Multiple Choice Questionnaires

1.    The atomic mass unit is defined as
    a.    the mass of a proton.
    b.    the mass of an electron.
    c.    the mass of a hydrogen-1 atom.
    d.    one twelfth the mass of a carbon-12 atom.

2.    An element with atomic mass number of 14 and atomic number 6 has how many neutrons?
    a.    6
    b.    8
    c.    14
    d.    20

3.    Isotopes of an element have nuclei with
    a.    the same number of protons, but different numbers of neutrons.
    b.    the same number of protons, and the same number of neutrons.
    c.    a different number of protons, and a different number of neutrons.
    d.    a different number of protons, and the same number of neutrons.

4.    If an atom's atomic number is given by Z, its atomic mass by A, and its neutron number
    by N, which of the following is correct?
    a.    $N = A + Z$
    b.    $N = Z - A$
    c.    $N = A - Z$
    d.    None of the above is correct.

5.    In a {93/41}Nb nucleus, the number of protons, neutrons, and electrons is

    a.    41, 52, 93
    b.    41, 52, 52
    c.    41, 52, 41
    d.    41, 52, 0

6.    The binding energy per nucleon
    a.    increases steadily as we go to heavier elements.
    b.    decreases steadily as we go to heavier elements.
    c.    is approximately constant throughout the periodic table, except for very light nuclei.
    d.    has a maximum near iron in the periodic table.

7.    An alpha particle is also known as

a.    an electron.
b.    a positron.
c.    a helium nucleus.
d.    a photon.

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      a.    an electron.
      b.    a positron.
      c.    a helium nucleus.
      d.    a photon.

9.    The existence of the neutrino was postulated in order to explain
      a.    alpha decay.
      b.    gamma emission.
      c.    beta decay.
      d.    fission.

10.   When an alpha particle is emitted from an unstable nucleus, the atomic mass number
      of the nucleus
      a.    increases by 2.
      b.    decreases by 2.
      c.    increases by 4.
      d.    decreases by 4.
      e.    none of the above.

11.   If $4.0 \times 10^{18}$ atoms decay with a half-life of 2.3 years, how many are remaining
      after 3.7 years?
      a.    $2.5 \times 10^{18}$
      b.    $1.7 \times 10^{18}$
      c.    $1.3 \times 10^{18}$
      d.    $1.1 \times 10^{18}$

12.   A radioactive sample has a half-life of 5.0 min.  What fraction of the sample is left
      after 20 min?
      a.    1/2
      b.    1/4
      c.    1/8
      d.    1/16

13.   The half-life of radioactive iodine-137 is 8.0 days.  How many iodine nuclei are
      necessary to produce an activity of 1.0 micro-Ci?
      a.    $2.9 \times 10^{9}$

b. $4.6 \times 10^9$
c. $3.7 \times 10^{10}$
d. $7.6 \times 10^{12}$

14. What happens to the half-life of a radioactive substance as it decays?
    a. It remains constant.
    b. It increases.
    c. It decreases.
    d. It could do any of these.

15. The mass of $\{90/38\}$Sr is 89.907737 u and the mass of the atom its beta decays to is 89.907151 u. What is the energy released in the decay?
    a. 1.2 MeV
    b. 112 keV
    c. 0.546 MeV
    d. 1.8 MeV

16. The neutral atoms of all isotopes of the same element contain the same number of _____ .

    a. neutrons only.
    b. Electrons
    c. Mass numbers
    d. Masses

Answer: (b) Electrons

17. The atomic number is not changed by which type of radioactive decay?

    a. Beta
    b. Gamma
    c. Alpha
    d. The atomic number is affected by all forms of radioactive decay

Answer: (b) Gamma

18. Isotopes of an element have a different number of

    a. Proton
    b. Neutron
    c. Electron
    d. atom

Answer: (b) Neutron

19. Three types of radioactive elements are emitted when unstable nuclei undergo radioactive decay. Which of the following is not one of them

   a. Beta
   b. Gamma
   c. Alpha
   d. delta

Answer: (d) delta

20. A nuclear fission reaction becoming self-sustaining depends on

   a. electrons
   b. Neutrons
   c. Energy
   d. Protons

Answer: (b) Neutrons

21. Helium nuclei particles are called

   a. Gamma particles
   b. Beta particles
   c. Alpha particles
   d. No particles that are helium nuclei

