\lambda(A_1-A_2)$

42. The mass defect for the nucleus of helium is 0.0303 a.m.u. What is the binding energy per nucleon for helium in MeV:
a) 28 b) 7 c) 4 d) 1

43. A radioactive decay can form an isotope of the original nucleus with the emission of particles
a) one α and four β b) one α and two β c) one α and one β d) four α and one β

44. In the Bohr model of the hydrogen atom, let R, V and E represent the radius of the orbit, speed of the electron and the total energy of the electron respectively. Which of the following quantities are proportional to the quantum number n?

a) VR b) RE c) R/E d) none of these

45. In an experiment on a-particle scattering, a-particles are directed towards a gold foil and detectors are placed in position P,Q and R. What is the distribution of a-particles as recorded at P, Q  and R?

a)

P	Q	R
all	none	none

b)

P	Q	R
none	none	all

c)

P	Q	R
a few	some	most

d)

P	Q	R
most	some	a few

46. 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

47. If the nuclear force between two protons, two neutrons and between proton and neutron is denoted by F_{pp}, F_{nn} and F_{pn} respectively, then _____ .
a) $F_{pp}^{pn} \approx F_{nn} \gg F_{pn}$ b) $F_{pp}{}^1 F_{nn} and F_{pp} = F_{nn}$ c) $F_{pp}^{pp} = F_{nn} = F_{pn}^{pn}$
d) $F_{pp}{}^1 F_{nn}{}^1 F_{pn}$

48. The total energy of electron in the ground state of hydrogen atom is -13.6 eV. The kinetic energy of an electron in the first excited state is _____ .
a) 6.8 eV b) 13.6 eV c) 1.7 eV d) 3.4 eV

49. Suppose an electron is attracted towards the origin by a force klr, where k is a constant and r is the distance of the electron from the origin. By applying Bohr model to this system, the radius of nth orbit of the electron is found to be rn and the kinetic energy of the electron is found to be Tn. Then which of the following is true?
a) $T_n \propto \frac{1}{n^2}$ b) T_n is independent of n; $r_n \propto n$ c) $T_n \propto \frac{1}{n} and\, r_n$
d) $T_n \propto \frac{1}{n} and\, r_n \propto n^2$

50. 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 $\infty \frac{1}{n}$

51. The ratio of the nuclear radii of the gold isotope $^{197}_{79}Au$ and silver isotope $^{197}_{47}Au$ is:
a) 1.23 b) 0.216 c) 2.13 d) 3.46

52. A núcleus $^{A}_{Z}X$ has mass represented by $M(A, Z)$. If M_p and M_n denote the mass of proton and neutron respectively and B.E. the, binding energy in MeV, then _____ .
a) $B.E. = [ZM_p + (A - Z)M_n - M(A, Z)]\, c^2$
b) $B.E. = [ZM_p + ZM_n - M(A, Z)]\, c^2$
c) $B.E. = M(A, Z) - ZM_p - (A - Z)M_n$
d) $B.E. = [M(A, Z) - ZM_p - (A - Z)M_n]\, c^2$

53. The moment of momentum for an electron in second orbit of hydrogen atom as per Bohr's model is

a) $\frac{h}{\pi}$ b) $2\pi h$ c) $\frac{2h}{\pi}$ d) $\frac{\pi}{h}$

54. Two radioactive substances A and B have decay constants 5λ and λ respectively. At t = 0, they have the same number of nuclei. The ratio of number of nuclei of A to those of B will be $(1/e)^2$ after a time interval
a) 4λ b) 2λ c) $1/2\lambda$ d) $1/4\lambda$

55. The set which represents the isotope, isobar and isotone respectively is:
a) $({}_1^2H, {}_1^3H), ({}_{79}^{197}Au, {}_{80}^{198}Hg)$ and $({}_2^3He, {}_1^2H)$ b) $({}_2^3He, {}_1^1H), ({}_{79}^{197}Au, {}_{80}^{198}Hg)$ and $({}_1^1He, {}_1^3H)$
c) $({}_2^3He, {}_1^3H), ({}_1^2H, {}_1^3H)$ and $({}_{79}^{197}Au, {}_{80}^{198}Hg)$ d) $({}_1^2H, {}_1^3H), ({}_2^3He, {}_1^3H)$ and $({}_{79}^{197}Au, {}_{80}^{198}Hg)$

56. Radioactive ${}_{27}^{60}Co$ is transformed into stable ${}_{28}^{60}Ni$ 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

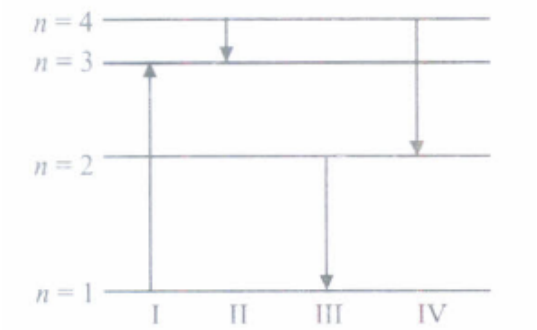
57. The count rate of a radioactive sample falls from 4.0 x 10^6 s^{-1} to 1.0 X 10^6 s^{-1} in 20 hours. What will be the count rate after 100 hours from begining?
a) 3.91 x 10^3 s^{-1} b) 3.91 x $10^2 s^{-1}$ c) 3.91 X 10^4 s^{-1} d) 3.91 x 10^6 s^{-1}

58. Consider 3^{rd} orbit of $\text{He}^+(Helium)$, 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) $= 6.6 \times 10^{-34}\ \text{J s}^{-1}$]
a) $1.46 \times 10^6\ \text{m/s}$ b) $0.73 \times 10^6\ \text{m/s}$ c) $3.0 \times 10^8\ \text{m/s}$ d) $2.92 \times 10^6\ \text{m/s}$

59. The radius of hydrogen atom in its ground state is 5.3 x 10^{-11} m. After collision with an electron it is found to have a radius of 21.2 x 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

60. In terms of Bohr radius a_0, the radius of the second Bohr orbit of a hydrogen atom is given by:
a) $4a_0$ b) $8a_0$ c) $\sqrt{2}a_0$ d) $2a_0$

61. The diagram shows the energy levels for an electron in a certain atom. Which transition shown represents the emission of a photon with the most energy?



a) I b) II c) III d) IV

62. The half life of radioactive radon is 3.8 days. The time at the end of which (1/20) th of the radon sample will remain undecayed (Given $\log_{10}e = 0.4343$) is
a) 3.8 days b) 16.5 days c) 33 days d) 76 days

63. An electron in the ground state of hydrogen atom is revolving in anticlockwise direction in circular orbit of radius R. The orbital magnetic dipole moment of the electron will be
a) $\frac{eh}{4\pi m}$ b) $\frac{eh}{2\pi m}$ c) $\frac{eh^2}{4\pi m}$ d) $\frac{e^2h}{4\pi m}$

64. A radioisotope 'X with a halflife 1.4 x 10^9 years decays to 'Y' which is stable. A sample of the rock from a cave was found to contain 'X and 'Y' in the ratio 1: 7. The age of the rock is:
a) 1.96 x 10^9 years b) 3.92 x 10^9 years c) 4.20 x 10^9 years d) 8.40 x 10^9 years

65. The binding energy of an electron in the ground state of He is equal to 24.6 eV. The energy required to remove both the electrons is
a) 49.2 eV b) 54.4 eV c) 79 eV d) 108.8 eV

66. 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) $^{101}_{36}\mathrm{Kr}$

67. The Bohr model of atoms
a) assumes that the angular momentum of electrons is quantized.
b) uses Einstein's photoelectric equation.
c) predicts continuous emission spectra for atoms.
d) predicts the same emission spectra for all types of atoms.

68. The wavelength of spectral line in the Lyman series of a H -atom is 1028$\mathring{A}$. If instead of hydrogen, we consider deuterium then shift in the wavelength of this line will be (m_p = 1860 m_e)
a) 1027.7 $\mathring{A}$ b) 1036 $\mathring{A}$ c) 1028 $\mathring{A}$ d) 1021 $\mathring{A}$

69. The energy of ground electronic state of hydrogen atom is -136 eV. The energy of the first excited state will be:
a) -54.4 eV b) -27.2 eV c) -6.8 eV d) -3.4 eV

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

71. 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) $\frac{e^2}{8\pi\varepsilon_0 r}$

72. Assertion: An α-particle is emitted when uranium 238 decays into thorium.
Reason: The decay of uranium 238 to thorium is represented by $^{238}_{92}U \rightarrow ^{234}_{90}Th + ^{4}_{2}He$ .The helium nuclei is called an alpha particle.
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.

73. 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.

74. 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

75. Radioactive material 'N has decay constant '8λ' and material 'B' has decay constant 'λ'. Initially they have same number of nuclei. After what time, the ratio of number of nuclei of material 'B' to that 'N will be 1/e?
a) 1/7λ b) 1/8λ c) 1/9λ d) 1/λ

76. 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/ν^2

77. Who modified Bohr's theory by introducing elliptical orbits for electron path :
a) Hund b) Thomson c) Rutherford d) Sommerfield

78. **Assertion:** In the experiment of alpha particle scattering, extremely thin gold foils are preferred over other metals.
Reason: Gold is a ductile material.
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.

