CHEMISTRY

BOOKS - G.R. BATHLA & SONS CHEMISTRY (HINGLISH)

RADIOACTIVITY AND NUCLEAR TRANSFORMATION

Illustration

1. During the transformation of ${}_{c}^{a}X$ of ${}_{d}^{b}Y$ the number of β-particle emitted are:

A. $\frac{a-b}{4}$

B. $d+\frac{a-b}{2}+c$

C. $d+\left(\frac{a-b}{2}\right)-c$

D. 2c - d + a - b

Answer: c

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2. A radioactive nuclide emits γ-rays due to

a. K-electron capture

b. Nuclear transition from higher to lower energy

c. Presence of greater number of neutrons than protons

d. Presence of greater of protons than neutrons

A. K-electron capture

B. nuclear transition from high to lower energy state

C. Presence of greater number of neutrons than protons

D. presence of greater numbe of protons than neutrons

Answer: b

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3. In which of the following transformation, the β-particles are emitted

A. Proton to neutron

B. Neutron to proton

C. Proton to proton

D. Neutron to neutron

Answer: b

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4. In the radioacitve decay

$${}_{Z}X^{A} \rightarrow {}_{z+1}Y^{A} \rightarrow {}_{z-1}P^{A-4} \rightarrow (z-1)Z^{\cdot A-4}$$

The sequence of emission is

a. α, β, γ b. γ, α, β c. β, α, γ c. β, γ, α

A. $\alpha, \beta\gamma$

B. β, α, γ

C. γ, α, β

D. β, γ, α

Answer: b

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5. Which of the following elements is an isodiaphere of $._{92}^{235}U$?

A. $._{83}^{209}Bi$

B. $._{82}^{212}Pb$

C. $._{90}^{231}Th$

D. $._{91}^{231}Pa$

Answer: c

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6. A certain radioactive material $._{Z}^{A}X$ starts emitting α and β particles successively such that the end product is $._{Z-3}^{A-8}Y$, The number of α and β particles emitted are:

A. 4 and 3 respectively

B. 2 and 1 respectively

C. 3 and 4 respectively

D. 3 and 8 respectively

Answer: b

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7. Half life of a radioactive sample is $2x$ years. What fraction of this sample will remain undecayed after x years?

A. $\frac{1}{2}$

B. $\frac{1}{\sqrt{2}}$

C. $\frac{1}{\sqrt{3}}$

D. 2

Answer: b

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8. Half life of a radioactive element is 10 days. What percentage of the element will remain undecayed after 100 days?

A. 0.1

B. 0.001

C. 0

D. 0.99

Answer: b

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9. Which among the following relation is correct

A. $t_{1/2} = 2t_{3/3}$

B. $t_{1/2} = 3t_{3/4}$

C. $t_{3/4} = 2t_{1/2}$

D. $t_{3/4} = 3t_{1/2}$

Answer: c

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10. Select the correct statement:

A. same amount will decay in every half life.

B. Amount decayed in first half life is maximum

C. Amount decayed in first half life is minimum

D. Amount decayed in a half life depends on the nature of element

Answer: b

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11. The half life period of a first order reaction is 60 min. What percentage will be left after 240 min.

A. 0.175

B. 0.15

C. 0.125

D. 0.1

Answer: c

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12. The half-life of a radioactive substance is 48 hours. How much time will it take to disintegrate to its $\frac{1}{16}th$ parts ?

A. 32 days

B. 32 hrs

C. 48 hrs

D. 16 hrs

Answer: b

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13. The time of decay for the nuclear reaction is given by $t = 5t_{1/2}$. The relation between mean life τ and time of decay t is given by:

A. 2τ In 2

B. 5τ In 2

C. $2\tau^4$ In 2

D. $\frac{1}{\tau^4}$ In 2

Answer: b

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14. The activity of a sample of radioactive element $.^{100}A$ is 6.02 curie. Its decay constant is $3.7 \times 10^4 s^{-1}$. The initial mass of the sample will be:

A. $10^{-14}g$

B. $10^{-6}g$

C. $10^{-15}g$

D. $10^{-3}g$

Answer: c

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15. A freshly prepared radioactive source of half-life $2h$ 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. 3 hrs

B. 9 hrs

C. 24 hrs

D. 12 hrs

Answer: d

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16. One gram of $.^{226}Ra$ has an activity of nearly 1 Ci. The half life of $.^{226}Ra$ is,

A. 1582 yrs

B. 12.5 hrs

C. 140 days

D. 4.5×10^9 yrs

Answer: a

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17. Assuming that $.^{226}Ra\left(t_{1/2} = 1.6 \times 10^3 yrs\right)$ is in secular equilibrium with $.^{238}U\left(t_{1/2} = 4.5 \times 10^9 yrs\right)$ in a certain mineral how many grams of radium will present in for every gram of $.^{238}U$ in the mineral?

A. 3.7×10^{-7}

B. 3.4×10^{7}

C. 3.4×10^{-7}

D. 3.7×10^{7}

Answer: c

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18. A certain radioactive isotope decay has α-emission,

$$.^{A_1}_{Z_1}X \rightarrow .^{A_1-4}_{Z_1-2}Y$$

half life of X is 10 days. If 1 mol of X is taken initially in a sealed container, then what volume of helium will be collected at STP after 20 days?

A. 22.4 L

B. 11.2 L

C. 16.8 L

D. 33.6 L

Answer: c

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19. The radioactive isotope ${}^{60}_{27}Co$ which is used in the treatment of cancer can be made by (n,p) reaction. For this reaction the target nucleus is

A. ${}^{59}_{28}Ni$

B. ${}^{59}_{27}Co$

C. ${}^{60}_{28}Ni$

D. ${}^{60}_{27}Co$

Answer: c

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20. . $^{14}_{7}N$ is attacked by doubly charged helium ion, it emits a proton and:

A. . $^{18}_{9}F$

B. . $^{17}_{8}O$

C. . $^{18}_{8}O$

D. . $^{19}_{9}F$

Answer: b

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21. Fill in the blank

$$_{92}U^{235} + {}_{0}n^{1} \rightarrow \ ? \ + {}^{92}_{36}Kr + 3^{1}_{0}n$$

A. . $^{137}_{52}Te$

B. . $^{144}_{55}Cs$

C. . $^{137}_{56}Ba$

D. $._{56}^{144}Ba$

Answer: d

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22. Fill in the blank

$_{92}U^{235} + {}_0n^1 \rightarrow \ ? + {}_{36}^{92}Kr + 3{}_0^1n$

A. $._{56}^{141}Sr$

B. $._{56}^{141}La$

C. $._{56}^{141}Ba$

D. $._{56}^{141}Cs$

Answer: c

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23. A wooden artifact sample gave activity $32-\beta$ particles per second while the freshly cut wood gave activity of 64β particles per second in Geiger Muller counter. Calculate the age of the wooden artifact $\left(t_{1/2}\text{of}C^{14}=5760\text{ years}\right)$

A. 11520 yrs

B. 5760 yrs

C. 2880 yrs

D. 1440 yrs

Answer: b

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24. Uranium $._{92}U^{238}$ decayed to $._{82}Pb^{206}$. They decay process is

$._{92}U^{238}\rightarrow \underset{x\alpha}{._{82}}\underset{y\beta}{Pb^{206}}$

$t_{1/2}$ of $U^{238}=4.5\times10^{9}$ years

The analysis of a rock shows the relative number of U^{238} and Pb^{206} atoms $(Pb/U = 0.25)$ The age of rock will be

A. $\frac{2.303}{0.693}(4.5 \times 10^9)\log\left(\frac{5}{4}\right)$

B. $\frac{2.303}{0.693}(4.5 \times 10^9)\log\left(\frac{1}{4}\right)$

C. $\frac{2.303}{0.693}(4.5 \times 10^9)\log(4)$

D. $\frac{2.303}{0.639}(4.5 \times 10^9)\log\left(\frac{4}{5}\right)$

Answer: a

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25. Assuming that about $200MeV$ of energy is released per fission of ${}_{92}U^{235}$ nuceli, the mass of U^{235} consumed per day in a fission ractor of power 1 megawatt will be approximately .

A. $10^{-2}g$

B. 1 g

C. 100 g

D. 1000 g

Answer: b

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26. What is the binding energy of the hydrogen nucleus?

A. zero

B. 13.6 eV

C. More than 13.6 eV

D. Infinite

Answer: a

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27. Which of the following is not the inverse square law force?

A. Electric force

B. Gravitational force

C. Nuclear force

D. Magnetic force between two poles

Answer: c

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28. A sample of rock moon contains equal numbers of atoms of uranium and lead $t_{1/2}$ for U is 4.5×10^9 years. The age of rock would be

a. 4.5×10^9 years b. 9.0×10^9 years

c. 13.5×10^9 years d. 2.25×10^9 years

A. 1.5×10^9 years

B. 2.25×10^9 years

C. 4.5×10^9 years

D. 9×10^9 years

Answer: d

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Example

1. Calculate the number of neutrons in the remaining atoms after the emission of an alpha particle from $._{92}U^{238}$ atom.

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2. Radioactive disintegration of $._{88}Ra^{226}$

$$Ra \xrightarrow{-\alpha} Rn \xrightarrow{-\alpha} RnA \xrightarrow{-\alpha} RaB \xrightarrow{-\beta} RaC$$

Determine the mass number, atomic number, and group in periodic table for RaC.

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3. A radioactive element A disintegrates in the following manner:

$A \xrightarrow{-a} B \xrightarrow{-\beta} C \xrightarrow{-\beta} D$

Which one (s) the elements A, B, C, and D are isotope (s) and which one (s) is/are isobar(s)?`

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4. $._{90}^{234}Th$ disintegrates to give $._{82}^{206}Pb$ as the final product. How many alpha and beta particles are emitted in this process?

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5. The atomic mass of helium is 232 and its atomic number is 90. During the course of its radioactive disintegration 6α and 4β-particles are emitted. What is the atomic and atomic number of the final atoms?

