Nuclear Chemistry Assignment - II

1. The atomic mass of lead is 208 and atomic number is 82. The atomic mass of bismuth is 209 and atomic number is 83. The ratio of n/p in the atom is

(a) Higher of lead (b) Higher of bismuth (c) Same (d) None of these

2. Which of the following nuclides has the magic number of both protons and neutrons

(a) ${}_{50}Sn^{115}$ (b) ${}_{82}Pb^{206}$ (c) ${}_{82}Pb^{208}$ (d) ${}_{50}Sn^{118}$

3. In the nuclear reaction ${}_{12}Mg^{24} + {}_{2}He^{4} = {}_{0}n^{1} + ?$, the product nucleus is

(a) ${}_{13}Al^{27}$ (b) ${}_{14}Si^{27}$ (c) ${}_{13}Al^{28}$ (d) ${}_{12}Mg^{25}$

4. In the following nuclear reactions ${}_{7}N^{14} + {}_{2}He^{4} \longrightarrow {}_{8}O^{17} + X_1$ and ${}_{13}Al^{27} + {}_{1}D^{2} \longrightarrow {}_{14}Si^{28} + X_2$, X_1 and X_2 are respectively

(a) ${}_{1}H^{1}$ and ${}_{0}n^{1}$ (b) ${}_{0}n^{1}$ and ${}_{1}H^{1}$ (c) ${}_{2}He^{4}$ and ${}_{0}n^{1}$ (d) ${}_{0}n^{1}$ and ${}_{2}He^{4}$

5. Which of the following combinations would make the nucleus unstable

(a) $N > 126, Z > 83, A < 208$ (b) $N > 126, Z > 83, A > 209$ (c) $Z > 82, N < 126, A > 108$ (d) $Z = 83, N = 126, A > 209$

6. For stable nuclei, the average binding energy per nucleon lies between

(a) 7 and 9 *MeV* (b) 10 and 12 *MeV* (c) 2 and 4 *MeV* (d) 5 and 7 *MeV*

7. Which of the following combinations will give the most stable nuclei

(a) Odd *Z* and odd *N* (b) Even *Z* and even *N* (c) Odd *Z* and even *N* (d) Even *Z* and odd *Z*

8. Stable nuclides cannot be obtained for

(a) $Z = 43, N = 35$ (b) $Z = 61, N = 89$ (c) $A = 8$ or 5 (d) $A > 209$

9. A particle having the same charge and 200 times greater mass than that of electron is

(a) Positron (b) Proton (c) Neutrino (d) Meson

10. The ${}_{6}C^{14}$ in upper atmosphere is generated by the nuclear reaction

(a) ${}_{7}N^{14} + {}_{1}H^{1} \longrightarrow {}_{6}C^{14} + {}_{+1}e^{0} + {}_{1}H^{1}$ (b) ${}_{7}N^{14} \longrightarrow {}_{6}C^{14} + {}_{+1}e^{0}$

(c) ${}_{7}N^{14} + {}_{0}n^{1} \longrightarrow {}_{6}C^{14} + {}_{1}H^{1}$ (d) ${}_{7}N^{14} + {}_{1}H^{3} + {}_{0}n^{1} \longrightarrow {}_{6}C^{14} + {}_{2}He^{4}$

11. When ${}_{3}Li^{7}$ are bombarded with protons. γ-rays are produced. The nuclide formed is

(a) ${}_{3}Li^{8}$ (b) ${}_{4}Be^{8}$ (c) ${}_{3}B^{9}$ (d) ${}_{4}Be^{9}$

12. On bombarding ${}_{8}O^{16}$ with deutrons, the nuclei of the product formed will be

(a) ${}_{9}F^{18}$ (b) ${}_{9}F^{17}$ (c) ${}_{8}O^{17}$ (d) ${}_{7}N^{14}$

13. An element with atomic number 84 and mass number 218 loses one α-particle and two β-particles in three successive stages, the resulting element will have

(a) Atomic number 84 and mass number 214 (b) Atomic number 82 and mass number 214

(c) Atomic number 84 and mass number 218 (d) Atomic number 82 and mass number 218

14. What happens when α-particle is emitted

(a) Mass number decreases by 12 unit, atomic number decreases by 4 unit

(b) Mass number decreases by 4 unit, atomic number decreases by 2 unit

(c) Only mass number decreases

(d) Only atomic number decreases

15. The radioactive decay of ${}_{35}X^{88}$ by a beta emission produces an unstable nucleus which spontaneously emits a neutron. The final product is