79. The radius of nth 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^{3}a$_0$

80. In any fission process, the ratio $\frac{\text{mass of fission products}}{\text{mass of parent nucleus}}$ is :
a) equal to 1 b) greater than 1 c) less than 1
d) depends on the mass of the parent nucleus

81. 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

82. If radius of the $^{27}_{12}\mathrm{AL}$ nucleus is taken to be RA1, then the radius of $^{125}_{53}\mathrm{Te}$ nucleus is nearly:
a) $\frac{5}{3}R_{A1}$ b) $\frac{3}{5}R_{A1}$ c) $\left(\frac{13}{53}\right)^{1/3}R_{A1}$ d) $\left(\frac{53}{13}\right)^{1/3}R_{A1}$

83. The element Curium $^{248}_{96}Cm$ has a mean life of 10^{13} second. Its primary decay modes are spontaneous fission and α-decay, the former with a probability of 8% and the latter with a probability of 92%. Each fission releases 200 MeV of energy. The masses involved in α-decay are as follow $^{248}_{96}Cm$ = 248.072220 u, $^{244}_{94}Pu$ = 244.064100 u and $^{4}_{2}He$ = 4.002603 u. Calculate the power output from a sample of 10^{20} Cm atoms. (1 u = 931 MeV/c^2).
a) 4.42 x 10^{-3} W b) 3.32 x 10^{-5} W c) 4.42 x 10^{-5} W d) 3.32 x 10^{-3} W

84. Energy levels A, B, C of a certain atom correspond to increasing values of energy ie., E$_A$ < E$_B$ < E$_C$. If l$_1$, l$_2$, l$_3$ are the wavelengths of radiation corresponding to the transitions C to B, B to A and C to A respectively, which of the following relation is correct?
a) $l_3 = 1_1 + l_2$ b) $l_3 = \frac{\lambda_1\lambda_2}{\lambda_1+\lambda_2}$ c) $1_1 + 1_2 + 1_3 = 0$ d) $\lambda_3^2 = \lambda_1^2 + \lambda_2^2$

85. Two radioactive materials X_1 and X_2 have decay constants 51 and 1 respectively. If initially they have the same number of nuclei, then the ratio of the number of nuclei of X_1 to that of X_2 will be $\frac{1}{e}$ after a time:
a) 1 b) $\frac{1}{2}\lambda$ c) $\frac{1}{4\lambda}$ d) $\frac{e}{\lambda}$

86. An electron is in an excited state in a hydrogen like atom. It has a total energy of -3.4 eV. The kinetic energy of the electron is E and its de Broglie wavelength is λ. Then
a) E = 6.8 eV,λ = 6.6 $\times$ 10^{-10} m b) E = 3.4 eV, λ = 6.6 $\times$ 10^{-10} m
c) E = 3.4 eV, λ = 6.6 $\times$ 10^{-11} m d) E = 6.8 eV, λ = 6.6 $\times$ 10^{-11} m

87. 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) $\sqrt{2}-1$

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

89. How does the binding energy per nucleon vary with the increase in the number of nucleons?
a) Increases continuously with mass number b) Decreases continuously with mass number
c) First decreases and then increases with increase in mass number
d) First increases and then decreases with increase in mass number

90. In nuclear reaction, there is conservation of
a) mass only b) energy only c) momentum only d) mass, energy and momentum

91. Hydrogen atoms are excited from ground state of the principal quantum number 4. Then, the number of spectral lines observed will be:
a) 3 b) 6 c) 5 d) 2

92. What is the ratio of the shortest wavelength of the Balmer series to the shortest wavelength of the Lyman series?
a) 4 : 1 b) 4 : 3 c) 4 : 9 d) 5 : 9

93. An element A decays into an element C by a two step process $A \rightarrow B + {}_2He^4$ and $B \rightarrow C + 2e^-$ .Then,
a) A and C are isotopes b) A and C are isobars c) B and C are isotopes
d) A and B are isobars

94. M_n and M**p**, represent mass of neutron and proton respectively. If an element having atomic mass M has N neutron and Z-proton, then the correct relation will be _____ .
a) $M < [NM_n + ZM_p]$ b) $M > [NM_n + ZM_p]$ c) $M = [NM_n + ZM_p]$
d) $M = N[M_n + M_p]$

95. Two stable isotopes ${}^6_3Li$ and ${}^7_3Li$ have respective abundances of 7.5% and 92.5%. These isotopes have masses 6.01512 u and 7.01600 u respectively. The atomic weight of lithium is
a) 6.941 u b) 3.321 u c) 2.561 u d) 0.621 u

96. When a nucleus in an atom undergoes a radioactive decay, the electronic energy levels of the atom
a) do not change for any type of radioactivity
b) change for α and β radioactivity but not for γ-radioactivity.

c) change for α-radioactivity but not for others
d) change for β-radioactivity but not for others.

97. A hydrogen atom and a Li^{++} ion are both in the second excited state. If l_H and l_{Li} are their respective electronic angular momenta and E_H and E_{Li} their respective energies, then
a) $l_H > l_{Li}$ and $|E_H| > |E_{Li}|$ b) $l_H = l_{Li}$ and $|E_H| > |E_{Li}|$ c) $l_H = l_{Li}$ and $|E_H| < |E_{Li}|$
d) $l_H < l_{Li}$ and $|E_H| < |E_{Li}|$

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

99. The half life of a radioactive isotope 'X' is 50 years. It decay to another element 'Y' which is stable. The two elements 'X' and 'Y' were found to be in the ratio of 1:15 in a sample of a given rock. The age of the rock was estimated to be :
a) 150 years b) 200 years c) 250 years d) 100 years

100. In the question number 5, if $\alpha = 2N_o\lambda$, 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) $\frac{3}{2}N_o, 2N_o$

101. 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

102. A hydrogen atom initially in the ground level absorbs a photon and is excited to n = 4 level then the wavelength of photon is
a) 790 $\mathring{A}$ b) 870 $\mathring{A}$ c) 970 $\mathring{A}$ d) 1070 $\mathring{A}$

103. If n is the orbit number of the electron in a hydrogen atom, the correct statement among the following is
a) electron energy increases as n increases.
b) hydrogen emits infrared rays for the electron transition from n = ∞ to n = 1.
c) electron energy is zero for n = 1. d) electron energy varies as n^2.

104. The equation $4{}_1^1H^+ \rightarrow {}_2^4He^{2+}$ +2e- + 26 MeV represents
a) β- decay b) $\gamma-$decay c) fusion d) fission

105. The ionisation energy of hydrogen atom is 13.6 eV. Following Bohr's theory the energy corresponding to a transition between 3rd and 4th orbit is _____ .
a) 3.40 eV b) 1.51 eV c) 0.85 eV d) 0.66 eV

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. The binding energy per nucleon of 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) 23.6 MeV b) 2.2 MeV c) 28.0 MeV d) 30.2 MeV

108. The spectrum obtained from a sodium vapour lamp is an example of _____ .
a) Band spectrum b) Continous spectrum c) Emission spectrum
d) Absorption spectrum

109. 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.

110. The energy equivalent of 0.5 g of a substance is:
a) 0.5 x 10^{13} J b) 4.5 x 10^{16} J c) 4.5 x 10^{13} J d) 1.5 x 10^{13} J

111. 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

112. 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

113. 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

114. The half life of $^{238}_{92}U$ undergoing α-decay is 4.5 x 10^9 years. The activity of 1 g sample of $^{238}_{92}U$ is
a) 1.23 x 10^4 Bq b) 1.23 x 10^5 Bq c) 1.23 X 10^3 Bq d) 1.23 x 10^6 Bq

115. It is possible to understand nuclear fission on the basis of the :
a) liquid drop model of the nucleus b) meson theory of the nuclear forces
c) proton-proton cycle d) independent particle model of the nucleus

116. 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}

117. The energy of second Bohr orbit of the hydrogen atom is - 328 kJ mol^{-1}, hence the energy of fourth Bohr orbit would be :
a) - 41 kJ/mol b) -1312 kJ/mol c) - 164kJ/mol d) - 82 kJ/mol

118. Assertion: Fusion of hydrogen nuclei into helium nuclei is the source of energy of all stars.
Reason: In fusion heavier nuclei split to form lighter nuclei.
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.