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6. An atom has atomic mass 232 atomic number 90. During the course of disintegration, it emits 2βparticles and few α particles. The resultant atom has atomic mass 212 and atomic number 82. How many α particles are emitted during this process?

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7. How many moles of helium are produced when one mole of $._{92}^{238}U$ disintegrates into $._{82}^{206}Pb$?

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8. How many α and β particles will be emitted when $._{90}Th^{234}$ change into $._{84}Po^{218}$?

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9. $._{92}^{238}Th$ is a natural an α-emitter. After α emission, the residual U_{X_1} in turns emits a β-particles to produce nucleus U_{X_2}. Find out the atomic number and mass number of U_{X_1} and U_{X_2}. Also if uranium belongs to IIIrd group to which group U_{X_1} and U_{X_2} belong.

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10. The half life period of radium is 1580 years. How do you imterpret this statement?

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11. The radioactive isotope $.^{137}Cs$ has a half life period of 30 years. Staring with 1 mg of $.^{137}Cs$. How much would remain after 120 years?

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12. A radioactive element has half life period of 30 days. How much of it will be left after 90 days?

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13. The half -life period of ${}_{84}Po^{210}$ is 140 days.

In how many days $1g$ of this isotope is reduced to $0.25g$?

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14. The half-life period of U^{234} is 2.5×10^5 years. In how much time is the quantity of the isotope reduce to 25% of the original amount?

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15. A radioisotope has $t_{1/2} = 5$ years. After a given amount decays for 15 years, what fraction of the original isotope remains?

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16. If in 3160 years, a radioactive substance becomes one-fourth of the original amount, find it's the half-life period.

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17. The half-life period of radium is 1600 years. Calculate the disintegration of radium.

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18. The disintegration constant of $.^{238}U$ is $1.54 \times 10^{-10} \text{years}^{-1}$. Calculate the half life period of $.^{238}U$.

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19. The half life of radon is 3.8 days . After how many days will only one twentieth of radon sample be left over ?

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20. A counter rate meter is used ot measure the activity of radioactive sample. At a certain instant the count rate was recorded as 475 counters per minute. Five minutes later, the count rate recorded was 270 counts per minute. Calculate the decay constant and half life period of the sample.

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21. How many atoms of $0.1g$-atom of a radioacitve isotope $._Z X^A$ (half life = 5 days) will decay during the 11th day?

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22. 10 g-atoms of an α-active radioisotope are disintegrating in a sealed container. In one hour the helium gas collected at STP is $11.2cm^3$. Calculate the half life of the radioisotope.

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23. Calculate the average life of a radioactive substance whose half life period is 1650 years.

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24. $._{}^{90}Sr$ shows βactivity and its half life period os 28 years. What is the activity of a sample containing 1 g of $._{}^{90}Sr$?

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25. A chemist prepares $1.00g$ of pure $._6C^{11}$. This isotopes has half life of 21 min, decaying by the equation: $._6C^{11}. \Rightarrow \ ._5B^{11}. + ._{-1}e^0.$

a. What is the rate of disintegration per second (dps) at starts ?

b. What is the activity and specific activity of $._6C^{11}$ at start?

c. How much of this isotope $\left(._6C^{11}\right)$ is left after 24 hr its preparation?

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26. Calculate the energy in the reaction

$2._1^1H + 2._0^1n \rightarrow ._2^4He$

Given, H = 1.00813 amu, n = 1.00897 amu and He = 4.00388

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27. A sample of uranium mineral was found to contain Pb^{208} and U^{238} in the ratio of 0.008 : 1. Estimate the age of the mineral (half life of U^{238} is 4.51×10^9 years).

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28. The amount of ${}_{.6}C^{14}$ isotope in a piece of wood is found to be one-fifth of that present in a fresh piece of wood. Calculate the age of wood (Half life of $C^{14} = 5577$ years)

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29. A piece of wood was found to have C^{14}/C^{12} ratio 0.6 times that in a living plant. Calculate that in a living plant. Calculate the period when the plant died. (Half life of $C^{14} = 5760$ years)?

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30. One mole of a present in a closed vessel undergoes decay as ${}_{z}{}^{m}A \to {}_{Z-4}{}^{m-8}B + 2_2{}^4He$. The volume of He collected at NTP a fter 20 days is ($t_{1/2} = 10$days) a)11.2 litre b)22.4 litre c)33.6 litre d)67.2 litre

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31. $._{}^{131}I$ has half life period 13.3 hour. After 79.8 hour, what fraction of $._{}^{131}I$ will remain ?

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32. A sample of $._{}^{14}CO_2$ was to be mixed with ordinary $.Co_2$ for a biological tracer experiment. In order that $10^3 cm^3$ of the diluted gas at NTP should have 10^4 dis/min, how many μCi Of radiocarbon-14 are needed to prepare 60 L of the diluted gas ?

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33. A radioactive nuclide is produced at a constant rate of α per second . It's decay constant is λ. If N_0 be the no. of nuclei at time t=0 , then max. no. nuclei possible are :

A. $\frac{\alpha}{\lambda}$

B. $N_0 + \frac{\alpha}{\lambda}$

C. N_0

D. $\frac{\lambda}{\alpha} + N_0$

Answer:

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34. The half life of $.^{212}Pb$ is 10.6 hour. It undergoes decay to its daughter (unstable) element $.^{212}Bi$ of half life 60.5 minute. Calculate the time at which the daughter element will have maximum activity.

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35. A radiaocatice isotope is being produced at a constant rate X. Half-life of the radioactive substance is Y. After some time, the number of radioactive nuceli become constant. The value of this constant is .

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36. $._{92}^{238}U$ by successive radioactive decay changes to $._{82}^{206}Pb$. A sample of uranium ore was analysed and found to contain 1.0g of $.^{238}U$ and 0.1g of $.^{206}Pb$. Assuming that all $.^{206}Pb$ hasaccumulated due to decay of $.^{238}U$, find the age of the ore (half life of $.^{238}U = 4.5 \times 10^9$ yrs).

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37. Calculate the mass of C^{14} (half life =5720 years) atoms give 3.7×10^7 disintegrations per second.

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38. The time required for the decompoistion of $99.9\,\%$ fraction of a first order reaction is.....to that of its half-life time.

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39. Half-life of a radioactive substance A is two times the half-life of another radioactive substance B. Initially, the number of A and B are N_A and N_B, respectively . After three half-lives of A, number of nuclei of both are equal. Then, the ratio N_A / N_B is .

A. $\frac{1}{2}$

B. $\frac{1}{8}$

C. $\frac{1}{3}$

D. $\frac{1}{6}$

Answer:

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40. $1g$ of $._{79}\, Au^{198}\left(t_{1/2} = 65hr\right)$ decays by β-emission to produce stable Hg.

a. Write nuclear reaction for process.

b. How much Hg will be present after 260 hr.

A. write the nuclear reaction for the process.

B. how much mercury will be present after 260 hours?

C.

D.

Answer:

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41. What is the probability of a radioactive nucleus to survive one mean life?

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42. 1 mg radium has 2.68×10^{18} atoms. Its half-life is 1620 years. How many radium atoms will disintegrate from 1 mg of pure radium in 3240 years ?

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43. A certain radio isotope $._{Z}X^{A}$ (half life $=10$ days) decays to give $._{Z-2}Y^{A-4}$. If $1.0g$ atom of X is kept in a sealed vessel, find the volume of helium accumulated at STP in 20 days ?

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44. Binding energy per nucleus of $._{1}^{2}H$ and $._{2}^{4}He$ are 1.1 MeV and 7 MeV respectively. Calculate the amount of energy released in the following process:

$._{1}^{2}H+._{1}^{2}H\rightarrow ._{2}^{4}He$

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45. Calculate the energy asociated with the following nuclear reaction:

$$\underset{26.9815a\mu}{._{13}^{27}Al}+\underset{2.014a\mu}{._{1}^{2}H}\rightarrow \underset{24.9858a\mu}{._{12}^{25}Mg}+\underset{4.0026a\mu}{._{2}^{4}He}$$

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46. A radioisotope $._Z A^m (t_{1/2} = 10$ days) decays to give $._{z-6} B^{m-12}$ stable atom along with α-particles. If mg of A are taken and kept in a sealed tube, how much He will accumulate in 20 days at STP.

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47. A sample of pitchblende is found to contain 50% minimum and 2.425% of lead. Of this lead only 93% was Pb^{26} isotope. If the disintegration constant is 1.52×10^{-10} yr^{-1}, how old could be the pitchblende deposidts?

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48. On analysis a sample of uranium are was found to contain 227g of $._{82} Pb^{208}$ and 1.667 g of $._{92} U^{238}$. The half life peiod of U^{238} is 4.51×10^9 yrs. If all the lead was assumed to have come from decay of $._{92} U^{238}$, what is the age of the earth?

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49. $._{19}K^{40}$ consists of 0.012% potassium in nature. The human body contains 0.35% potassium by weight. Calculate the total radioactivity resulting from $._{19}K^{40}$ decay in a 75 Kg human body. Half life of $._{19}K^{40}$ is 1.3×10^9 years

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50. The sun radiates energy at the rate of 4×10^{26} joule $\sec^{-1}$. If the energy of fusion process

$4._1^1H \rightarrow ._2^4He + 2._1^0e$

is $27MeV$, calculated amount of hydrogen atoms that would be consumed per day for the given process.

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51. A radioactive isotope X with a half-life of 1.37×109 years decays to Y which is stable. A sample of rock from the moon was found to contain both the elements X and Y which were in the ratio of $1:7$. The age of the rock is.

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52. A sample of radioactive substance shows an intensity of 2.3 millicurie at a time t and an intensity of 1.62 millicurie after 600 s. The half-life period of the radioactive metal is

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53. What mass of Ra^{226} whose $t_{1/2} = 1620$ years will give the activity of 1 millicurie?