(a) ${}_{37}X^{88}$ (b) ${}_{35}Y^{89}$ (c) ${}_{34}Z^{88}$ (d) ${}_{36}W^{87}$

16. When an radioactive element emits an alpha particle, the daughter element is placed in the periodic table

(a) Two positions to the left of the parent element (b) Two positions to the right of the parent element

(c) One position to the right of the parent element (d) In the same position as the parent element

17. In the radioactive decay ${}_{92}X^{232} \rightarrow {}_{89}Y^{220}$, how many α and β-particles are ejected from X to form Y

(a) 3α and 3β (b) 5α and 3β (c) 3α and 5β (d) 5α and 5β

18. Group displacement law states that the emission of α or β particles results in the daughter element occupying a position, in the periodic table, either to the left or right of that of the parent element. Which one of the following alternatives gives the correct position of the daughter element

	On emission of α particles	On emission of β particles
(a)	2 groups to the right	1 group to the right
(b)	2 groups to the right	1 group to the left
(c)	2 groups to the left	1 group to the left
(d)	2 groups to the left	1 group to the right

19. When radium atom which is placed in II group, loses an α-particle, a new element is formed which should be placed in group

(a) Second (b) First (c) Fourth (d) Zero

20. ${}_{84}Po^{210} \rightarrow {}_{82}Pb^{206} + {}_{2}He^{4}$. From the above equation, deduce the position of polonium in the periodic table (lead belongs to group IV A)

(a) II A (b) IV B (c) VI B (d) VI A

21. ${}_{92}U^{235}$ belongs to group III B of periodic table. If it loses one α-particle, the new element will belong to group

(a) I B (b) I A (c) III B (d) V B

22. $Nd\ (Z = 60)$ is a member of group –3 in periodic table. An isotope of it is β-active. The daughter nuclei will be a member of

(a) Group – 3 (b) Group – 4 (c) Group – 1 (d) Group – 2

23. A wood specimen from an archeological centre shows a ${}_{6}^{14}C$ activity of 5.0 *counts/min/gm* of carbon. What is the age of the specimen ($t_{1/2}$ for ${}_{6}^{14}C$ is 5000 years) and a freshly cut wood gives 15 *counts/min/gm* of carbon

(a) 5.78×10^{4} years (b) 9.85×10^{5} years (c) 7.85×10^{3} years (d) 0.85×10^{6} years

24. If half-life of a subtance is 5 years, then the total amount of substance left after 15 years, when initial amount is 64 grams is

(a) 16 grams (b) 2 grams (c) 32 grams (d) 8 grams

25. ${}^{226}Ra$ disintegrates at such a rate that after 3160 years only one-fourth of its original amount remains. The half-life of ${}^{226}Ra$ will be

(a) 790 years (b) 3160 years (c) 1580 years (d) 6230 years

26. The half-life period of a radioactive substance is 140 days. After how much time 15 *g* will decay from 16*g* sample of it

(a) 140 days (b) 560 days (c) 280 days (d) 420 days

27. A wooden box excavated from indus valley had an activity of 9.3 disintegration per minute per *gm* of carbon. What is the approximate age of this civilization

(a) 4000 years (b) 5700 years (c) 8100 years (d) 6000 years

28. The half-life of 1 *gm* of radioactive sample is 9 hours. The radioactive decay obeys first order kinetics. The time required for the original sample to reduce to 0.2 *gm* is

(a) 15.6 *hours* (b) 156 *hours* (c) 20.9 *hours* (d) 2.09 *hours*

29. The half-life period of a radioactive element is 1 hours. After 3 hours, what fraction of it will remain

(a) $\frac{1}{8}$ (b) $\frac{1}{16}$ (c) $\frac{1}{64}$ (d) $\frac{1}{9}$

30. Which of the following expressions are correct

(a) $t = t_{1/2} \frac{\log (N_0 / N)}{\log 2}$ (b) $A = A_0 e^{-\lambda t}$ (c) $T = 1.44\, t_{1/2}$ (d) $t_{1/2} = \frac{\ln 2}{\lambda}$

31. A certain radioactive isotope ${}_{Z}^{A}X(t_{1/2} = 10\ days)$ decays to ${}_{Z-2}^{A-4}Y$. If 1 mol of ${}_{Z}^{A}X$ is kept in a sealed vessel, how much helium will accumulate in 20 days

(a) $22.4\ L$ (b) $11.2\ L$ (c) $16.8\ L$ (d) $33.6\ L$

32. $\frac{15}{16}th$ of a radioactive sample decays in 40 days half life of the sample is

(a) 100 *days* (b) 10 *days* (c) 1 *day* $\log_e 2$ *days*

33. If half-life of a certain radioactive nucleus is 1000*s*, the disintegration constant is

(a) $6.93 \times 10^{2}\ s^{-1}$ (b) $6.93 \times 10^{-4}\ s$ (c) $6.93 \times 10^{-4}\ s^{-1}$ (d) $6.93 \times 10^{3}\ s$