119. An electron in a hydrogen atom makes a transition from n = n_1 to n = n_2. The time period of the electron in the initial state is eight times that in the final state. The possible values of n_1 and n_2 are

a) $n_1 = 4, n_2 = 2$ b) $n_1 = 8, n_2 = 2$ c) $n_1 = 8, n_2 = 1$ d) $n_1 = 6, n_2 = 2$

120. 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) $\frac{-136}{n^2}eV$

121. M_p denotes the mass of a proton and M_n that of a neutron. A given nucleus, of binding energy B, contains Z protons and N neutrons. The mass M(N, Z) of the nucleus is given by (c is the velocity of light) :
a) $M(N, Z) = NM_n + ZM_p + B/c^2$ b) $M(N, Z) = NM_n + ZMp - Bc^2$
c) $M(N, Z) = NM_n + ZMp + Bc^2$ d) $M(N, Z) = NM_n + ZM_p - B/c^2$

122. 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

123. 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

124. 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

125. What is the radius of iodine atom? (atomic no. 53 , mass no. 126)
a) 2.5×10^{-11} m b) 2.5×10^{-9} m c) 7×10^{-9} m d) 7×10^{-6} m

126. The Rydberg formula, for the spectrum of the hydrogen atom where all terms have their usual meaning is
a) $h\upsilon_{if} = \frac{me^4}{8\varepsilon_0^2 h^2}\left(\frac{1}{n_f} - \frac{1}{n_i}\right)$ b) $h\upsilon_{if} = \frac{me^4}{8\varepsilon_0^2 h^2}\left(\frac{1}{n_f^2} - \frac{1}{n_i^2}\right)$
c) $h\upsilon_{if} = \frac{8\varepsilon_0^2 h^2}{me^4}\left(\frac{1}{n_f} - \frac{1}{n_i}\right)$ d) $h\upsilon_{if} = \frac{8\varepsilon_0^2 h^2}{me^4}\left(\frac{1}{n_f^2} - \frac{1}{n_i^2}\right)$

127. Light energy emitted by star is due to
a) breaking of nuclei b) joining of nuclei c) burning of nuclei d) reflection of solar light

128. Hydrogen atom from excited state comes to the ground state by emitting a photon of wavelength λ. If R is the Rydberg constant, then the principal quantum number n of the excited state is
a) $\sqrt{\frac{\lambda R}{\lambda R - 1}}$ b) $\sqrt{\frac{\lambda}{\lambda R - 1}}$ c) $\sqrt{\frac{\lambda R^2}{\lambda R - 1}}$ d) $\sqrt{\frac{\lambda R}{\lambda - 1}}$

129. 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) $M(A, Z) = ZM_p + (A - Z)M_n + BE/c^2$

130. If speed of electron in ground state energy level is 2.2×10^6 m s^{-1}, then its speed in fourth excited state will be
a) 6.8×10^6 m s^{-1} b) 8.8×10^5 m s^{-1} c) 5.5×10^5 m s^{-1} d) 5.5×10^6m s^{-1}

131. The half life of a radioactive substance is 30 days. What is the time taken to disintegrate to $3/4^{th}$ of its original mass?
a) 30 days b) 15 days c) 60 days d) 90 days

132. 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

133. 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.

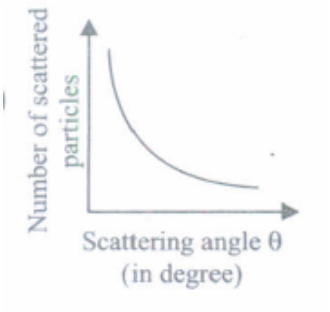
134. **Assertion:** Bohr's postulate states that the electrons in stationary orbits around the nucleus do not radiate.
Reason: According to classical physics, all moving electrons radiate.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b) If both assertionand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

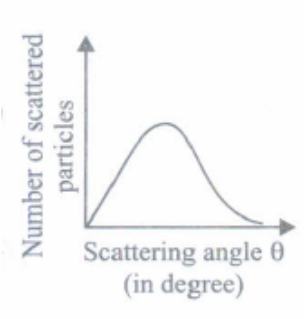
135. If the binding energy per nucleon of deuterium is 1.115 MeV, its mass defect in atomic mass unit is
a) 0.0048 b) 0.0024 c) 0.0012 d) 0.0006

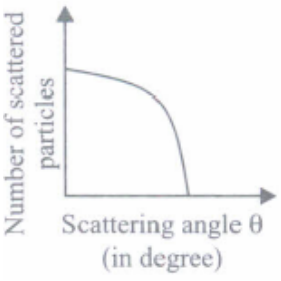
136. Assertion: The whole mass of the atom is concentrated in the nucleus.
Reason: The mass of a nucleus can be either less than or more than the sum of the masses of nucleons present in it.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion 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.

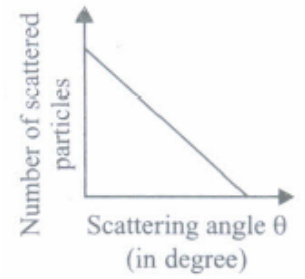
137. The simple Bohr model cannot be directly applied to calculate the energy levels of an atom with many electrons. This is because
a) of the electrons not being subject to a central force
b) of the electrons colliding with each other c) of screening effects
d) the force between the nucleus and an electron will no longer be given by Coulomb's law.

138. The graph of the total number of a-particles scattered at different angles in a given interval of time for a-particle scattering in the Geiger-Marsden experiment is given by

a) 

b) 

c) 

d) 

139. A radioactive nucleus of mass M emits a photon of frequency v and the nucleus recoils. The recoil energy will be :
a) Mc^2-hv b) $h^2v^2/2Mc^2$ c) zero d) hv

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

141. **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.

142. Samples of two radioactive nuclides A and B are taken. λ_A and λ_B are the disintegration constants of A and B respectively. In which of the following cases, the two samples can simultaneously have the same decay rate at any time? Initial rate of decay of A is twice the initial rate of decay of Band AA = AB.
a) Initial rate of decay of A is twice the initial rate of decay of B and $\lambda_A = \lambda_B$
b) Initial rate of decay of A is twice the initial rate of decay of B and $\lambda_A > \lambda_B$
c) Initial rate of decay of B is twice the initial rate of decay of A and $\lambda_A > \lambda_B$
d) Initial rate of decay of B is twice the initial rate of decay of A at t = 2h and $\lambda_B = \lambda_A$

143. 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}

144. The half life of a radioactive substance is 20 s, the time taken for the sample to decay by $7/8^{th}$ of its initial value is
a) 20s b) 40s c) 60s d) 80s

145. The half life period of a radioactive element X is same as the mean life time of another radioactive element Y. Initially, they have the same number of atoms. Then
a) X and Y decay at same rate always b) X will decay faster than Y
c) Y will decay faster than X d) X and Y have same decay rate initially

146. A source S_1 is producing, 10^{15} photons per second of wavelength 5000 $\mathring{A}$. Another source 52 is producing 1.02 x 10^{15} photons per second of wavelength 5100$\mathring{A}$. Then, (power of S_2)/(power of S_1) is equal to :
a) 1.00 b) 1.02 c) 1.04 d) 0.98

147. One requires energy E_n to remove a nucleon from a nucleus and an energy 'E_e' to remove an electron from the orbit of an atom. Then:
a) $E_n = E_e$ b) $E_n < E_e$ c) $E_n > E_e$ d) $E_n \geq E_e$

148. The frequency of radiation emitted when the electron falls from n = 4 to n = 1 in a hydrogen atom will be (Given ionization energy of H = 2.18 X 10^{-18} J/atom and h = 6.625 X 10^{-34} Js) :
a) 3.08×10^{15}/s b) 2.00×10^{15}/s c) 1.54×10^{15}/s d) 1.03×10^{15}/s

149. The halflife of a radioactive nucleus is 50 days. The time interval (t_2-t_1) between the time t_2 when $\frac{2}{3}$ of it has decayed and the time t_1 when $\frac{1}{3}$ of it had decayed is:
a) 30 days b) 50 days c) 60 days d) 15 days

150. 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

151. Which source is associated with a line emission spectrum?
a) Electric fire b) Neon street sign c) Red traffic light d) Sun

152. 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

153. 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.

154. 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

155. 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

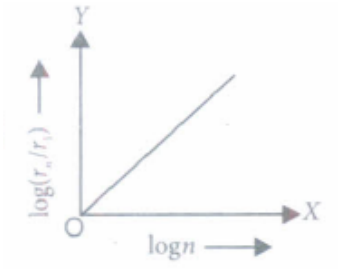
156. When an electron falls from a higher energy to a lower energy level the difference in the energies appears in the form of
a) electromagnetic radiation only b) thermal radiation only
c) both electromagnetic and thermal radiations d) none of these

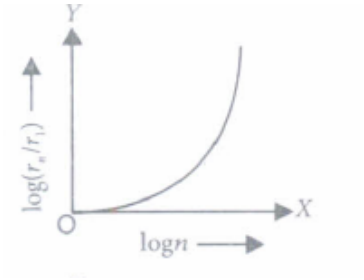
157. In the Geiger-Marsden scattering experiment the number of scattered particles detected are maximum and minimum at the scattering angles respectively at
a) 0° and 180° b) 180° and 0° c) 90° and 180° d) 45° and 90°

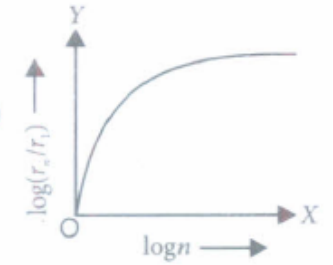
158. A 10 kg satellite circles earth once every 2 h in an orbit having a radius of 8000 km. Assuming that Bohr's angular momentum postulate applies to a satellite just as it does to an electron in the hydrogen atom, then the quantum number of the orbit of satellite is
a) 5.3×10^{40} b) 5.3×10^{45} c) 7.8×10^{48} d) 7.8×10^{50}

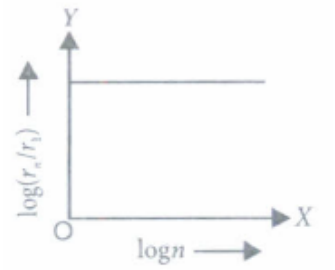
159. Consider 3rd orbit of He^+ (Helium) using nonrelativistic approach, the speed of electron in this orbit will be :
a) 0.73 x 10^6 m/s b) 3.0 x 10^8 m/s c) 2.92 x 10^6 m/s d) 1.46 x 10^6 m/s

160. 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) 

161. Assertion: The mass of β-particles when they are emitted is higher than the mass of electrons obtained by other means.
Reason: β-particle and electron, both are similar particles.
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.