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Problem Practices

1. Half life of $.^{24}Na$ is 14.8 hours. In what period of time will a sample of this element lose 90% of its activity?

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2. A β-particle emitter has a half life of 60.6 min. At any instant of time, a sample of this element registers 2408 counts per second. Calculate the counting rate after 1.5 hours.

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3. Consider an $\alpha-$ particle just in contact with a $._{92}U^{238}$ nucleus. Calculate the coulombic repulsion energy (i.e., the height fo coulombic barrier between U^{238} and $\alpha-$ particle.)Assume that the distance between them is equal to the sum of their radii.

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4. The acitivity of a certain sample of raidoactive element 'A' decreases to $1\sqrt{2}$ of its value in 4 days. What is its life? Assuming that,

$$._{Z}^{M}A - ._{2}^{4}He \rightarrow ._{Z-2}^{M-4}B$$

What mass of the sample will be left over after 24 days if we start with one gram of 'A' ? calaculate this in terms of M.

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5. The half life of $._{92}^{238}U$ is 4.5×10^{9} years. Uranium emits an αparticle to give thorium. Calculate the time required to get the product which contains equal masses of thorium and uranium.

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6. 32 mg of pure $._{94}^{238}PuO_2$ has an activity of $6.4 \times 10^{7}\ \sec^{-1}$

(i) What will be the half life of $._{94}^{238}Pu$ in years?

(ii) What amount of PuO_2 will remain if 100 mg PuO_2 is kept for 500 years?

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7. A radioactive isotope decays as:

$$\cdot_Z^M A \rightarrow \cdot_{Z-2}^{M-4} B \rightarrow \cdot_{Z-1}^{M-4} C$$

The half lives of A and B are 6 and 10 months respectively. Assuming that initially only A was precent, will it be possible to achieve the radioactive equilibrium for B ? If So, what would be the ratio of A and B at equilibrium? What would happen if the half lives of A and B were 10 and 6 months respectively?

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8. An analysis of the rock shows that the relative number of Sr^{87} and $Rb^{87}\left(t_{1/2} = 4.7 \times 10^{10}\right.$ year) atoms is 0.05 . What is the age of the rock? Assume all the Sr^{87} have been formed from Rb^{87} only

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9. Hydrolysis of ester was studied by isotopic labelling method. Write down the structures of products A and B in the given reaction.

$$CH_3 - \overset{O}{\overset{||}{C}} - \overset{18}{O} - H + HOH \rightarrow A \rightarrow B$$

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10. Arrange the following species in decreasing order of chemical reactivity and radioactivity,

$._1^1 H, ._1^2 H, ._1^3 H$

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11. The half life of $._{}^{212} Pb$ is 10.6 hour. It undergoes decay to its daughter (unstable) element $._{}^{212} Bi$ of half life 60.5 minute. Calculate the time at which the daughter element will have maximum activity.

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12. Radioactive elements is spread over a room, its half life is 30 day, Its activity is 50 times the permissible value. After how many days will it be safe?

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13. Calculate the energy released in joules and MeV in the following nuclear reaction:

$._1H^2 + ._1H^2 \rightarrow ._2He^3 + ._0n^1$

Assume that the masses of $._1H^2$, $._2He^3$, and neutron (n), respectively, are 2.40, 3.0160, and 1.0087 in amu.

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14. Radiactive element due to accident in research laboratory gets embedded in its floor and walls. The initial rate of decay is 64 times the

safe limit. The half life of the element is 32 days. Calculate the time after which the laboratory will be safe for use.

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15. Radium has a half life 1600 years and its daughter elements radon has a half life 3.82 days. In an enclosure, the volume of radon was found constant for a week. Explain and calculate the ratio of the number of radium and radon nuclei. Will the ratio be constant after 400 years?

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16. Calculate the radius and density of $._{92}^{235}U$

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17. $._{92}^{235}U$ decays with emission of α and β- particles to form ultimately $._{82}^{207}Pb$. How many α and β-particles are emitted per atom of Pb

produced?

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18. The half life of radium is 1600 years. After how much time, $\frac{1}{16}th$ part of radium will radium will remain undisintergrated in a sample?

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19. 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?

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20. The activity of a radioactive isotope falls to 12.5% in 90 days. Compute the half life and decay constatn of isotope.

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21. The radioactivity of an element was found to be one millicurie. What will be its radioactivity after 42 days if its has half life of 14 days?

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22. A sample of a radioactive substance has 10^6 radioactive nuclei. Its half life time is 20 s How many nuclei will remain after 10 s ?

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23. Radioactive elements decays at such a rate that after 68 minutes only one-fourth of its original amount remains. Calculate its decay constant and half life period.

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24. One gram of a radioactive element decays by β-emission to 0.125 in 200 hours. How much more time will elapse only 0.10 g of it is left?

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25. A wooden article found in a cave has only 40% as much $.^{34}C$ activity as a fresh piece of wood. How old is article?

($t_{1/2}$ for $.^{14}C = 5760$ year)

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26. One μg of a radioactive iodine contained in thyroxine is injected into the blood of a patient. How long will it take for radioactivity to fall to 50%, 25% and 10% of the initial value?

($t_{1/2}$ for $._{53}^{131}I = 8.052$ days)

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27. One gram of radium is reduced by 2 miligram in 5 yers by α-decay. Calculate the half-life of radium.

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28. The activity of a radioactivity substance fall to 87.5% of the initial value in 5 years. What is the half life of the elements?

calculate the time in which the activity will fall by 87.5%.

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29. Starting with 1.0g of a radioactive sample, 0.25 g fo its is left after 5 days. Calculate the amount which was left one day.

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30. A sample of wooden artifact is found to undergo 9 disintegration per minute per gram of carbon. What is the approximate age of the artifact?

The half life of ${}_{6}^{14}C$ is 5730 years and radioactivity of wood recently cut is 15 disintegrations per minute per gram of carbon.

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31. Xenon-127 has a half life of 36.4 days. How much of a sample of xenon that orginally weighed 1.0g remains after 20 days?

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32. Calculate the ratio of $\frac{N}{N_0}$ after n hour has passed for a radioactive material of half life 47.2 seconds.

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33. The activity of the hair of an Egyptian mummy is 7 disintegration $\min^{-1}$ of C^{14}. Find age of Egyptian mummy. Given $t_{0.5}$ of C^{14} is 5770

years and disintegration rate of fresh sample of C^{14} is 14 disintegration $\min^{-1}$.

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34. On analysis a sample of $.^{238}U$ ore was found to contain 20.6g of $._{82}^{206}Pb$ ad 23.8g of $._{92}^{238}U$. The half life period $.^{238}U$ is 4.50×10^9 years. If all the lead were assumed to have come from decay of $._{92}^{238}U$, what is the age of the ore?

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35. It is known that 1g of $.^{226}Ra$ emits 11.6×10^{17} atoms of α per years. Given, the half life of $.^{236}Ra$ to be 1600 years, compute the value of Avogadro's number.

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36. A uranium mineral contains $.^{238}U$ and $.^{206}Pb$ in the ratio of 4 : 1 by weigh. Calculate the age of the mineral, $t_{1/2}.^{238}U = 4.5 \times x10^{9}$ years. Assume that all the lead present in the mineral is formed from disintegration of $.^{238}U$.

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37. In a sample of pitchbende, the atomic ratio of $.^{206}Pb : .^{238}U$ is 0.23 : 1. Calculate the age of the mineral if half life of uranium is 4.5×10^{9} years. Assume that all lead has originated from uranium.

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38. The ratio of the atoms of two elements A and B at radioactive equilibrium is 5.0×10^{5} : 1 respectively. Calculate half life of B if half life of A is 245 days.

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39. Calculate the energy released in MeV during the reaction $._3^7Li + ._1^1H \rightarrow 2\left[._2^4He\right]$ if the masses of $._3^7Li$, $._1^1H$ and $._2H_4He$ are 7.018, 1.008 and 4.004 amu respectively.

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40. The half life period of $._{58}^{141}Ce$ is 13.11 days. It is a β-particle emitter and the average energy of the β-particle emitted is 0.442 MeV. What is the total energy emitted per second in watts by 10 mg of $._{58}^{141}Ce$?

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41. A sample of $._{38}^{90}Sr$ has an activity of 0.5 mCi. What is its specific activity? ($t_{1/2}$ of $._{38}^{90}Sr = 19.9$ years)

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42. The disintegrationn rate of a certain radioactive sample at any instant is 4750 dpm which becomes 2700 dpm 5 min later. Calculate the half life to sample?

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43. One of the hazards of nuclear explosion is the generation of $.^{90}Sr$ and its subsequent incorporation in bones. This nuclide has a half-life of 28.1 year. Suppose one micro-gram was absorbed by a new-born child, how much Sr^{90} will remain in his bones after 20 year?

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44. To which radioactive families do the following nuclides belong?

$.^{222}Rn, .^{228}Ra, .^{307}Pb, .^{209}Bi, .^{233}Pa$

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Obj A

1. Natural radioactivity was discovered by a)Schmidt b)Curie c)Becquerel d)Rutherford

A. Rutherford

B. Becquerel

C. Curie

D. Schmidt

Answer: b

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2. Radioactivity is due to a) Stable electronic configuration b) Unstable electronic configuration c) Stable nucleus d) Unstable nucleus

A. stable electronic configuration

B. unstable electronic configuration

C. stable nucleus

D. unstable nucleus

Answer: d

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3. Radioactivity is essentially:

A. a chemical activity

B. a physical property

C. a nuclear property

D. a porperty of non-metals

Answer: c

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4. Radioactivity is generally not found in a)Light nuclei b)Stable nuclei c)Heavy nuclei d)Nuclei of intermediate mass

A. light nuclei

B. stable nuclei

C. heavy nuclei

D. nuclei of intermediate mass

Answer: c

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5. The activity of radioisotope changes with:

A. temperature

B. pressure

C. chemical enviorment

D. none of these

Answer: d

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6. The rays are given off by a radioactive element from A)Nucleus B)Valence electrons C)All the orbits D)Outer orbit

A. nucleus

B. valence electrons

C. all the orbits

D. outer orbit

Answer: a

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7. The alpha particles are A)High $-$ energy electrons B)Positively charged hydrogen ions C) High $-$ energy $X-$ rays radiations D)Double

positively charged helium nuclei.