Answer: (c) alpha particles

22. When two atomic nuclei combine it is called as

   a. Chain reaction
   b. Nuclear fusion
   c. Nuclear decay
   d. Nuclear fission

Answer: (b) Nuclear fusion

23. The number of protons or atomic number is reduced to 2 by which form of radioactive decay?

   a. Beta-decay
   b. Gamma decay
   c. Alpha decay
   d. None of the above

Answer: (c) Alpha decay

24. Which statement is true for all three types of radioactive emission?

a. They are deflected by electric fields
b. They ionise gases
c. They are completely absorbed by a thin aluminium sheet
d. They emit light

Answer: (b) They ionise gases

25. A nuclide of the element plutonium $_{94}$ Pu $^{242}$. What is the number of neutrons in its nucleus?

a. 242
b. 336
c. 148
d. 94

Answer: (c) 148

26. In the Geiger-Nuttall law, $\log R = A \log \lambda + B$, which factor is constant for almost all the radioactive series,

a. R

b. B

C. A

d. $\lambda$

27. $^3$H is a

a. Boson

b. Fermion

c. Neutrion

d. None

28. Which statement is true

a. Neutrion has zero charge

b. Neutrino has almost zero mass

c. Neutrino has spin ½

d. All of the above

29. Electron-capture is associated with _____
a. conversion of a neutron to a proton.

b. decrease in mass number by 4 and atomic number by 2.

c. conversion of a proton to a neutron.

d. emission of γ rays.

30. Which of them are atomic models?
   i.   Thomson's plum puddling model
   ii.  Rutherford's nuclear model
   iii. Bohr's model
   iv.  Sommerfeld's model
   a.  i & ii
   b.  i, ii & iii
   c.  ii, iii & iv
   d.  All of these
(Ans:d)

31. The nucleus consists of
a.  neutrons
b.  protons
c.  neutrons and protons
d.  electrons and neutrons
(Ans:c)

32. Nucleus is
a.  positively charged
b.  negatively charged
c.  neutral
d.  charge keeps on changing
(Ans:a)

33. Proton has the charge
a.  1637 times of an electron
b.  1737 times of an electron
c.  1837 times of an electron
d.  1937 times of an electron
(Ans:c)

34. In neutral atom, the electrons are bound to the nucleus by
a.  Magnetic force
b.  Electrostatic force
c.  Friction force
d.  Centripetal force
(Ans:b)

35. The limited number of electrons in 'M' shell is
a.  2
b.  8
c.  18

d. 32

(Ans:c)

36. Radioactivity is confined almost entirely to the elements __ to __ in the periodic table
a. 60, 92
b. 83, 106
c. 92, 118
d. None of the above

(Ans:b)

37. Which of the following rays are emitted during radioactivity?
a. Alpha-rays
b. Beta-rays
c. Gamma-rays
d. All of the above

(Ans:d)

38. The difference in the mass of the resultant nucleus and the sum of the masses of two parent nuclear particle is known as
a. mass defect
b. solid defect
c. weight defect
d. nucleus defect

(Ans:a)

39. When the nuclei of $U^{235}$ is splitted into approximately two equal nuclei, the amount of energy released per nucleon is
a. 0.45 MeV
b. 0.9 MeV
c. 1.35 MeV
d. 1.7 MeV

(Ans:b)

40. As per radioactive decay law, the small amount of disintegration of the isotope in a small period is equal to
a. $-\lambda N$
b. $\lambda N$
c. $-2\lambda N$
d. $2\lambda N$

Where $\lambda$=radioactive decay constant, N=number of radioactive nuclei present at any time 't'
(Ans:a)

41. The half life of radioactive nuclei is
a. $0.693 / \lambda$
b. $0.793 / \lambda$
c. $0.693\lambda$
d. $0.793\lambda$

Where λ=radioactive decay constant
(Ans:a)

42. The average (mean) life for particle decay is
a. 1.145 times greater than half life
b. 1.245 times greater than half life
c. 1.345 times greater than half life
d. 1.445 times greater than half life
(Ans:d)

43. An antiproton is an atomic particle that has
a) the mass of a proton and the charge of an electron.
b) the mass of an electron and the charge of a proton.
c) the mass of a neutron and the charge of a proton.
d) the mass of a proton and the charge of a neutron.