162. If an electron is revolving in its Bohr orbit having Bohr radius of 0.529 $\mathring{A}$, then the radius of third orbit is
a) 4234 nm b) 4496 $\mathring{A}$ c) 4.761 $\mathring{A}$ d) 5125 nm

163. If separation of two energy levels in an atom is 2.3 eV, then the frequency of radiation emitted when the atom transits from the upper level to the lower level is
a) 2.6×10^{13} Hz b) 5.6×10^{14} Hz c) 5.6×10^{18} Hz d) 2.6×10^{18} Hz

164. Experimental evidence for the existence of the atomic nucleus comes from:
a) Millikan's oil drop experiment b) Atomic emission spectroscopy
c) The magnetic bending of cathode rays d) Alpha scattering by a thin metal foil

165. The shortest wavelength in the Balmer series is (R = 1.097×10^7 m^{-1})
a) 200 nm b) 256.8 nm c) 300 nm d) 364.6 nm

166. Assertion: A free neutron is unstable.

Reason: Free neutron disintegrates into proton, electron and an anti neutrino i.e.

$n \rightarrow p + \overline{e} + \overline{v}$

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.

167. 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

168. The ground state energy of hydrogen atom is -13.6eV. The kinetic energy of the electron in this state is

a) 2.18 x 10^{-14}J b) 2.18 x 10^{-16}J c) 2.18 x 10^{-18}J d) 2.18 x 10^{-19}J

169. Atomic hydrogen has life period of :

a) one minute b) one day c) a fraction of a second d) one hour

170. The relation between the orbit radius and the electron velocity for a dynamically stable orbit in a hydrogen atom is (where, all notations have their usual meanings)

a) $v = \sqrt{\frac{4\pi\varepsilon_0}{me^2r}}$ b) $r = \sqrt{\frac{e^2}{4\pi\varepsilon_0 v}}$ c) $v = \sqrt{\frac{e^2}{4\pi\varepsilon_0 mr}}$ d) $r = \sqrt{\frac{ve^2}{4\pi\varepsilon_0 m}}$

171. 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.

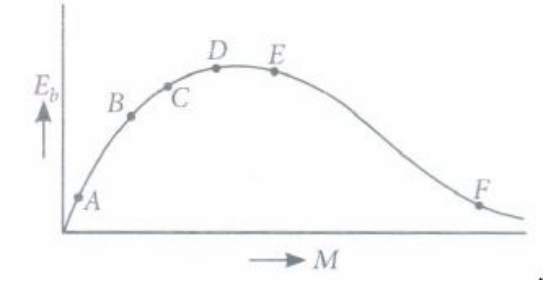
172. The nucleus ${}_6C^{12}$ absorbs an energetic neutron and emits a beta particle (b). The resulting nucleus is _____ .

a) ${}_7\,\mathrm{N}^{14}$ b) ${}_7\,\mathrm{N}^{13}$ c) ${}_5\,\mathrm{B}^{13}$ d) ${}_6\mathrm{C}^{13}$

173. The number of de Broglie wavelengths contained in the second Bohr orbit of Hydrogen atom is

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

174. Given figure shows a plot of binding energy per nucleon e,against the nuclear mass M. A, B, C, D, E, F correspond to different nuclei. Consider four reactions



(i) A + B ⟶ C + ε (ii) C ⟶ A + B + ε

(iii) D + E ⟶ F + ε (iv) F ⟶ D + E + ε

Where E is the energy released. In which reactions is ε positive?

a) (i) and (iii) b) (ii) and (iv) c) (ii) and (iii) d) (i) and (iv)

175. Existence of positively charged nucleus was established by :

a) Positive ray analysis b) a-ray scattering experiments c) X-ray analysis
d) Discharge tube experiments

176. 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

177. In the nuclear decay given below:
${}^{A}_{Z}X \rightarrow {}^{A}_{Z-1}Y \rightarrow {}^{A-4}_{Z-1}B^{*} \rightarrow {}^{A-4}_{Z-1}B$
the particles emitted in the sequence are:
a) g, b, a b) b, g, a c) a, b, g d) b, a, g

178. 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

179. Two radioactive nuclei A and B are taken with their disintegration constant λ_A and λ_B and initially N_A and N_B number of nuclei are taken then the time after which their un disintegrated nuclei are same is
a) $\frac{\lambda_A\lambda_B}{(\lambda_A-\lambda_B)}In(\frac{N_B}{N_B})$ b) $\frac{1}{(\lambda_A+\lambda_B)}In(\frac{N_B}{N_A})$ c) $\frac{1}{(\lambda_B-\lambda_A)}In(\frac{N_B}{N_A})$ d) $\frac{1}{(\lambda_A-\lambda_B)}In(\frac{N_B}{N_A})$

180. The mass of proton is 1.0073 u and that of neutron is 1.0087 u (u = atomic mass unit). The binding energy of ${}_2He^4$ is :
a) 0.061 u b) 0.0305 J c) 0.0305 erg d) 28.4 MeV

181. Ionization potential of hydrogen atom is 13.6 eV. Hydrogen atoms in the ground state are excited by monochromatic radiation of photon energy 12.1 eV. According to Bohr's theory, the spectral lines emitted by hydrogen will be _____ .
a) Three b) Four c) One d) Two

182. The half life of ${}^{90}_{38}Sr$ is 28 years. The disintegration rate of 15 mg of this isotope is of the order of:
a) 10^{11} Bq b) 10^{10} Bq c) 10^{7} Bq d) 10^{9} Bq

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

184. The Binding energy per nucleon of ${}^{7}{}_{3}Li$ and ${}^{4}{}_{2}He$ nuclei are 5.60 MeV and 7.06 MeV, respectively. In the nuclear reaction ${}_3Li^7 + {}_1H^1 \rightarrow {}_2He^4 + {}_3He^4 + Q$ the value of energy Q released is :
a) 8.4 MeV b) 17.3 MeV c) 19.6 MeV d) - 2.4 MeV

185. Assertion: The detection of neutrinos is extremely difficult.
Reason: Neutrinos interact only very weakly with matter.
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.

186. Energy E of a hydrogen atom with principal quantum number n is given by E = -13.6/n^2 eV. The energy of photon ejected when the electron jumps from n = 3 state to n = 2 state of hydrogen is approximately;
a) 1.9 eV b) 1.5 eV c) 0.85 eV d) 3.4 eV

187. 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}

188. 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

189. 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

190. In question number 70, what is the frequency of photon?
a) 3.1 x 10^{15}Hz b) 3.1 x 10^{18}Hz c) 9.1 X 10^{15}Hz d) 9.1 x 10^{18}Hz

191. The first spectral series was discovered by
a) Balmer b) Lyman c) Paschen d) Pfund

192. An electron is accelerated from rest through a potential difference of V volt. If the de-Broglie wavelength of the electrons is $1.227 \times 10^{-2}\ \mathrm{nm}$, the potential difference is:
a) $10^4\ \mathrm{V}$ b) $10\ \mathrm{V}$ c) $10^2\ \mathrm{V}$ d) $10^3\ \mathrm{V}$

193. In the Geiger-Marsden scattering experiment, in case of head-on collision the impact parameter should be
a) maximum b) minimum c) infinite d) zero

194. The energy of a hydrogen atom in the ground state is - 13.6 eV. The energy of He^+ ion in the first excited state will be :
a) -13.6 eV b) - 27.2 eV c) - 54.4 eV d) - 6.8 eV

195. A radioactive element has half-life period 800 yr. After 6400 yr, what amount will remain?
a) $\frac{1}{2}$ b) $\frac{1}{16}$ c) $\frac{1}{8}$ d) $\frac{1}{256}$

196. If υ_1 is the frequency of the series limit of Lyman series, υ_2 is the frequency of the first line of Lyman series and υ_3 is the frequency of the series limit of the Balmer series, then
a) $\upsilon_1 - \upsilon_2 = \upsilon_3$ b) $\upsilon_1 = \upsilon_2 - \upsilon_3$ c) $\frac{1}{\upsilon_2} = \frac{1}{\upsilon_1} + \frac{1}{\upsilon_3}$ d) $\frac{1}{\upsilon_1} = \frac{1}{\upsilon_2} + \frac{1}{\upsilon_3}$

197. 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 $\overset{o}{A}$

198. 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

199. 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.