A. high energy electrons

B. positively charged hydrogen ions

C. high energy X-ray radiations

D. double positively charged helium nuclei

Answer: d

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8. The emission of beta particle is from A)The valence shell of an atom B)The inner shell of an atom C)The nucleus due to the nuclear conversion :

$\text{Proton} \rightarrow \text{neutron} + \text{electron}$ D)The nucleus due to the nuclear conversion :

$\text{neutron} \rightarrow \text{proton} + \text{electron}$

A. the valence shell of an atoms

B. the inner shell of an atom

C. the nucleus due to the nuclear conversion proton $\rightarrow$ neutron + electron

D. the nucleus due to the nuclear conversion neutron $\rightarrow$ proton + electron

Answer: d

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9. Identify the nuclear reaction that differs from the rest:

A. Positron emission

B. K-capture

C. β-decay

D. α-decay

Answer: d

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10. Gamma rays are:

A. high energy electrons

B. low energy electrons

C. high energy electromagnetic waves

D. high energy positrons

Answer: c

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11. Radium is a radioactive substance. It dissolves in dilute H_2SO_4 and forms a compound radium sulphate. The compound is a)No longer radioactive b)Half as radioactive as the radium content c)As radioactive as the radium content d)Twice as radioactive as the radium content.

A. no longer radioactive

B. half as radioactive as the radium content

C. as radioactive as the radium content

D. twice as radioactive as the radium content

Answer: c

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12. The velocity of α-rays is approximately:

A. equal to that of the velocity of light

B. $\frac{1}{10}$th of the velocity of light

C. 10 times more than velocity of light

D. uncomparable to the velocity of light

Answer: b

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13. α-rays have ionization power because they possess

a. Lesser kinetic energy

b. Higher kinetic energy

c. Lesser penetration power

d. Higher penetration power

A. lesser kinetice energy

B. higher kinetic energy

C. lesser penetration power

D. higher penetration power

Answer: b

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14. The radiation from naturally occuring radioactive substance as seen after deflection by a magnetic field in one direction are :

A. definitely α-ryas

B. definitely β-rays

C. both α and βrays

D. either α or β-rays

Answer: d

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15. Which of the following statements about radioactivity is are true? a)It involves outer electrons activity b)It is not affected by temperature of pressure. c)It is an exothermic process. d)The radioactivity of an element is not affected by any other element compounded by it.

A. It involves outer electrons activity

B. It is not affected by temperature of pressure

C. It is an exothermic process

D. The radioactivity of an element is not affected by any other element compounded by it.

Answer: a

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16. The radioactivity of uranium mineras is usually more in comparison to pure uranium. This is due to presence of ... in the mineral.

A. actinium

B. thorium

C. radium

D. plutonium

Answer: c

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17. The correct order of ionising capcity of α, β and γ-rays is

A. $\alpha > \beta > \gamma$

B. $\beta > \alpha > \gamma$

C. $\gamma > \alpha > \beta$

D. $\beta > \gamma > \alpha$

Answer: a

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18. which of the following radiations have least effect on both the photographic plate and zinc sulphide screen?

A. α-rays

B. β-rays

C. `gamma-decays

D. All have equal effect

Answer: c

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19. In $\alpha -$ decay , n/p ratio : a)May inrease or decrease b) Remains constant c)Decreases d)Increases

A. may increase off decrease

B. remains constant

C. decreases

D. increases

Answer: d

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20. In $\beta -$ decay n/p ratio: a)May inrease or decrease b) Remains constant c)Decreases d)Increases

A. remains unchanged

B. may increase or decrease

C. increases

D. decreases

Answer: d

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21. A device used for the measurement of radioactivity is

A. mass spectrometer

B. cyclotron

C. nuclear reactor

D. GM counter

Answer: d

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22. Which of the following does not contain material particles?

A. α-rays

B. β-rays

C. γ-rays

D. Anode rays

Answer: c

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23. If by mistake radioactive substance gets into human body, then from the point of view of radiation damage, the most harmful will be one that emits.

A. γ-rays

B. neutrons

C. β-rays

D. α-rays

Answer: a

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24. Emission of β-particle by an atom of an element results in the formations of:

A. isobar

B. isomer

C. isotope

D. isotone

Answer: a

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25. The particles not emitted by radioactive susbstace are:

A. gamma rays

B. electrons

C. protons

D. He nuclei

Answer: c

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26. Successive emission of an α-particle and two β-particles by an atom of an element result in the formation of its

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27. The isotope $._{92}^{235}U$ decays in a number of steps to an isotope of $._{82}^{207}Pb$. The groups of particle emitted in this process will be:

A. $4\alpha, 7\beta$

B. $6\alpha, 4\beta$

C. $7\alpha, 4\beta$

D. $10\alpha, 8\beta$

Answer: c

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28. The number of α and β-particles emitted in the nuclear reaction $._{90}^{210}Th \rightarrow ._{83}^{212}Bi$ are:

A. $8\alpha, 1\beta$

B. $4\alpha, 7\beta$

C. $3\alpha, 7\beta$

D. $4\alpha, 1\beta$

Answer: d

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29. $._{84}^{210} Po \rightarrow_{82}^{206} Pb + ._{2}^{4} He$ in this reaciton predict the positon of group of Po when lead is the the IVB group:

A. IIA

B. VIB

C. IVB

D. VB

Answer: b

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30. When $._{88}^{226} Ra$ emits an α-particle, the new element formed belongs to:

A. third group

B. zero group

C. fourth group

D. second group

Answer: b

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31. The radius of nucleus is:

A. proportional to its mass number

B. inversely proportioanl to its mass number

C. proportional to the cube root of its mass number

D. not related to its mass number

Answer: c

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32. The end product of $4n$ series is a). ${}_{82}Pb^{208}$ b). ${}_{82}Pb^{207}$ c). ${}_{82}Pb^{209}$ d) ${}_{82}Pb^{204}$

A. ${}^{208}_{82}Pb$

B. ${}^{207}_{82}Pb$

C. ${}^{209}_{82}Pb$

D. ${}^{210}_{83}Bi$

Answer: a

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33. 4n + 2 series is known as:

A. actinium series

B. thorium series

C. uranium series

D. neptunium series

Answer: c

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34. A radioactive element A on disintegration gives two elements B and C. If B is helium and C is the element of atomic number 90 and atomic mass 234, the element A is:

A. $._{92}^{238}U$

B. $._{88}^{234}Ra$

C. $._{90}^{234}Th$

D. $._{91}^{234}Pa$

Answer: a

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35. . ^{234}U has 92 protons and 234 nucleons total in tis nucleus. It decays by emitting an alpha particle. After the decay it becomes:

A. . ^{232}U

B. . ^{232}Pa

C. . ^{230}Th

D. . ^{230}Ra

Answer: c

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36. Starting from radium, the radioactive disintegration process terminates when the following is obtained a)radon b)lead c)uranium d)thorium

A. lead

B. radon

C. radium A

D. radium B

Answer: a

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37. The only, most stable nucleus formed by bombarding either $._{13}^{27}Al$ by neutrons of $._{11}^{23}Na$ by deutrons is

A. $._{15}^{30}P$

B. $._{14}^{30}Si$

C. $._{12}^{24}Mg$

D. $._{56}^{137}Ba$

Answer: d

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38. The number of α-particles emitted per second by 1g fo $.^{226}Ra$ is $.7 \times 10^{10}$. The decay constant is:

A. $1.39 \times 10^{-11}\,\text{sec}^{-1}$

B. $13.9 \times 10^{-11}\,\text{sec}^{-1}$

C. $139 \times 10^{-10}\,\text{sec}^{-1}$

D. $13.9 \times 10^{-10}\,\text{sec}^{-1}$

Answer: a

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39. The decay constant of Ra^{226} is $1.37 \times 10^{-11} s^{-1}$. A sample of Ra^{226} having an activity of 1.5 millicurie will contain

A. 4.05×10^{18}

B. 3.7×10^{17}

C. 2.05×10^{15}

D. 4.7×10^{10}

Answer: a

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40. A sample of $._{19}^{40} K$ contains invariably $._{18}^{40} Ar$. This is because $._{19}^{40} K$ has tendency to undergo:

A. α-decays

B. positronium decay

C. β-decays

D. γ-decay

Answer: b

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41. If the amount of radioactive substance is increased three times, the number of atoms disintegrated per ubit time would :

A. be double

B. not be change

C. be triple

D. be $\frac{1}{3}$ rd of the original number of atoms

Answer: c

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42. The decay constant of a radioactive sample is $'\lambda'$. The half-life and mean life of the sample are respectively a) $\frac{1}{\lambda}, \frac{\text{in2}}{\lambda}$ b) $\frac{\text{in2}}{\lambda}, \frac{1}{\lambda}$ c) $\text{in2}, \frac{1}{\lambda}$ d) $\frac{\lambda}{\text{in2}}, \frac{1}{\lambda}$

A. $1/\lambda, 1n2/\lambda$

B. $1n2/\lambda, 1/\lambda$

C. $\lambda 1n2, 1/\lambda$

D. $\lambda/Pn_2, 1/\lambda$

Answer: b

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43. Radium has atomic weight 226 and a half-life of 1600 Yr. The number of disintegrations produced per second from one gram are

A. 4.8×10^{10}

B. 3.7×10^{8}

C. 9.2×10^{6}

D. 3.7×10^{10}

Answer: d

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44. A radioactive sample has a half life 1500 years. A sealed tube conataining 1g of the sample will contain after 3000 years,

A. 1g of the sample

B. 0.5 g of the sample

C. 0.25 g of the sample

D. 0.01g of the sample

Answer: c

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45. C^{14} has a half $-$ life of 5760 years. $100mg$ of the sample containing $.^{14}C$ is reduced to $25mg$ in a)11520years b)2880years c)1440years d)17128years

A. 11520 years

B. 2880 years

C. 1440 years

D. 17280 years

Answer: a

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46. If $3/4$ quantity of a radioactive substance disintegrates in 2 hours, its half $-$ life period will be a)$15min$ b) $30min$ c)$60min$ d)$90min$

A. 15 minutes

B. 30 minutes

C. 60 minutes

D. 90 minutes

Answer: c

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47. Half life of radium is 1580 years. It remains 1/16 after the.....