44. A certain radioactive element has a half-life of 20 d. The time it will take for 7/8 of the atoms originally present to disintegrate is
a) 20 d
b) 40 d
c) 60 d
d) 80 d

45. A conservation law that is not universal but applies only to certain kinds of interactions is conservation of _____
a) lepton number
b) baryon number
c) spin
d)Strangeness

46. In quantum electrodynamics (QED), electromagnetic forces are mediated by
a) the interaction of electrons.
b) hadrons.
c) action at a distance.
d) the weak nuclear interaction.

47. Fission occurs because the average binding energy per nucleon for the fission fragments is higher than that for the original nucleus. The change in binding energy per nucleon is approximately
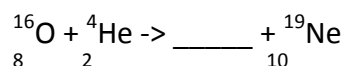a) 0.20 MeV
b) 1.0 MeV
c) 7.0 MeV
d) 28 MeV

48. When lead-207 (Z = 82) is bombarded with neutrons, it can change into
a. lead-208
b. lead-206
c. tellurium-208 (Z = 81)

d. bismuth-208 (Z = 83)

49. Complete the following nuclear reaction:

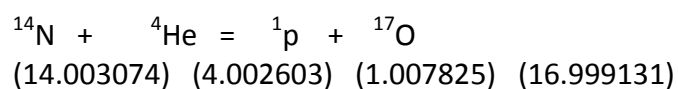$$^{16}_{8}\text{O} + {}^{4}_{2}\text{He} \rightarrow \underline{\hspace{1cm}} + {}^{19}_{10}\text{Ne}$$

a. $^{1}\text{p}$
b. $^{1}\text{n}$
c. $^{2}\text{H}$
d. $^{3}\text{H}$

50. When a target nucleus is bombarded by an appropriate beam of particles, it is possible to produce
a. a less massive nucleus, but not a more massive one.
b. a more massive nucleus, but not a less massive one.
c. a nucleus with smaller atomic number, but not one with a greater atomic number.
d. a nucleus with greater atomic number, but not one with a smaller atomic number.

51. What is the Q-value of the folllowing reaction?

$$^{14}\text{N} + {}^{4}\text{He} = {}^{1}\text{p} + {}^{17}\text{O}$$
   (14.003074)  (4.002603)  (1.007825)  (16.999131)
a. 1.191 MeV
b. -1.191 MeV
c. $1.279\text{X}10^{-3}$ MeV
d. $-1.279\text{X}10^{-3}$ MeV

52. What is the energy released (positive) or absorbed (negative) in the following reaction?
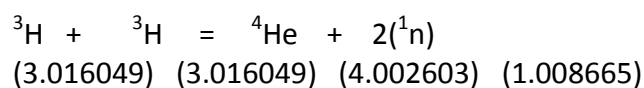
$$^{3}\text{H} + {}^{3}\text{H} = {}^{4}\text{He} + 2({}^{1}\text{n})$$
   (3.016049)  (3.016049)  (4.002603)  (1.008665)
a. 0.0122 MeV
b. -0.0122 MeV
c. 11.3 MeV
d. -11.3 MeV

53. What is the mass of the products of a nuclear fission reaction compared to the mass of the original products?
a. greater
b. less
c. the same
d. varies according to the reaction

54.   What is the mass of the products of a nuclear fusion reaction compared to the original elements?
a.  greater
b.  less
c.  the same
d.  varies according to the reaction

55.   The fuel for nuclear fusion in the center of the Sun is
a.  H
b.  He
c.  U
d.  any radioactive material

56.  The fuel for nuclear fission is
a.  H
b.  He
c.  U
d.  any radioactive material

57.  In the fission reaction $^{235}U + {}^{1}n \rightarrow {}^{141}Ba + {}^{92}Kr$ + neutrons, the number of neutrons produced is
a.  zero.
b.  1.
c.  2.
d.  3.