200. In a radioactive material the activity at time t_1 is R_1 and at a later time t_2, it is R_2. If the decay constant of the material is 1, then
a) $R_1 = R_2 e^{\lambda(t_1 - t_2)}$ b) $R_1 = R_2 e^{t_1/t_2}$ c) $R_1 = R_2$ d) $R_1 = R_2 e^{-\lambda(t_1 - t_2)}$

201. The Bohr model for the H-atom relies on the Coulomb's law of electrostatics. Coulomb's law has not directly been verified for very short distances of the order of angstroms. Supposing Coulomb's law between two opposite charge + q_1 , - q_2 is modified to
$= \frac{q_1 q_2}{4\pi\varepsilon_0}\frac{1}{R_0^2}\left(\frac{R_0}{r}\right)^{\varepsilon}, r \leq R_0$ Calculate in such a case, the ground state energy (in eV) of a H-atom, if ε = 0.1, R_0 = 1 $\mathring{A}$.
a) -11.4 b) -17.3 c) 5.9 d) -23.2

202. When atoms are bombarded with alpha particles, only a few in million suffer deflection, others pass out undeflected. This is because:
a) The force of repulsion on the moving alpha particle is small
b)
The force of attraction on the alpha particle to the oppositely charged electrons is very small
c) There is only one nucleus and large number of electrons
d) The nucleus occupies much smaller volume compared to the volume of the atom

203. Let $E_n = \frac{-me^4}{8\varepsilon_0^2 n^2 h^2}$ be the energy of the n^{th} 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

204. 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

205. **Assertion:** Atom as a whole is electrically neutral.
Reason : Atom contains equal amount of positive and negative charges.
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.

206. The half life of a radioactive nucleus is 50 days. The time interval (t_2 - t_1) between the time t_2 when 2/3 of it has decayed and the time t_1 when 1/3 of it had decayed is :
a) 50 days b) 60 days c) 15 days d) 30 days

207. 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) $\frac{5}{27}$

208. How much mass has to be converted into energy to produce electric power of 500 MW for one hour?
a) 2 x 10^{-5}kg b) 1 x 10^{-5}kg c) 3 x 10^{-5}kg d) 4 x 10^{-5}kg

209. 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

210. 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

211. 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: $3^{1/2}$

212. Consider aiming abeam offree electrons towards free protons. When they scatter, an electron and a proton cannot combine to produce a H-atom, because of
a) energy conservation b) simultaneously releasing energy in the from of radiation
c) momentum conservation d) angular momentum conservation

213. The activity of a radioactive sample is measured as N_0 counts per minute at t = 0 and N_0/e counts per minute at t = 5 minutes. The time (in minutes) at which the activity reduces to half its value is :
a) $\log_e 2/5$ b) $5/1\log_e 2$ c) $51\log_{10} 2$ d) $5\log_e 2$

214. Assertion: Neutrons penetrate matter more readily as compared to protons.
Reason: A neutron has no charge.
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.

215. 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.

216. 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

217. The nuclei ${}^{13}_{6}C$ and ${}_{7}N^{14}$ can be described as:
a) isotones b) isobars c) isotopes of carbon d) isotopes of nitrogen

218. 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

219. Out of the following which one is not a possible energy for a photon to be emitted by hydrogen atom according to Bohr's atomic model?
a) 0.65 eV b) 1.9 eV c) 11.1 eV d) 13.6 eV

220. 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

221. The ionisation energy of hydrogen atom is 13.6 eV the ionisation energy of helium atom would be:
a) 13.6 eV b) 27.2 eV c) 6.8 eV d) 54.4 eV

222. The electric current I created by the electron in the ground state of H atom using Bohr model in terms of Bohr radius (a_0) and velocity of electron in first orbit v_0 is
a) $\frac{ev_0}{2\pi a_0}$ b) $\frac{2\pi a}{ev_0}$ c) $\frac{2\pi a}{v_0}$ d) $\frac{v_0}{2\pi a}$

223. 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.

224. Assertion: The radius of a nucleus determined by electron scattering is found to be slightly different from that determined by alpha particle scattering.
Reason: Electron scattering senses the charge distribution of the nucleus whereas alpha and similar particles sense the nuclear matter.
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.

225. The deuteron is bound by nuclear forces just as H -atom is made up of p and e bound by electrostatic forces. If we consider the force between neutron and proton in deuteron as given in the form of a Coulomb potential but with an effective charge e' $F = \frac{1}{4\pi\varepsilon_o}\frac{e'^2}{r}$ Estimate the value of (e'/e) given that the binding energy of a deuteron is 2.2 MeV.
a) 1.89 b) 9.24 c) 3.64 d) 7.62

226. 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

227. 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.

228. The binding energy of a H-atom, considering an electron moving around a fixed nuclei (proton), is

B=$\frac{me^4}{8n^2\varepsilon_0^2h^2}$ (m = electron mass). If one decides to work in a frame of reference where the electron is at rest, the proton would be moving around it. By similar arguments, the binding energy would be

B=$\frac{me^4}{8n^2\varepsilon_0^2h^2}$ (M = proton mass)

This last expression is not correct because

a) n would not be integral b) Bohr-quantisation applies only to electron

c) the frame in which the electron is at rest is not inertial

d) the motion of the proton would not be in circular orbits, even approximately

229. The mass of alpha-particle is :

a) less than the sum of masses of two protons and two neutrons

b) equal to mass of four protons c) equal to mass of four neutrons

d) equal to sum of masses of two protons and two neutron

230. 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

231. A 280 day old radioactive substance shows an activity of 6000 dps, 140 days later its activity becomes 3000 dps. What was its initial activity?

a) 20000 dps b) 24000 dps c) 12000 dps d) 6000 dps

232. In the given reactions, which of the following nuclear fusion reaction is not possible?

a) ${}^{13}_{6}C + {}^{1}_{1}H \rightarrow {}^{14}_{6}C + 4.3MeV$ b) ${}^{12}_{6}C + {}^{1}_{1}H \rightarrow {}^{13}_{7}C + 2MeV$

c) ${}^{14}_{7}N + {}^{1}_{1}H \rightarrow {}^{15}_{8}O + 7.3MeV$ d) ${}^{235}_{92}C + {}^{1}_{0}n \rightarrow {}^{140}_{54}Xe + {}^{94}_{38}Sr + {}^{1}_{0}n + {}^{1}_{0}n + 200MeV$

233. 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

234. The angular speed of the electron in the n^{th} orbit of Bohr's hydrogen atom is

a) directly proportional to n b) inversely proportional to $\sqrt{n}$ c) inversely proportional to n^2

d) inversely proportional to n^3

235. 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)

236. In a nuclear fusion reaction, two nuclei, A & B, fuse to produce a nucleus C, releasing an amount of energy $\triangle$E in the process. If the mass defects of the three nuclei are $\triangle$ M_A , $\triangle$ M_B & $\triangle$ M_C respectively, then which of the following relations holds? Here, c is the speed of light.
a) $\triangle M_A + \triangle M_B = \triangle M_C - \triangle E/C^2$ b) $\triangle M_A + \triangle M_B = \triangle M_C + \triangle E/C^2$
c) $\triangle M_A - \triangle M_B = \triangle M_C - \triangle E/C^2$ d) $\triangle M_A - \triangle M_B = \triangle M_C + \triangle E/C^2$

237. 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

238. The power obtained in a reactor using U^{235} disintegration is 1000 kW, The mass decay of U^{235} per hour is:
a) 10 microgram b) 20 microgram c) 40 microgram d) 1 microgram

239. The first line of the Lyman series in a hydrogen spectrum has a wavelength of 1210 $\mathring{A}$. The corresponding line of a hydrogen- like atom of Z = 11 is equal to
a) 4000 $\mathring{A}$ b) 100 $\mathring{A}$ c) 40 $\mathring{A}$ d) 10 $\mathring{A}$

240. Let m_p be the mass of a proton, m_n the mass of a neutron, M_1 the mass of a $^{20}_{10}Ne$ nucleus and M_2 the mass of a $^{40}_{20}Ca$ nucleus. Then
a) $M_2 = M_1$ b) $M_2 > 2M_1$ c) $M_2 < 2M_1$ d) $M_1 < 10 (m_n + m_p)$

241. The most penetrating radiation of the following is:
a) gamma-rays b) alpha particles c) beta-rays d) X-rays

242. 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 μ = $m_eM/(m_e + M)$ 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 $\times$ 10^{-27} kg, Mass of ^2H nucleus is 3.3374 $\times$ 10^{-27} kg, Mass of electron = 9.10^9 $\times$ 10^{-31} kg.)
a) 2.7 $\times$ 10^{-1} % b) 2.7 $\times$ 10^{-2}% c) 3.5 $\times$ 10^{-2}% d) 3.5 $\times$ 10^{-1}%

243. When beryllium is bombarded with a-particles, extremely penetrating radiations which cannot be deflected by electrical or magnetic field are given out. These are:
a) A beam of protons b) a-rays c) A beam of neutrons d) X-rays

244. Order of magnitude of density of uranium nucleus is:

a) 10^{20} kg m^{-3} b) 10^{17} kgm^{-3} c) 10^{14} kg m^{-3} d) 10^{11} kgm^{-3}

245. **Assertion:** Most of the mass of the atom is concentrated in its nucleus.
Reason: All alpha particles striking a gold sheet are scattered in different directions.
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.