A. 1580 years

B. 3160 years

C. 4740 years

D. 6320 years

Answer: d

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48. If half life period of radium is 1600 years, its average life period will be:

A. 2304 years

B. 4608 years

C. 230.4 years

D. 23040 years

Answer: a

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49. A radioactive isotope having a half life of 3 days was received after 12 days. It was found that there were 3 gm of the isotopes in the container. The initial weight of the isotope when packed was a)12 gm b)24gm c)36 gm d)48 gm

A. 48 g

B. 36 g

C. 24 g

D. 12 g

Answer: a

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50. Radioactivity of a radioactive element remains $1/10$ of the original radioactivity after 2.303 seconds. The half life period is

A. 2.303

B. 0.2303

C. 0.693

D. 0.0639

Answer: c

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51. A freshely prepared radioactive source of half 2 hours emits radiations 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)6 hours b)12 hours c)24 hours d)128 hours

A. 6 hours

B. 12 hours

C. 24 hours

D. 48 hours

Answer: b

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52. A radioisotope has a half life of 10 days. If today there is $125g$ of it left, what was its mass 40 days earlier ? a)600g b)1000g c)1250g d)2000g

A. 600g

B. 1000g

C. 1250g

D. 2000g

Answer: d

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53. The half $-$ life periods of four isotopes are give below :

$(i) 7.6 years$, $ii.\ 4000 years$

$iii.\ 6000 years$,$iv.\ 3.2 \times 10^5 years$

Which of the above isotope is most stable ?

A. iv

B. iii

C. ii

D. i

Answer: a

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54. The first stable which was transmuted b artificial means was:

A. ${}_{8}^{16}O$

B. $._{7}^{14} N$

C. $._{6}^{12} C$

D. $._{4}^{9} Be$

Answer: b

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55. When $._{13}^{27} Al$ is bombarded whith α-particles, a radioactive isotope of phosphorus $._{15}^{30} P$ with the emission of .... Is formed

A. neutrons

B. protons

C. positrons

D. electrons

Answer: a

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56. Which of the following transformation is not correct?

A. $._{33}^{75}As + ._{2}^{4}He \rightarrow ._{35}^{78}Br + ._{0}^{1}n$

B. $._{3}^{7}Li + ._{1}^{1}H \rightarrow ._{4}^{7}Be + ._{0}^{1}n$

C. $._{21}^{45}Sc + ._{0}^{1}n \rightarrow ._{20}^{45}Ca + ._{0}^{1}n$

D. $._{83}^{209}Bi + ._{1}^{2}H \rightarrow ._{84}^{210}Po + ._{1}^{1}n$

Answer: c

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57. The reaction $._{92}U^{235} + ._{0}n^{1} \rightarrow ._{56}Ba^{140} + ._{36}Kr^{93} + 3._{0}n^{1}$ represents a)Artificial radioactivity b)Nuclear fission c)Nuclear fusion d)None of these

A. artificial radioactivity

B. nuclear fission

C. nuclear fussion

D. none of the above

Answer: b

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58. $._6 C^{14}$ in upper atmosphere is generated by the nuclear reaction

A. $._7^{14} N + ._1^1 H \rightarrow ._6^{14} C + ._{+1}^0 e + ._1^1 H$

B. $._7^{14} N \rightarrow ._6^{14} C + ._{+1}^0 e$

C. $._7^{14} N + ._0^1 n \rightarrow ._6^{14} C + ._1^1 H$

D. $._7^{14} N + ._1^1 H \rightarrow ._6^{11} C + ._2^4 He$

Answer: c

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59. In the transformation of ${}_{92}{}^{238}U$ to ${}_{92}{}^{234}U$, if one emission is an α particle, what should be the other emission(s)? a)Two β^- Two β^- b)Two β^- and one β^- c) One β^- and one γ d)One β^+ and one β^-

A. two β^-

B. two β^- and one β^+

C. one β^- and one γ

D. one β^+ and one β^-

Answer: a

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60. A positron is emitted from ${}_{11}Na^{23}$. The ratio of the atomic mass and atomic number of the resulting nuclide is

A. 22/10

B. 22/11

C. 23/10

D. 23/12

Answer: c

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61. Hydrogen bomb is based on the principle of

A. nuclear fission

B. natural ratioactivity

C. nuclear fusion

D. artificial radioactivtiy

Answer: d

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62. Which of the following is not a fissionalbe material?

A. $._{}^{235}U$

B. $._{}^{238}U$

C. $._{}^{233}U$

D. $._{}^{239}Pu$

Answer: b

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63. The fuel in atomic pile is :

A. carbon

B. sodium

C. petroleum

D. uranium

Answer: d

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64. The energy released in an atom bomb explosion is mainly due to

A. Conversion of heavier to lighter atoms

B. Products having lesser mass than initial substance

C. release of neutrons

D. release of electrons

Answer: b

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65. One gram of mass is equal to:

A. 5×10^{10} erg

B. 9×10^2 erg

C. 7×10^5 erg

D. 11×10^{12} erg

Answer: b

View Text Solution

66. Liquid sodium is used in nuclear reactor. What is its function?

A. ti collect the reaction product

B. to act as heat exchanger

C. to absorb the neutrons in order to control the chain reaction

D. to absorb as moderator to slow down the neutrons

Answer: b

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67. A sample of rock moon contains equal numbers of atoms of uranium and lead $t_{1/2}$ for U is 4.5×10^9 years. The age of rock would be

a. 4.5×10^9 years b. 9.0×10^9 years

c. 13.5×10^9 years d. 2.25×10^9 years

A. 9×10^9 years

B. 4.5×10^9 years

C. 13.5×10^9 years

D. 2.25×10^9 years

Answer: b

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68. In treatment of cancer, which of the following is used?

A. ${}^{131}_{53}I$

B. ${}^{32}_{15}P$

C. ${}_{27}^{60}Co$

D. ${}_{1}^{2}H$

Answer: c

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69. Wooden article and freshly cut tree show activity 7.6 and 15.2 $\min^{-1}g^{-1}$ of carbon ($t_{1/2} = 5760$year) respectively. The age of the article is a)5760 year b)$5760 \times \frac{15.2}{7.6}year$ c)$5760 \times \frac{7.6}{15.2}year$ d) $5760 \times 15.2 - 7.6year$

A. 5760 years

B. $5760 \times \frac{15.2}{7.6}$

C. $5760 \times \frac{7.6}{15.2}$ year

D. $5760 \times (15.2 - 7.6)$ year

Answer: a

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70. Which one of the following statement is wrong?

A. Neutrons was discovered by Chadwick.

B. Nuclear fission was discovered by Hain and strassmann.

C. Polonium was discovered by Madam Curie.

D. Nuclear fission was discovered by Fermi.

Answer: d

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71. Neutrons are more effective projectiles than protons because they

A. are attracted by nuclie

B. are not repelled by nuclei

C. travel with high speed

D. none of these

Answer: b

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72. The source of enormous energy of sun is a)Fusion of hydrogen to form helium b)Fission of uranium c)Fusion of deuterium and tritium d)Fusion to tritium ot form helium

A. fusion of hydrogen to form heliun

B. fission of uranium

C. fusion of deuterium and tritium

D. fission of tritium to form helium

Answer: a

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73. In the neutron – induced fissioin reaction of $._{92}U^{235}$ one of the products if $._{37}Rb^{95}$, in this mode, another nuclide and three neutrons are also produced. Identify the nuclide.

A. $._{54}^{144}Xe$

B. $._{55}^{144}Co$

C. $._{55}^{145}Co$

D. $._{54}^{143}Xe$

Answer: b

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74. $._{88}^{228}X - 3\alpha - \beta \rightarrow Y$. The element Y is:

A. $._{82}^{216}Pb$

B. $._{82}^{217}Pb$

C. $._{83}^{218}Bi$

D. $._{83}^{216} Bi$

Answer: b

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75. Which radioactive isotope is used to detect tumours?

A. $._{}^{74} As$

B. $._{}^{24} Na$

C. $._{}^{131} I$

D. $._{}^{60} Co$

Answer: a

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76. Natural uranium consists of $._{}^{235} U$:

A. 0.99

B. 0.5

C. 0.1

D. 0.007

Answer: d

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77. $._{92}^{238}U$ atom distintgrates to $._{84}^{214}Po$ with a half life of 4.5×10^9 years by emitting six alpha particles and n electrons. Here n is -

A. 6

B. 4

C. 10

D. 7

Answer: b

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78. A parent nucleus X is decaying into daughter nucleus Y which in turn decays to Z. The half lives of X and Y are 40000 years and 20 years respectively. In a certain sample, it is found that the number of Y nuclei hardly changes with time. If the number of X nuclei in the sample is 4×10^{20}, the number of Y nuclei present in its is–

A. 2×10^{17}

B. 2×10^{20}

C. 4×10^{23}

D. 4×10^{20}

Answer: a

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79. $._{13} Al^{27}$ is a stable isotope. $._{13} Al^{29}$ is expected to disintegrate by

A. α-emission

B. β-emission

C. positron emission

D. proton emission

Answer: b

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80. Which of the following is the man-made radioactive disintegration series?