34. A radioactive substance has a constant activity of 2000 disintegration/minute. The material is separated into two fractions, one of which has an initial activity of 1000 disintegrations per second while the other fraction decays with $t_{1/2} = 24$ *hours.* The total activity in both samples after 48 *hours* of separation is

(a) 2000 (b) 1250 (c) 1000 (d) 1500

35. The half-life period of Pb^{210} is 22 *years.* If 2 *gm* of Pb^{210} is taken, then after 11 *years* how much of Pb^{210} will be left

(a) 1.414 *gm* (b) 2.428 *gm* (c) 3.442 *gm* (d) 4.456 *gm*

36. A radioelement decays by two parallel reactions, the decay constants for which are λ_1 and λ_2. The effective decay constant (λ) of the nuclide is

(a) $\lambda = \lambda_1 / \lambda_2$ (b) $\lambda = \lambda_1 - \lambda_2$ (c) $\lambda = \lambda_1 + \lambda_2$ (d) $\lambda = \frac{1}{\lambda_1} + \frac{1}{\lambda_2}$

37. The time of decay for a nuclear reaction is given by $t = 4t_{1/2}$. The relation between the mean life (T) and time of decay (t) is given by

(a) $2T \ln 2$ (b) $4T \ln 2$ (c) $2T^4 \ln 2$ (d) $\frac{1}{T^2} \ln 2$

38. The activity of a given mass of a sample is given by

(a) $\frac{\text{wt}}{\text{At. mass} \times N_A} \times \lambda$ (b) $\frac{\text{wt}}{\text{Mol. mass} \times N_A} \times \lambda$ (c) λN (d) $\lambda_1 N_1 = N_0 e^{-\lambda t}$

39. The activity of a sample of a radioactive nuclide (^{100}X) is 6.02 curies. Its disintegration constant is $3.7 \times 10^4\ s^{-1}$. The initial mass of the sample is

(a) $10^{-14}\ g$ (b) $10^{-6}\ g$ (c) $10^{-15}\ g$ (d) $10^{-3}\ g$

40. A first order nuclear reaction is half completed in 45 minutes. How long does it need 99.9% of the reaction to be completed

(a) 5 *hours* (b) 7.5 *hours* (c) 10 *hours* (d) 20 *hours*

41. Number of α-particles emited per second by a radioactive element falls to 1/32 of its original value in 50 days. The half life-period of this elements is

(a) 5 *days* (b) 15 *days* (c) 10 *days* (d) 20 *days*

42. What will be half-life period of a nucleus if at the end of 4.2 *days,* $N = 0.798\ N_0$

(a) 15 *days* (b) 10 *days* (c) 12.83 *days* (d) 20 *days*

43. 10 *gm* of a radioactive substance subtance is reduced to 1.25 *gm* after 15 days. Its $1\ kg$ mass will reduce (in how many days) to 500 *gm* in

(a) 500 *days* (b) 125 *days* (c) 25 *days* (d) 5 *days*

44. Half-life of a radioactive element is 100 *yrs.* The time in which it disintegrates to 50% of its mass, will be

(a) 50 *yrs* (b) 200 *yrs* (c) 100 *yrs* (d) 25 *yrs*

45. 1.0 *g* of a radioactive isotope was found to reduce to 125 *mg* after 24 *hours.* The half life of the isotope is

(a) 8 *hours* (b) 24 *hours* (c) 6 *hours* (d) 4 *hours*

46. Half-life of radium is 1580 *yrs.* Its average life will be

(a) 2.5×10^3 *yrs* (b) 1.832×10^3 *yrs* (c) 2.275×10^3 *yrs* (d) 8.825×10^2 *yrs*

47. Initial mass of a radioactive element is 40 *g.* How many grams of it would be left after 24 years, if its half life period is 8 years

(a) 2 (b) 5 (c) 10 (d) 20

48. The half life of Co^{60} is 7 *years.* If one *gm* of it decays, the amount of the substance remaining after 28 *years* is

(a) 0.25 *gm* (b) 0.125 *gm* (c) 0.0625 *gm* (d) 0.50 *gm*

49. A radioactive element has a half life of 20 minutes. How much time should elaspe before the element is reduced to $\frac{1}{8}th$ of the original mass

(a) 40 minutes (b) 60 minutes (c) 80 minutes (d) 160 minutes

50. A radioactive isotope decays at such a rate that after 96 minutes only $\frac{1}{8}th$ of the original amount remains. The half life of this nuclide in minutes is

(a) 12 (b) 24 (c) 32 (d) 48