246. 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

247. Thermal neutrons are those which
a) Are at very high temperature b) Move with high velocities
c) Have kinetic energies similar to those of surrounding molecules d) Are at rest

248. The average binding energy of a nucleon inside an atomic nucleus is about _____ .
a) 8 MeV b) 8 eV c) 8 J d) 8 erg

249. **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.

250. M_x and M_y denote the atomic masses of the parent and the daughter atom respectively in a radioactive decay. The Q-value for a β^-decay is Q_1 and that for a β^+decay is Q_2. If m_e denotes the mass of an electron, then which of the following statements is correct?
a) $Q_1 = (M_x - M_y)c^2$ and $Q_2= (M_x - M_y - 2m_e)c^2$ b) $Q_1 = (M_x - M_y)c^2$ and $Q_2= (M_x - M_y)c^2$
c) $Q_1 =(M_x-M_y-2m_e) C^2$ and$Q_2=(M_x-M_y+2me)C^2$
d) $Q1 = (M_x - M_y+ 2m_e)c^2$ and $Q2 = (Mx - M_y+ 2m_e)c^2$

251. A sample of radioactive material has mass m, decay constant λ, molecular weight M and Avogadro constant N_A. The initial activity of the sample is
a) λm b) $\frac{\lambda m}{M}$ c) $\frac{\lambda m N_A}{M}$ d) $mN_A\lambda$

252. **Assertion:** Bohr model can not be extended to two or more electron atoms.
Reason : Each electron in the atom interacts not only with the positively charged nucleus but also with all other electrons.
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.

253. When an electron jumps from the fourth orbit to the second orbit, one gets the
a) second line of Paschen series b) second line of Balmer series
c) first line of Pfund series d) second line of Lyman series

254. In which of the following systems will the radius of the first orbit (n =1) be minimum?

a) Hydrogen atom b) Doubly ionized lithium c) Singly ionized helium d) Deuterium atom

255. If a proton had a radius R and the charge was uniformly distributed, the ground state energy (in eV) of a H-atom for R = 0.1 $\mathring{A}$ is
a) -13.6 b) -27.2 c) -3.4 d) -30.8

256. The constituents of atomic nuclei are believed to be:
a) neutrons and protons b) protons only c) electrons and protons
d) electrons, protons and neutrons

257. α-particles, β-particles and γ-rays are all having same energy. Their penetrating power in a given medium in increasing order will be _____ .
a) b, g, a b) g, a, b c) a, b, g d) b, a, g

258. The mass of a $^{7}_{3}\mathrm{Li}$ nucleus is 0.042 u less than the sum of the masses of all its nucleons. The binding energy per nucleon of $^{7}_{3}\mathrm{Li}$ nucleus is nearly:
a) 46 MeV b) 5.6 MeV c) 3.9 MeV d) 23 MeV

259. **Assertion:** According to electromagnetic theory an accelerated particle continuously emits radiation.
Reason: According to classical theory, the proposed path of an electron in Rutherford atom model will be parabolic.
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

260. A deuteron strikes $_{8}O^{16}$ nucleus with subsequent emission of an alpha particle. Identify the nucleus so produced:
a) $_{3}Li^{7}$ b) $_{5}B^{10}$ c) $_{7}N^{13}$ d) $_{7}N^{14}$

261. A certain mass of Hydrogen is changed to Helium by the process of fusion. The mass defect in fusion reaction is 0.02866 a.m.u. The energy liberated per a.m.u. is:
(Given: 1a.m.u = 931 MeV)
a) 26.7 MeV b) 6.675 MeV c) 13.35 MeV d) 2.67 MeV

262. If in nuclear fusion process the masses of the fusing nuclei be m_1 and m_2 and the mass of the resultant nucleus be m_3 then:
a) $m_3 > (m_1 + m_2)$ b) $m_3 = m_1 + m_2$ c) $m_3 = | m_1 - m_2 |$ d) $m_3 < (m_1 + m_2)$

263. 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

264. If 200 MeV energy is released in the fission of a single nucleus of $^{235}_{92}U$,the fissions which are required to produce a power of 1 kW is
a) 3.125 x 10^{13} b) 1.52 x 10^{6} c) 3.125 X 10^{12} d) 3.125 x 10^{14}

265. The nucleus $_{48}Cd^{115}$, after two successive β-decay will give _____ .
a) $_{46}\mathrm{Pa}^{115}$ b) $_{49}In^{114}$ c) $_{50}Sn^{113}$ d) $_{50}Sn^{115}$

266. Assertion: Nuclear sources will give a million times larger energy than conventional sources.
Reason: Nuclear energy sources are massive than conventional energy sources

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.

267. Nuclei of a radioactive element A are being produced at a constant rate α. The element has a decay constant λ. At time t = 0, there are N_o. nuclei of the element. The number N of nuclei of A at time t is :
a) $\frac{1}{\lambda}[\alpha + (\alpha - N_o\lambda)e^{-\lambda t}]$ b) $\frac{1}{\lambda}[\alpha - (\alpha - N_o\lambda)e^{-\lambda t}]$ c) $[\alpha - (\alpha - N_o\lambda)e^{-\lambda t}]$
d) $[\alpha - (N_o\lambda - \alpha)e^{-\lambda t}]$

268. 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

269. Two nuclei have their mass numbers in the ratio of 1:3. The ratio of their nuclear densities would be:
a) 1:3 b) 3:1 c) $(3)^{1/3}$:1 d) 1:1

270. In the question number 59, the value of velocity of the revolving electron is:
a) 1.2×10^6 ms^{-1} b) 2.2×10^6 ms^{-1} c) 3.2×10^6 ms^{-1} d) 4.2×10^6 ms^{-1}

271. If 13.6 eV energy is required to separate a hydrogen atom into a proton and an electron, then the orbital radius of electron in a hydrogen atom is
a) 5.3×10^{-11} m b) 4.3×10^{-11} m c) 6.3×10^{-11} m d) 7.3×10^{-11} m

272. A proton carrying 1 MeV kinetic energy is moving in a circular path of radius R in uniform magnetic field. What should be the energy of an a-particle to describe a circle of same radius in the same field?
a) 1 MeV b) 0.5 MeV c) 4 MeV d) 2 MeV

273. In one a and 2β-emissions:
a) Mass number reduces by 2 b) Mass number reduces by 6
c) Atomic number reduces by 2 d) Atomic number remains unchanged

274. 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) ${}_{20}\mathrm{Ca}^{40}, {}_{16}\ \mathrm{S}^{32}$

275. 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

276. Heavy stable nuclei have more neutrons than protons. This is because of the fact that
a) neutrons are heavier than protons. b) electrostatic force between protons are repulsive.
c) neutrons decay into protons through beta decay.
d) nuclear forces between neutrons are weaker than that between protons.

277. 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

278. When an atomic gas or vapour is excited at low pressure, bypassing an electric current through it then
a) emission spectrum is observed b) absorption spectrum is observed
c) band spectrum is observed d) both (b) and (c)

279. 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

280. **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.

281. Tritium with a half-life of 12.5 years undergoing beta decay. What fraction of a sample of pure tritium will remain undecayed after 25 years.
a) one half b) one fourth c) one third d) can't say

282. During negative β-decay, an antineutrino is also emitted along with the emitted electron. Then,
a) only linear momentum will be conserved
b) total linear momentum and total angular momentum but not total energy will be conserved
c) total linear momentum and total energy but not total angular momentum will be conserved
d) total linear momentum, total angular momentum and total energy will be conserved

283. Atomic power station at Tarapore has a generating capacity of 200 MW. The energy generated in a day by this station is :
a) 200 MW b) 200 J c) 4800 x 10^6 J d) 1728 x 10^{10}J

284. In Balmer series of emission spectrum of hydrogen, first four lines with different wavelength H α'Hβ,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

285. **Assertion :** Bohr's third postulate states that the stationary orbits are those for which the angular momentum is some integral multiple of h2πh2π.
Reason : Linear momentum of the electron in the atom is quantised.
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.

286. Assertion: When a nucleus is in an excited state, it can make a transition to a lower energy state by the emission of gamma rays.
Reason: There are energy levels for a nucleus just like there are energy levels in atoms.
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.

287. 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.