A. Thorium series

B. Neptunium series

C. Uranium series

D. Actinium series

Answer: b

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81. The density of a nucleus is of the order of

A. $10^5 kgm^{-3}$

B. $10^{10} kgm^{-3}$

C. $10^{17} kgm^{-3}$

D. $10^{25} kgm^{-3}$

Answer: c

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82. Radioactive material is deacign with $t_{1/2} = 30$ days on being, separated into two fractions , one of the fracation, immediately after separation decays with $t_{1/2} = 2$ days. The other fraction, immediately after separation, would show:

A. constant activity

B. increasing activity

C. decay with $t_{1/2} = 30$ days

D. decay with $t_{1/2} = 28$ days

Answer: b

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

A. 1500

B. 1000

C. 1250

D. 2000

Answer: d

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84. A radioactive element X has an atomic number of 100. It decays directly into an element Y which decays directly into an element Z. In both the processes either one α or one $\beta -$ particle is emitted. Which of the following statement could be true?

A. Y has an atomic number of 102

B. Y has an atomic number of 101

C. Z has an atomic number of 100

D. Z has an atomic number of 99

Answer: b,d

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85. Enrichment of uranium is made by :

A. distillation

B. diffusion

C. evaporation

D. bleaching

Answer: b

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86. Let us consider emission of αparticle from uranium nucleus:

$$_{92}^{235}U - {}_{2}He^{4} \rightarrow {}_{90}Th^{231}$$

$e = 92 \quad e = 0 \quad e = 90$

$p = 92 \quad p = 2 \quad p = 90$

$n = 143 \quad n = 2 \quad n = 141$

shortage of two electorns in thorium is due to:

A. conversion of electrons to positron

B. combination with positron to evolve energy

C. annihilation

D. absorption in the nucleus

Answer: b,c

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87. Artifical radioactive element are present in:

A. s-block

B. p-block

C. d-block

D. f-block

Answer: d

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88. The $.^{60}C$ isotope decays with a half life of 5.3 years. How long would it take for 7/8 of a sample of 500 mg of $.^{60}Co$ to disintegrate?

A. 21.2 years

B. 15.9 years

C. 10.6 years

D. 5.3 years

Answer: b

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89. Which among the following is wrong about isodiaphere?

A. They have the same differenc of neutrons and protons or same isotopic number.

B. Nuclide and its decay product after α-emission are isodiapheres.

C. ${}_{Z}A^{M} \rightarrow {}_{Z-2}B^{M-4} + {}_{2}He^{4}$

'A' and 'B' are isodiapheres

D. All are correct.

Answer: d

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90. At radioactive equilibrium, the ratio between two atoms of radioactive elements A and B is $3.1 \times 10^{9} : 1$. If the half-life period of A is 2×10^{10} years, what is the half-life of B?

A. 6.45 yrs

B. 4.65 yrs

C. 5.46 yrs

D. 5.64 yrs

Answer: a

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91. The decay constant for an $\alpha -$ decay of Th^{232} is $1.58 \times 10^{-10} s^{-1}$. How many $\alpha -$ decays occur from $1g$ sample in 365 days ?

A. 2.89×10^{19}

B. 1.298×10^{19}

C. 2.219×10^{19}

D. None of these

Answer: b

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92. The number of neutrons accompanying the formation of $._{54} Xe^{139}$ and $._{38} Sr^{94}$ from the absorption of a slow neutron by $._{92} U^{235}$, followed by nuclear fission is

A. 0

B. 2

C. 1

D. 3

Answer: d

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93. Thiosulphate ion $\left(S_2O_3^{2-}\right)$ on acidification changes to SO_2 along the precipitation of sulpur,

$$.^{35}S^{32}SO_3^{2-} + 2H^+ \rightarrow H_2O + SO_2 + S$$

Which is the correct statement?

A. S^{35} is in sulphur

B. S^{35} is in SO_2

C. S^{35} is in both

D. S^{35} is in none

Answer: a

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94. A radioactive element X, decays by the sequence and with half-lives, given below,

$$X \xrightarrow[30\text{min}]{\alpha} Y \xrightarrow[2\text{days}]{\beta}$$

Which of the follwing statemetns about this system are correct?

A. After two hours, less than 10% of the initial X is left

B. Maximum amount of Y present at any time before 30 min is less than 50% of the initial amount of X

C. Atomic number of X and Z are same.

D. The mass number of Y is greater than X

Answer: d

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95. Identify [A] and [B] in the following:

$$_{29}^{227}Ac \xrightarrow{-\beta} [A] \xrightarrow{-\alpha} [B] \xrightarrow{-\alpha} Rn$$

A. Po, Rn

B. Th, Po

C. Ra, Th

D. Th, Ra

Answer: d

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96. β-particle is emitted in radioactivity by

A. conversion of proton to neutron

B. from outermost orbit

C. conversion of neutron to proton

D. β-particle is not emitted

Answer: c

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97. The nuclear reaction

$$^{63}_{29}Cu + ^{4}_{2}He \rightarrow ^{37}_{17}Cl + ^{1}_{1}H + 16^{1}_{0}n$$

is referred to as

A. spallation reaction

B. fusion reaction

C. fission reaction

D. chain reaction

Answer: a

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98. ^{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

Answer: c

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99. $_{92}U^{235}$ nucleus absorbs a neutron and disintegrates into $_{54}Xe^{139}$. $_{38}Sr^{94}$ and X. What will be the product X ?

A. 3-neutrons

B. 2-neutrons

C. α-particles

D. β-particle

Answer: b

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100. The radioisotope , tritium $\left({}_{1}^{3}H\right)$ has a half-life of 12.3 years. If the initial amount of tritium is 32 mg , how many milligrams of it would remain after 49.2 years ?

A. 1 mg

B. 2 mg

C. 4 mg

D. 8 mg

Answer: b

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101. The radioactive nuclide $._{90}^{234}Th$ shows two successive $\beta-$ decay followed by one $\alpha-$ decay. The atomic number and mass number respectively of the resulting atom is:

A. 92234

B. 94230

C. 90230

D. 92230

Answer: c

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102. The half life of radioactive isotope is 3 hour. If the initial mass of isotope were 256 g, the mass of it remaining undecayed after 18 hr is a)12 g b)16 g c)4 g d)8 g

A. 4 g

B. 8 g

C. 12 g

D. 16 g

Answer: a

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103. Consider the following nuclear reactions:

$_{92}{}^{238}M \rightarrow {}._{y}{}^{x}N + 2.{}_{2}{}^{4}He, {}_{x}{}^{y}N \rightarrow {}_{B}{}^{A}L + 2\beta^{+}$

The number of neutrons in the element L is

A. 142

B. 144

C. 140

D. 146

Answer: b

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104. A radioactive element gets spilled over the floor of a room. Its half life period is 30 days. If its initial activity is ten times the permissible value, after how many days will it be safe to enter the room?

A. 100 days

B. 1000 days

C. 300 days

D. 10 days

Answer: a

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105. A photon of gamma radiation knocks out a proton from ${}_{12}Mg^{24}$ nucleus to form a)The isotope of parent nucleus b)The isobar of parent nucleus c)The nuclide ${}_{11}Na^{23}$ d)The isobar of $(11)Na^{23}$

A. the isotope of parent nucleus

B. the isobar of parent nucleus

C. the nuclide of $._{11}^{23}Na$

D. the isobar of $._{11}^{23}Na$

Answer: c

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106. The end product of the series, starting with $._{90}Th^{232}$, is

A. $._{82}^{208}Pb$

B. $._{82}^{209}Bi$

C. $._{82}^{206}Pb$

D. $._{82}^{207}Pb$

Answer: a

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107. $._{92}U^{238}$ emits $8\alpha -$ particles and $6\beta -$ particles. The n/p ratio in the product nucleus is a) $\frac{62}{41}$ b) $\frac{60}{41}$ c) $\frac{61}{42}$ d) $\frac{62}{42}$

A. 60/41

B. 61/40

C. 62/41

D. 61/42

Answer: c

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108. Calculate the mass loss in the following:

$._1^2H + ._1^3H \rightarrow ._2^4He + ._0^1n$

given the masses: $._1^2H = 2.014$ amu, $._1^3H = 3.016$ amu: $._2^4He = 4.004$ amu, $._0^1n = 008$ amu

A. 0.018amu

B. 0.18 amu

C. 18 amu

D. 1.8 amu

Answer: a

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109. A nuclide of an alkaine earth metal undergoes radioactive deacy by emission of the $\alpha -$ particles in sucession. The group of the periodic tablle to which the resulting daughter element would belong to:

A. 4th group

B. 6th group

C. 14 th group

D. 16th group

Answer: c

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110. In the reaction $._1^2H + ._1^3H \rightarrow ._2^4He + ._0^1n$, if the binding energies of $._1^2H$, $._1^3H$ and $._2^4He$ are respectively a, b and c (in MeV), then the energy (in MeV) released in this reaction is.

A. a + b - c

B. c + a - b

C. c - a - b

D. a + b + c

Answer: c

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111. Two radioactive elements X and Y have half lives 6 min and 15 min respectively. An experiment starts with 8 times as many atoms of X as Y.

how long it takes for the number of atoms of X left to equal the number of atoms of Y left?

A. 6 min

B. 12 min

C. 48 min

D. 30 min

Answer: d

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112. Which of the following has the highest value of radioactivity?

A. 1 g of Ra

B. 1 g of $RaSO_4$

C. 1 g of $RaBr_2$

D. 1 g of $Ra(HPO_4)$

Answer: a

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113. An artifical transmutation was carried out on ${}_{7}^{14}N$ by an α-particle which resulted in an unstable nuclide and a proton. What is the ratio of the atmoic mass to be atomic number of the unstable nuclide?