58.    What is the meaning of the term "critical mass"?
a.  This refers to the mass of the "critical" elements in a reactor, i.e., the uranium or plutonium.
b.  This refers to the minimum amount of fissionable material required to sustain a chain reaction.
c.  This is the amount of mass needed to make a power reactor economically feasible.
d.  This is the material which is just on the verge of becoming radioactive.

59.   All of the following are units used to describe radiation dosage in humans except
a.  curie.
b.  rad.
c.  rem.
d.  RBE.
e.  sievert.

60.    A unit that measures the effective dose of radiation in a human is the
a.  curie.
b.  RBE.

c. rad.
d. rem.

61. The chief hazard of radiation is
a. damage to living cells due to ionization.
b. damage to cells due to heating.
c. damage to living cells due to the creation of chemical impurities.
d. the creation of new isotopes within the body.

62, An X-ray technician takes an avearge of ten X-rays per day and receives 2.5 mrad per X-ray. What is the total dose the technician receives in 250 working days?
a. 2.50 rem
b. 5.00 rem
c. 6.25 rem
d. 7.75 rem

63. The instrinsic spin of a photon is
a. 1
b. 0
c. ½
d. -1/2

64.Which is not an energy term in Semi Empirical mass formula in Liquid drop model
a.Volume Energy
b.Surface Energy
c.Coulombs Energy
d.Nuclear Energy

65.Pairing Energy in Liquid drop model is zero for
a.Even-Even Nuclei
b.Odd-Odd Nuclei
c.Even-Odd Nuclei
d.All of the above

66. The angular frequency of a cyclotron is independent of

    a. Speed
    b. Mass
    c. Magnetic field
    d. Charge

Answer: (a) Speed

67. The maximum kinetic energy of the positive ion in the cyclotron is

a. $qBR^2/2m$
b. $q^2B^2R^2/2m$
c. $q^2B^2R^2/m$
d. $qBR/m$

Answer: (b) $q^2B^2R^2/2m$

68. Cyclotron cannot accelerate

a. Electrons
b. Neutrons
c. Positive ions
d. (Both (1) and (2)

Answer: (d) Both (1) and (2)

69. The cyclotron frequency of an electron grating in a magnetic field of 1 T is approximately

a. 28 MHz
b. 280 MHz
c. 2.8 GHz
d. 28 GHz

Answer: (d) 28 GHz

70. Suppose a cyclotron is operated at an oscillator frequency of 12 MHz and a dee radius of 53cm. What is the resulting kinetic energy of the deuterons?

a. 16.6 MeV
b. 12 MeV
c. 15 MeV
d. 14 MeV

Answer: (a) 16.6 MeV

71. An alternating electric field of frequency f is applied across the dees (radius = R) of a cyclotron that is being used to accelerate protons (mass = m). The operating magnetic field (B) used in the cyclotron and the kinetic energy (K) of the proton, produced by it, are given by

a. $B = mf/e$ and $K = 2m\pi^2v^2R^2$
b. $B = 2\pi mf/e$ and $K = m^2\pi vR^2$
c. $B = 2\pi mf/e$ and $K = 2m\pi^2v^2R$
d. $B = mf/e$ and $K = m^2\pi vR^2$

Answer: (c) $B = 2\pi mf/e$ and $K = 2m\pi^2v^2R$

72. The energy of emergent protons in MeV from a cyclotron having a radius of its dees 2 m and applied magnetic field 0.8 T is (mass of proton = $1.67 \times 10^{-27}$ kg).

a. $0.961 \times 10^{-11}$ J
b. $1.22 \times 10^{-11}$ J
c. $1.5 \times 10^{-12}$ J
d. $12 \times 10^{-11}$ J

Answer: (a) $0.961 \times 10^{-11}$ J

73. Cyclotron can be used in

a. Particle therapy to treat cancer
b. Source of high energy beam for a nuclear physics experiment
c. Produce short-lived positron-emitting isotopes for PET imaging
d. All the above