288. Solar energy is due to :
a) fusion reaction b) fission reaction c) combustion reaction d) chemical reaction

289. Radon has 3.8 days as its half-life. How much radon will be left out of 15 mg mass after 38 days?
a) 1.05 mg b) 0.015 mg c) 0.231 mg d) 0.50 mg

290. The binding energy of deuteron is 2.2 MeV and that of $_{2}^{4}\mathrm{He}$ is 28 MeV. If two deuterons are fused to form one $_{2}^{4}\mathrm{He}$, then the energy released is _____ .
a) $23.6\mathrm{MeV}$ b) $19.2\mathrm{MeV}$ c) $30.2\mathrm{MeV}$ d) $25.8\mathrm{MeV}$

291. Electron occupies the available orbital singly before pairing in anyone orbital occurs, it is :
a) Pauli's exclusion principle b) Hund's Rule c) Heisenberg's principle
d) Prout's hypothesis

292. A triply ionized beryllium (Be^{3+}) has the same orbital radius as the ground state of hydrogen. Then the quantum state n of Be^{3+} is
a) n = 1 b) n = 2 c) n = 3 d) n = 4

293. 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

294. The ionization energy of the electron in the hydrogen atom in its ground state is 13.6 eV. The atoms are excited to higher energy levels to emit radiations of 6 wavelengths. Maximum wavelength of emitted radiation corresponds to the transition between _____ .
a) n=3 to n=1 states b) n=2 to n=1 states c) n=4 to n=3 states d) n=3 to n=2 states

295. The wavelength limit present in the Pfund series is (R = 1.097 $\times$ 10^7 m^{-1})
a) 1572 nm b) 1898 nm c) 2278 nm d) 2535 nm

296. 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) $\frac{16}{7R}$

297. The relationship between kinetic energy (K) and potential energy (U) of electron moving in a orbit around the nucleus is
a) U = -K b) U = -2K c) U = -3K d) $U = -\frac{1}{2}K$

298. Two radioactive nuclei P and Q, in a given sample decay into a stable nucleolus R. At time t = 0, number of P species are $4N_0$ and that of Q are N_0. Half-life of P (for conversion to R) is 1 minute where as that of Q is 2 minutes. Initially there are no nuclei of R present in the sample. When number of nuclei of P and Q are equal, the number of nuclei of R present in the sample would be:
a) $3\ \mathrm{N}_0$ b) $\frac{9N_0}{2}$ c) $\frac{5N_0}{2}$ d) $2\ \mathrm{N}_0$

299. 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

300. 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

301. The ground state energy of an atom is -13.6 eV. The photon emitted during the transition of electron from n = 3 to n = 1 state, is incident on a photosensitive material of unknown work function. The photoelectrons are emitted from the materials with a maximum kinetic energy of 9 eV. The threshold wavelength of the material used is
a) 0.9×10^{-7} m b) 4×10^{-7} m c) 0.47×10^{-7} m d) 9×10^{-7} m

302. 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 $M_1 \times M_2$

303. The shortest wavelength present in the Paschen series of spectral lines is
a) 720 nm b) 790 nm c) 800 nm d) 820 nm

304. The wavelength of the first line of Lyman series for hydrogen atom is equal to that of the second line of Balmer series for hydrogen like ion. The atomic number Z of hydrogen like ion is :
a) 3 b) 4 c) 1 d) 2

305. The half-life of a radioactive substance is 30 minutes. The time (in minutes) taken between 40% decay and 85% decay of the same radioactive substance is :
a) 15 b) 30 c) 45 d) 60

306. 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

307. Wavelength of spectral line emitted is inversely proportional to :
a) Radius b) Energy c) Velocity d) Quantum number

308. Which of the following is not correct about Bohr model of the hydrogen atom?
a)
An electron in an atom could revolve in certain stable orbits without the emission of radiant energy.
b)
Electron revolves around the nucleus only in those orbits for which angular momentum $L_n = \frac{nh}{2\pi}$.
c)
When electron make a transition from one ofits stable orbit to lower orbit then a photon emitted with energy $h\upsilon = E_f - E_i$
d) Bohr model is applicable to all atoms.

309. The stable nucleus that has a radius half that of Fe^{56} is:
a) Li^{7} b) Na^{21} c) S^{16} d) Ca^{40}

310. In Geiger-Marsden scattering experiment, the trajectory traced by an α-particle depends on
a) number of collision b) number of scattered α- particles c) impact parameter
d) none of these

311. Complete the equation for the following fission process.
$_{92}\mathrm{U}^{235} + {}_0n^1 3/4 \rightarrow {}_{38}\mathrm{Sr}^{90} + \ldots\ldots$
a) $_{54}\mathrm{Xe}^{143} + 3{}_0n^1$ b) $_{54}\mathrm{Xe}^{145}$ c) $_{57}\mathrm{Xe}^{142}$ d) $_{54}\mathrm{Xe}^{142} + {}_0n^1$

312. To explain his theory Bohr used;
a) Conservation of linear momentum b) Conservation of angular momentum
c) Conservation of quantum frequency d) Conservation of energy

313. In the question number 67, find the potential energy of electron (in Joule) in the given state.
a) -4.36 $\times$ 10-14 J b) -4.36 $\times$ 10^{-16} J c) -4.36 $\times$ 10^{-17} J d) -4.36 $\times$ 10^{-18} J

314. A nuclear reaction is given by
$_zX^A \rightarrow {}_{z+1}Y^A + {}_{-1}e^0 + \bar{v},$ represents :
a) fission b) β-decay c) g-decay d) fusion

315. 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

316. Atomic weight of boron is 10.81 and it has two isotopes $^{10}_9B$ and $^{11}_5B$. Then, the ratio of atoms of $^{10}_5B$ and $^{11}_5B$ in nature would be:
a) 19: 81 b) 10: 11 c) 15: 16 d) 81: 19

317. J.J. Thomson's cathode-ray tube experiment demonstrated that.
a)
The e/m ratio of the cathode-ray particles changes when a different gas is placed in the discharge tube
b) Cathode rays are streams of negatively charged ions
c) All the mass of an atom is essentially in the nucleus.
d) The e/m of electrons is much greater than the e/m of protons

318. In accordance with the Bohr's model, the quantum number that characterises the earth's revolution around the sun in an orbit of radius 1.5 $\times$ 10^{11} m with orbital speed 3 $\times$ 10^4 m s^{-1} is (Mass of earth = 6 $\times$ 10^{24}kg)
a) 5.98 $\times$ 10^{86} b) 2.57 $\times$ 10^{38} c) 8.57 $\times$ 10^{64} d) 2.57 $\times$ 10^{74}

319. 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

320. Which of the following statements does not form part of Bohr's model of the hydrogen atom:

a) Energy of the electrons in the orbit is quantized
b) The electron in the orbit nearest the nucleus has the lowest energy
c) Electrons revolve in different orbits around the nucleus
d)
The position and velocity of the electrons in the orbit cannot be determined simultaneously

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

322. The energy required to excite an electron in hydrogen atom to its first excited state is
a) 8.5 eV b) 10.2 eV c) 12.7 eV d) 13.6 eV

323. 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) $-3.4\text{eV}, -3.4\text{eV}$

324. Which of the following spectral series falls within the visible range of electromagnetic radiation?
a) Lyman series b) Balmer series c) Paschen series d) Pfund series

325. 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)λ_0 b) (20/27)λ_0 c) (27/20)λ_0 d) (25/16)λ_0

326. 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%

327. **Assertion :** For the scattering of α-particles at large angles, only the nucleus of the atom is responsible.
Reason : Nucleus is very heavy in comparison to electrons.
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.

328. A radioactive sample with a half-life of 1 month has the label: Activity =2 microcurie on 1-8-1991. What would be its activity two months earlier?
a) 1.0 microcurie b) 0.5 microcurie c) 4 microcurie d) 8 microcurie

329. 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

330. The minimum energy that must be given to a H atom in ground state so that it can emit an H_γ line in Balmer series is
a) 12.4 eV b) 10.2 eV c) 13.06 eV d) 13.6 eV

331. 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

332. Two particles of masses m_1, m_2 move with initial velocities u_1 and u_2. On collision, one of the particles get excited to higher level, after absorbing energy e. If final velocities of particles be v_1 and v_2 then we must have _____ .
a) $\frac{1}{2}m_1u_1^2 + \frac{1}{2}m_2u_2^2 = \frac{1}{2}m_1v_1^2 + \frac{1}{2}m_2v_2^2 - \varepsilon$
b) $\frac{1}{2}m_1u_1^2 + \frac{1}{2}m_2u_2^2 - \varepsilon = \frac{1}{2}m_1v_1^2 + \frac{1}{2}m_2v_2^2$
c) $\frac{1}{2}m_1^2u_1^2 + \frac{1}{2}m_2^2u_2^2 + \varepsilon = \frac{1}{2}m_1^2v_1^2 + m_2^2v_2^2$
d) $m_1^2u_1 + m_2^2u_2 - \varepsilon = m_1^2v_1 + m_2^2v_2$

333. 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

334. Taking the Bohr radius as ao = 53 pm, the radius of Li^{++} ion in its ground state, on the basis of Bohr's model, will be about:
a) 53 pm b) 27 pm c) 18 pm d) 13 pm

335. Electron in hydrogen atom first jumps from third excited state to second excited state and then from second excited to the first excited state. The ratio of the wavelength $1_1 : 1_2$ emitted in the two cases is _____ .
a) 7/5 b) 27/20 c) 27/5 d) 20/7

336. **Assertion:** The total energy of an electron revolving in any stationary orbit is negative.
Reason: Energy can have positive or negative values.
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.