A. $\frac{17}{8}$

B. $\frac{15}{7}$

C. $\frac{17}{9}$

D. $\frac{15}{8}$

Answer: a

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114. If 0.4 curie be the activity of 1 gram of radioactive samples whose atomic mass is 226, then what is the half life period the sample? (1 curie $= 3.7 \times 10^{10} \text{dissec}^{-1}$)

A. 1.2×10^{11} sec

B. 1.8×10^{11} sec

C. 1.2×10^{10} sec

D. 1.8×10^{10} sec

Answer: a

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115. The half life period of uranium is 4.5 billion years. After 9.0 billion years, the number of moles of heliumm liberated from the following nuclear reaction will be:

$$._{92}^{238}U \rightarrow ._{90}^{234}Th + ._{2}^{4}He$$

Initially there was I mole uranium.

A. 0.75 mol

B. 1.0 mol

C. 11.2 mol

D. 22.4 mol

Answer: a

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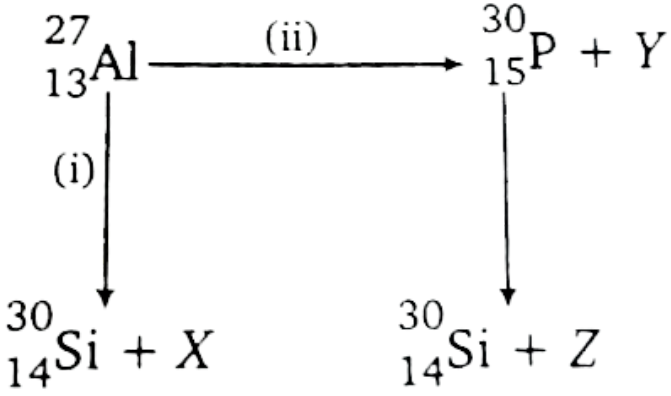
116. Bombardment of aluminium by $\alpha - \text{particle}$ leads to its artificial disintegration in two ways, (i) and (ii) as shown.

Products X, Y and Z respectively, are



A. proton, neutron, positron

B. neutron, positron, proton

C. proton, positron, neutron

D. positron, proton, neutron

Answer: a

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117. A radioactive nucleus A has a single decay mode with half life τ_A. Another radioactive nucleus B has two decay modes 1 and 2. If decay mode 2 were absent, the half life of B would have been $\tau_A / 2$. If decay mode 1 were absent, the half life of B would have been $3\tau_A$, then the ratio τ_B / τ_A is–

A. $\frac{3}{7}$

B. $\frac{7}{2}$

C. $\frac{7}{3}$

D. 1

Answer: a

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118. 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 decay processes but not for γ decay processes

C. Change for γ-decay process but not for α and β-decay processes

D. Change for type of radioactivity.

Answer: a

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119. Half - lives of two radioactive . Initially . The samples have equal number of nuclie After 80 minutes ,the ratio of decyed number of A and B nuclei will be

A. $1:16$

B. $4:1$

C. $1:4$

D. $5:4$

Answer: d

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120. A radioactive element is preset in VIII group of the periodic table. If it emits one αparticle, the new position of the nuclide will be

A. VI B

B. VIII

C. VIIB

D. I B

Answer: a,b,c

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121. Which statement is true about n/p ratio?

A. It increases by β- emission

B. It increases by α emission

C. It increases by γ-emission

D. None of the above

Answer: b

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122. How many α and β particles should be eliminated so that an isodiaphere is formed?

A. $n\alpha, n\beta$

B. $n\alpha, (n+1)\beta$

C. $n\alpha$

D. $n\beta$

Answer: c

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123. which of the following are used as control rods in a nuclear reacto ?

A. Cadmium rod

B. Graphite rods

C. steel rods

D. All of these

Answer: a

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124. Which of the following notation shows the product incorrectly?

A. $._{96}\,Cm^{242}(\alpha, 2n)._{97}\,Bk^{243}$

B. $._{5}\,B^{10}(\alpha, n)._{7}\,N^{13}$

C. $._{7}\,N^{14}(n, p)._{6}\,C^{14}$

D. $._{14}\,Si^{28}(d, n)._{15}\,P^{29}$

Answer: a

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125. Which is ture about decay constant (λ)?

A. Unit is time^{-1}

B. value of λ is always less than 1.

C. λ is independent of temperature.

D. λ is defined as the ratio of no. of atoms disintegrating per unit time to the total no. of atoms present at the time.

Answer: ac

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126. Which of the following is not correct?

A. Nuclei of atoms participate in nuclear reactions

B. $._{20}^{40}Ca$ and $._{18}^{40}Ar$ are isotopes

C. 1 amu of mass defect is approximately equal to 931.5 MeV

D. Uranium $\left(U^{238}\right)$ series is knowns as $(4n+2)$ series.

Answer: b

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127. Correct order of radioactivity is:

A. ${}_{.1}H^1 > {}_{.1}H^2 > {}_{.1}H^3$

B. ${}_{.1}H^3 > {}_{.1}H^2 > {}_{.1}H^1$

C. ${}_{.1}H^3 > {}_{.1}He^1 > {}_{.1}H^2$

D. ${}_{.1}H^3 > {}_{.1}H^1 > {}_{.1}H^2$

Answer: b

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128. At radioactive equilibrium, the ratio between two atoms of radioactive elements A and B is $3.1 \times 10^9 : 1$. If the half-life period of A is 2×10^{10} years, what is the half-life of B?

A. 30 yrs

B. 3 yrs

C. 3.3 yrs

D. None of these

Answer: c

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129. In the sequence of the following nuclear reaction,

$$X_{98}^{238} \xrightarrow{-\alpha} Y \xrightarrow{-\beta} L \xrightarrow{n\alpha} {}_{.90}M^{218}$$

What is the value of n?

A. 3

B. 4

C. 5

D. 6

Answer: b

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130. Co^{60} has half-life of 5.3 years. Find the number of half-lives for $7/8$ of the orignal sample to disintergrate.

A. 4.6 yrs

B. 9.2 yrs

C. 10.6 yrs

D. 15.9 yrs

Answer: d

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131. Which of the following "is"//"are" correct? a)α-rays are more penetrating then β-rays. b)α-rays have greater ionizing power than β-rays. c)β-particles are not present in the elements, yet they are emitted from the nucleus. d)α-rays are not emitted simultaneously with α- and β-rays.

A. α rays are more penetrating then β-rays

B. α-rays have greater ionizing power then β-rays

C. βparticle are not present in the nucleus, yet they are emitted from the nucleus.

D. γ-rays are not emitted simultaneously with α and β-rays

Answer: b,c,d

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132. Select the wrong statement:

A. Nuclear isomers contains the same number of protons and neutrons.

B. The decay constant is independent of the amount of the substance taken.

C. One cuire $= 3.7 \times 10^{10}$ dis/minute

D. Actinium series starts with U^{238}

Answer: c,d

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133. In a nuclear reactor, heavy water is used

A. provide high speed to neutrouns

B. reduce the speed to neutrons

C. capture neutrons produced by nuclear fission

D. transfer the heat from the nuclear reactor

Answer: b,c

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134. The correct starting material and product of different disintegration series is/are a)Th^{232}, Pb^{208} b)Np^{237}, Bi^{209} c)U^{235}, Pb^{206} d)U^{238}, Pb^{206}

A. $._{}^{232}Th, ._{}^{208}Pb$

B. $._{}^{235}U, ._{}^{206}Pb$

C. $._{}^{238}U, ._{}^{207}Pb$

D. $._{}^{237}Np, ._{}^{209}Bi$

Answer: a,d

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135. Which of the following is/are not ture?

A. The most radioactive element present in pitchblende is uranium

B. $._{}^{32}P$ is used for the treatment of leukaemia.

C. CO_2 present in the air contains $._{}^{12}C$ only

D. Emission of γ-rays changes the mass number but not atomic number.

Answer: a,d

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136. Which of the following is/are correct?

A. 1 Curie $= 3.7 \times 10^{10} \frac{d}{s}$

B. 1 Rutherford $= 10^6 d/s$

C. 1 Becquerel = 1d/s

D. 1 Fermi $= 10^3 d/s$

Answer: a,b,c

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137. Consider the following nuclear reactions:

(1) $._{7}^{14}N + ._{2}^{4}HE \rightarrow ._{8}^{17}O + ._{1}^{1}H$

(2) $._{4}^{9}Be + ._{1}^{1}H \rightarrow ._{3}^{9}Li + ._{2}^{4}He$

(3) $._{12}^{24}Mg + ._{2}^{4}He \rightarrow ._{14}^{27}Si + ._{0}^{1}n$

(4) $._{5}^{10}B + ._{2}^{4}He \rightarrow ._{7}^{13}N + ._{0}^{1}n$

Example of induced radioativty would include the reactions:

A. 3 and 4

B. 1 and 2

C. 1,3 and 4

D. 1,2,3 and 4

Answer: d

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138. Which of the following statements is/are correct

A. A nucleus in an excited state may give up its excitation energy and return to the ground state by emission of electromagnetic γ-radiation.

B. γ-radiations are emitted as secondary effect of α and β-emission

C. The nuclear isomers produced by γ-ray bombardment have the same atomic and mass number but differ in their life-times (whatever their ground state may be)

D. X-ray and γ-rays are both electromagnetic

Answer: d

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139. Which of the following statements is/are correct

A. When an electron is emitted by an atom and its nucleus get de-excited as a result, the process is called internal conversion.

B.

C.

D.

Answer: b

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140. A nuclide has mass number (A) and atomic number (Z). During a radioactive process if:

(A) both A and Z decrease, the process is called α-decay

(B)A remains unchanged and Z decreases by one, the process is called β^+ or positron decay of K-electron capture

(C) both A and Z remain unchanged the process is called γ-decay

(D)both A and Z increase, the process is called nuclear isomerism.

The correct answer is:

A. 1,2 and 3

B. 2,3, and 4

C. 1,3, and 4

D. 1,2, and 4

Answer: a

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141. In the decay process:

$$A \xrightarrow{-\alpha} B \xrightarrow{-alpHa} C \xrightarrow{-\beta} C$$

1. A and B are isobars 2. A and D are isotopes

3. C and D are isobars 4. A and C are isobars

The correct answer is :

A. 1 and 2

B. 2 and 3

C. 3 and 4

D. 1 and 4

Answer: b

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142. The nuclide X undergoes α-decay and other nuclide Y, β^- decay. Which of the following statements are correct?