Answer: (d) All the above

75. A proton of energy 100 eV is moving perpendicular to a magnetic field 10-4 T. The cyclotron frequency of the proton in radian/sec

a. $2.80 \times 10^6$
b. $9.6 \times 10^3$
c. $5.6 \times 10^6$
d. $1.76 \times 10^6$

Answer: (b) $9.6 \times 10^3$

76. A cyclotron can accelerate

a. $\beta$ particles
b. $\alpha$ particles
c. High-velocity gamma rays
d. High-velocity X-rays

Answer: (b) $\alpha$ particles

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c.  41, 52, 41
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    a. an electron.
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81. The existence of the neutrino was postulated in order to explain
    a. alpha decay.
    b. gamma emission.
    c. beta decay.
    d. fission.

82. When an alpha particle is emitted from an unstable nucleus, the atomic mass number of the nucleus
    a. increases by 2.
    b. decreases by 2.
    c. increases by 4.
    d. decreases by 4.
    e. none of the above.

83. If $4.0 \times 10^{18}$ atoms decay with a half-life of 2.3 years, how many are remaining after 3.7 years?
    a. $2.5 \times 10^{18}$
    b. $1.7 \times 10^{18}$
    c. $1.3 \times 10^{18}$
    d. $1.1 \times 10^{18}$

84. A radioactive sample has a half-life of 5.0 min. What fraction of the sample is left after 20 min?
    a. 1/2
    b. 1/4
    c. 1/8
    d. 1/16

85. The half-life of radioactive iodine-137 is 8.0 days. How many iodine nuclei are necessary to produce an activity of 1.0 micro-Ci?

a. $2.9 \times 10^9$
b. $4.6 \times 10^9$
c. $3.7 \times 10^{10}$
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86.  What happens to the half-life of a radioactive substance as it decays?
    a.    It remains constant.
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    c.    It decreases.
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87.  The mass of {90/38}Sr is 89.907737 u and the mass of the atom its beta decays to is 89.907151 u. What is the energy released in the decay?
    a. 1.2 MeV
    b. 112 keV
    c.  0.546 MeV
    d.  1.8 MeV

88. The neutral atoms of all isotopes of the same element contain the same number of _____.

    e.  neutrons only.
    f.  Electrons
    g.  Mass numbers
    h.  Masses

Answer: (b) Electrons

89.  The atomic number is not changed by which type of radioactive decay?

    e.  Beta
    f.  Gamma
    g.  Alpha
    h.  The atomic number is affected by all forms of radioactive decay

Answer: (b) Gamma

90.  Isotopes of an element have a different number of

    e.  Proton
    f.  Neutron
    g.  Electron
    h.  atom

Answer: (b) Neutron

91. Three types of radioactive elements are emitted when unstable nuclei undergo radioactive decay. Which of the following is not one of them

  e. Beta
  f. Gamma
  g. Alpha
  h. delta

Answer: (d) delta

92. A nuclear fission reaction becoming self-sustaining depends on

  e. electrons
  f. Neutrons
  g. Energy
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Answer: (b) Neutrons

93. Helium nuclei particles are called

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  f. Beta particles
  g. Alpha particles
  h. No particles that are helium nuclei

Answer: (c) alpha particles

94. When two atomic nuclei combine it is called as

  e. Chain reaction
  f. Nuclear fusion
  g. Nuclear decay
  h. Nuclear fission

Answer: (b) Nuclear fusion

95. The number of protons or atomic number is reduced to 2 by which form of radioactive decay?

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f. 336
g. 148
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Answer: (c) 148

98. In the Geiger-Nuttall law, $\log R = A \log \lambda + B$, which factor is constant for almost all the radioactive series,

a. R

b. B

C. A

d. $\lambda$

27. $^3$H is a

a. Boson

b. Fermion

c. Neutrion

d. None

28. Which statement is true

a. Neutrion has zero charge

b. Neutrino has almost zero mass

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99. Electron-capture is associated with _____

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100. Which of them are atomic models?

    v.   Thomson's plum puddling model
    vi.  Rutherford's nuclear model
    vii. Bohr's model
    viii.Sommerfeld's model
    e.   i & ii
    f.   i, ii & iii
    g.   ii, iii & iv
    h.   All of these
(Ans:d)