337. Rutherford's experiments suggested that the size of the nucleus is about
a) 10^{-14} m to 10^{-12} m b) 10^{-15} m to 10^{-13} m c) 10^{-15} m to 10^{-14} m d) 10^{-15} m to 10^{-12} m

338. Assertion: Nuclear force between neutron-neutron, proton-neutron and proton-proton is approximately the same.
Reason: The nuclear force does not depend on the electric charge.
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.

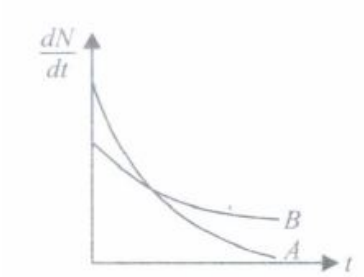
339. Assertion: Isotopes of an element can be separated by using a mass spectrometer.
Reason: Separation of isotopes is possible because of difference in electron number of isotopes.
a) If both assertion and reason are true and reason is the correct explanation of assertion.
b)
If both assertion and 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.

340. The mass number of a nucleus is :

a) sometimes less than and sometimes more than its atomic number
b) always less than its atomic number c) always more than its atomic number
d) sometimes equal to its atomic number

341. **Assertion:** Large angle of scattering of alpha particles led to the discovery of atomic nucleus.
Reason : Entire positive charge of atom is concentrated in the central core.
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.

342. 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).

343. The transition from the state n=3 to n=1 in a hydrogen like atom results in ultraviolet radiation. Infrared radiation will be obtained in the transition from:
a) $2 \rightarrow 1$ b) $3 \rightarrow 2$ c) $4 \rightarrow 2$ d) $5 \rightarrow 4$

344. 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) $\frac{24m}{25hR}$

345. A nucleus ${}_{n}X'''$ emits one α-particle and two β particles. The resulting nucleus is :
a) ${}_{n\_4}Z^{m-6}$ b) ${}_{n}Z^{m-6}$ c) ${}_{n}X^{m-4}$ d) ${}_{n\_2}Y^{m-4}$

346. Bohr's basic idea of discrete energy levels in atoms and the process of emission of photons from the higher levels to lower levels was experimentally confirmed by experiments performed by
a) Michelson-Morley b) Millikan c) Joule d) Franck and Hertz

347. 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}

348. Match the correct pairs.

	Emission series		**Make transitions from higher levels to following levels**
A	Lyman series	P	n=l
B	Paschen series	Q	n=2

C	Balmer series	R	n=3
D	Brackett series	S	n=4
		T	n=5

a) A-P; B-R; C-Q; D-S b) A-P; B-Q; C-R; D-T c) A-Q; B-R; C-S; D- T
d) A- T; B-S; C-R; D-Q

349. 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

350. 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_12 c) $f_1=f_2$
d) either of (a), (b) or (c) depending on the values of the mean life and half life.

351. The nature of ions knocked out from hot surfaces is:
a) protons b) electrons c) neutrons d) nuclei

352. 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

353. For scattering by an inverse-square field (such as that produced by a charged nucleus in Rutherford's model) the relation between impact parameter b and the scattering angle θ is given by, b = (Ze^2 cot (θ/2))/($2\pi\varepsilon_0$m v^2) The scattering angle for b = 0 is
a) 180° b) 90° c) 45° d) 120°

354. The wavelength of the first line of Lyman series is 1215 $\mathring{A}$, the wavelength of first line of Balmer series will be
a) 4545 $\mathring{A}$ b) 5295 $\mathring{A}$ c) 6561 $\mathring{A}$ d) 6750 $\mathring{A}$

355. An electron in hydrogen atom makes a transition $n_1 \rightarrow n_2$ where n_1 and n_2 are principal quantum numbers of the two states. Assuming Bohr's model to be valid the time period of the electron in the initial state is eight times that in the final state. The possible values of n_1 and n_2 are:
a) n_1 = 4 and n_2 = 2 b) n_1 = 6 and n_2 = 2 c) n_1 = 8 and n_2 = 1 d) n_1 = 8 and n_2 = 2

356. If the radius of inner most electronic orbit of a hydrogen atom is 5.3 $\times$ 10^{-11} m, then the radii of n = 2 orbit is
a) 1.12 $\mathring{A}$ b) 2.12 $\mathring{A}$ c) 3.22 $\mathring{A}$ d) 4.54 $\mathring{A}$

357. If the binding energy per nucleon in $_3\mathrm{Li}^7$ and $_2\mathrm{He}^4$ nuclei are respectively 5.60 MeV and 7.06 MeV, then the energy of proton in the reaction $_3\mathrm{Li}^7 + \mathrm{p}^{3/4} \rightarrow 2_2\mathrm{He}^4$ is _____ .
a) 19.6 MeV b) 2.4 MeV c) 8.4 MeV d) 17.3 MeV

358. Sometimes a radioactive nucleus decays into a nucleus which itself is radioactive. An example is :

$$^{38}Sulphur \xrightarrow[=2.48]{half-life\ ^{38}} Cl \xrightarrow[=0.62h]{half-life\ ^{38}} Ar(stable)$$

Assume that we start with 1000 ^{38}S nuclei at time t = 0. The number of ^{38}Cl is of count zero at t = 0 and will again be zero at t =∞ . At what value of t, would the number of counts be a maximum?

a) 1.65 h b) 2.62 h c) 3.24 h d) 3.95 h

359. The acronym LASER stands for

a) Light Amplification by Stimulated Emission of Radiation

b) Light Amplitude by Stimulated Emission of Radiation

c) Light Amplification by Strong Emission of Radiation

d) Light Amplification by Stimulated Emission of Radiowave

360. Consider an electron in the nth orbit of a hydrogen atom in the Bohr model. The circumference of the orbit can be expressed in terms of de-Broglie wavelength 1 of that electron as:

a) $(0.529)n\lambda$ b) $\sqrt{n\lambda}$ c) $(13.6)\lambda$ d) $n\lambda$

361. The half-life of radium is $1600\mathrm{yr}$. The fraction of a sample of radium that would remain after 6400 year.

a) $\frac{1}{4}$ b) $\frac{1}{2}$ c) $\frac{1}{8}$ d) $\frac{1}{16}$

362. 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

363. Consider α and β particles and γ-rays each having an energy of 0.5 MeV. In the increasing order of penetrating power, the radiation are respectively

a) α, β, γ b) α, γ, β c) β, γ, α d) γ, β, α

364. 1 mg radium has 2.68 x 10^{18} atoms. Its half life is 1620 years. How many radium atoms will disintegrate from 1 mg of pure radium in 3240 years?

a) 2.01 x 10^{9} b) 2.01 x 10^{18} c) 1.01 X 10^{9} d) 1.01 x 10^{18}

365. Complete the series $^{6}He \longrightarrow e^{-} + {}^{6}Li^{+}$

a) neutrino b) antineutrino c) proton d) neutron

366. The energy equivalent of one atomic mass unit is :

a) 1.6 x 10^{-19}J b) 6.02 x 10^{23}J c) 931 MeV d) 9.31 MeV

367. In a radioactive decay process, the negatively charged emitted β-particles are _____ .

a) The electrons produced as a result of the decay of neutrons inside the nucleus

b) The electrons produced as a result of collisions between atoms

c) The electronics orbiting around the nucleus d) The electrons present inside the nucleus

368. Energy released in the fission of a single $_{92}U^{235}$ nucleus is 200 MeV. The fission rate of a $_{92}U^{235}$ filled reactor operating at a power level of 5 W is _____ .

a) $1.56 \times 10^{-10}\ \mathrm{s}^{-1}$ b) $1.56 \times 10^{11}\ \mathrm{s}^{-1}$ c) $1.56 \times 10^{-16}\ \mathrm{s}^{-1}$ d) $1.56 \times 10^{-17}\ \mathrm{s}^{-1}$

369. For the ground state, the electron in the H-atom has an angular momentum=-h, according to the simple Bohr model. Angular momentum is a vector and hence there will be infinitely many orbits with the vector pointing in all possible directions. In actuality this is not true,
a) because Bohr model gives incorrect values of angular momentum
b) because only one of these would have aminimum energy
c) angular momentum must be in the direction of spin of electron
d) because electrons go around only in horizontal orbits

370. A nucleus of Ux_1 has a half life of 24.1 days. How long a sample of Ux_1 will take to change to 90% of Ux_1.
a) 80 days b) 40 days c) 20 days d) 10 days

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

372. The first use of quantum theory to explain the structure of atom was made by
a) Heisenberg b) Bohr c) Planck d) Einstein

373. The radius of electron orbit and the speed of electron in the ground state of hydrogen atom is 5.30×10^{-11} m and 2.2×10^{6} m s^{-1} respectively, then the orbital period of this electron in second excited state will be
a) 1.21×10^{-14} s b) 1.21×10^{-12} s c) 1.21×10^{-10} s d) 1.21×10^{-15} s

374. 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