1. The β^{-1} particles emitted by Y may have widely different speeds.

2. The α-particles emitted by X may have widely different speeds

3. The α-particles emitted X will have almost same speed.

4. The β-particles emitted by Y will have the same speed.

A. 1 and 3 are correct

B. 2 and 3 are correct

C. 2 and 4 are correct

D. 1 and 4 are correct

Answer: a

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143. Fill in the blank space with a suitable answer selected from the list below. Write only the letter (A,B,C.....etc.) of the correct answer in the blanks

$(i).^{12}_{6}C + .^{1}_{1}H \rightarrow .^{13}_{7}N$	A: Projectilecapture
$(ii).^{27}_{13}Al + .^{1}_{1}H \rightarrow .^{24}_{12}Mg + .^{4}_{2}He$	B: Spallation
$(iii).^{235}_{92}U + .^{1}_{0}n \rightarrow .^{140}_{56}Ba + .^{93}_{36}Kr + 3.^{1}_{0}n$	C: Fusion
$(iv).^{75}_{33}As + .^{2}_{1}H \rightarrow .^{56}_{25}Mn + 9.^{1}_{1}H + 12.^{1}_{0}n$	D: Projectilecaptureandpar
$(v).^{2}_{1}H + .^{3}_{1}H \rightarrow .^{4}_{2}He + .^{1}_{0}n$	E: fission

Select the correct answers according to the given codes:

A.

	(i)	(ii)	(iii)	(iv)	(v)
(a)	A	D	E	B	C

B.

	(i)	(ii)	(iii)	(iv)	(v)
(b)	D	C	A	E	B

C.

	(i)	(ii)	(iii)	(iv)	(v)
(C)	A	B	C	D	E

D.

	(i)	(ii)	(iii)	(iv)	(v)
(d)	E	D	C	B	A

Answer: a

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Obj B

1. The average life of a W gm sample of $.^{200}\ RaE$ is T seconds and average energy of the β-particles emitted is E MeV. At what rate in watts does the sample emits energy?

A. $\frac{8WN_0E}{T} \times 10^{-16}$

B. $\frac{8(1n2)WN_0E}{T} \times 10^{-13}$

C. $\frac{8WN_0E}{T} \times 10^{-13}$

D. None is correct

Answer: a

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2. In nuclear fission, 0.01% mass is converted into energy. The energy released by the fission of 100 kg mass will be:

A. $9 \times 10^{15} j$

B. $9 \times 10^{11} kJ$

C. $9 \times 10^{17} j$

D. $9 \times 10^{13} J$

Answer: b

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3. The activity of a radioactive substance is R_1 at time t_1 and R_2 at time $t_2 (> t_1)$. Its decay cosntant is λ. Then .

A. $R_1 t_1 = R_2 t_2$

B. $R_2 = R_1 e^{\lambda (t_2 - t_1)}$

C. $R_2 = R_1 e^{\lambda (t_1 - t_2)}$

D. $\frac{R_1 - R_2}{t_2 - t_1}$ = constant

Answer: c

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4. A radioactive substance (parent) decays to its daughter element . The age of radioactive substance (t) is related to the daughter (d)/parent (p) ratio by the equation :

A. $t = \frac{1}{\lambda} In\left(\frac{D}{P}\right)$

B. $t = \frac{1}{\lambda} In\left(1 + \frac{P}{D}\right)$

C. $t = \frac{1}{\lambda} In\left(1 + \frac{D}{P}\right)$

D. $t = \frac{1}{\lambda} In\left(2 + \frac{D}{P}\right)$

Answer: c

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5. A radioactive substance is being consumed at a constant of $1s^{-1}$. After what time will the number of radioactive nuclei becoem 100. Initially, there were 200 nuceli present.

A. 1 sec

B. 2 sec

C. In (2) sec

D. $\frac{1}{In(2)}\text{sec}$

Answer: b

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6. The rate of decay of a radioactive sampel is given by R_1 at time t_1 and R_2 at a later time. t_2. The mean life of this radioactive sample is:

A. $T = \frac{R_1}{R_2} \times \frac{t_2}{t_1}$

B. $T = \frac{t_1 - t_2}{In(R_2/R_1)}$

C. $T = \frac{t_2 - t_1}{In(R_2/R_1)}$

D. $T = \frac{In(R_2/R_1)}{t_1 - t_2}$

Answer: b

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7. Isodiapheres are the atoms of two elements having same values of:

A. p/n

B. (p-n)

C. (n - p)

D. $n \times p$

Answer: c

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8. In a sample of radioactive material, what fraction of initial number of active nuclei will remain undistintegrated after half of a half0life of the sample?

A. $\frac{1}{4}$

B. $\frac{1}{2\sqrt{2}}$

C. $\frac{1}{\sqrt{2}}$

D. $\sqrt{2}-1$

Answer: c

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9. Let T be the mean life of a radioactive sample. $75\,\%$ of the active nuclei present in th sample initially will deacy in time

A. 2T

B. $\frac{1}{2}(\log_e 2)T$

C. 4T

D. $2(\log_e 2)T$

Answer: d

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10. ${}_{84}^{218}Po$ $\left(t_{1/2} = 183\,\text{sec}\right)$ decay to ${}_{82}^{214}Pb$ $(t_{1/2} = 161)$ sec by α emission, while ${}_{82}^{214}Pb$ decay by β-emission. In how much time the number of nuclei of ${}_{82}^{214}Pb$ will reach to the maximum?

A. 182 sec

B. 247.5 sec

C. 308 sec

D. 194.8 sec

Answer: b

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11. Fusion reaction takes place at high temperature because

A. atoms are ionised at high temperature

B. molecules break up at high temperature

C. nuclei break up at high temperature

D. kinetic is high enough to overcome repulsion between nuclei

Answer: d

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12. In the radioactive change,

$$._{Z}^{A}P \rightarrow ._{Z+1}^{A}Q \rightarrow ._{Z-1}^{A-4}R \rightarrow ._{Z-1}^{A-4}S$$

The radioactive emitted in sequence are:

A. α, β, γ

B. β, α, γ

C. γ, α, β

D. β, γ, α

Answer: b

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13. The half life of radioactive isotope is 3 hour. If the initial mass of isotope were 256 g, the mass of it remaining undecayed after 18 hr is a)12 g b)16 g c)4 g d)8 g

A. 12 g

B. 16 g

C. 4 g

D. 8 g

Answer: c

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14. In an ofd rock, the mass ratio of $._{92}^{238}U$ to $._{82}^{206}Pb$ is formed to be 595:103. The age of the rock is (Mean life of $._{92}^{238}U$ is T_0) :

A. T_0 In 1.2

B. $T_0 \ln \frac{698}{595}$

C. $T_0 \frac{In1.2}{In2}$

D. $T_0 \frac{In\frac{698}{595}}{In2}$

Answer: b

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15. 80% of the radioactive nuclei present in a sample is found to remain undecayed after one day. The percentage of undecayed nuclei left after two days will be

A. 64

B. 20

C. 46

D. 80

Answer: a

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16. A sample of radioactive material has mass m, decay constant λ, and molecular weight M. Avogadro constant $= N_A$. The initial activity of the sample is:

A. λm

B. $\lambda \frac{m}{M}$

C. $\frac{\lambda m N_4}{M}$

D. mMe^{λ}

Answer: c

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17. A radioactive nucleus can decay by two different processes. The mean value period for the process is Z_1 and that for the second process is Z_2. The effective mean value period for the two processes is:

A. $\frac{Z_1 + Z_2}{2}$

B. $Z_1 + Z_2$

C. $\sqrt{Z_1 Z_2}$

D. $\frac{Z_1 Z_2}{Z_1 + Z_2}$

Answer: d

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18. The radioactivity of a sample is R_1 at a time T_1 and R_2 at time T_2. If the half-life of the specimen is T, the number of atoms that have disintegrated in the time $(T_2 - T_1)$ is proporational to

A. $(R_1 T_1 - R_2 T_2)$

B. $R_1 - R_2$

C. $\frac{(R_1 - R_2)}{T}$

D. $(R_2 - R_1)T$

Answer: d

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19. Half-life-speed of lead is:

A. zero

B. infinite

C. 1590 years

D. 1590 days

Answer: b

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20. A freshly prepared radioactive source of half-life $2h$ 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. 6 hrs

B. 12 hrs

C. 24 hrs

D. 128 hrs

Answer: b

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21. Which of the following is the best nuclear fuel?

A. $._{}^{238}U$

B. $._{}^{236}U$

C. $._{}^{239}Pu$

D. $._{}^{239}Np$

Answer: c

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22. A radioacive element decays by parallel path as given below:

$A \xrightarrow{\lambda_1} \lambda_1 = 1.8 \times 10^{-2}\,\text{sec}^{-1}$

$2A \xrightarrow{\lambda_2} B\lambda_2 = 10^{-3}\,\text{sec}^{-1}$

Average life of radio nuclide A will be:

A. 52.63 sec

B. 500 sec

C. 50 sec

D. 120 sec

Answer: c

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23. Among the following, which has the longest half life?

A. $._{90}^{232}Th$

B. ${}_{93}^{237}Np$

C. ${}_{92}^{238}U$

D. ${}_{92}^{235}U$

Answer: a

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24. Which of the following is likely to be least stable?

A. ${}_{20}^{40}Ca$

B. ${}_{25}^{55}Mn$

C. ${}_{50}^{119}Sn$

D. ${}_{13}^{30}Al$

Answer: d

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25. ${}_{13}Al^{27}$ is a stable isotope. ${}_{13}Al^{29}$ is expected to disintegrate by

A. α-emission

B. β-emission

C. positron emission

D. proton emission

Answer: b

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26. For a radioactive element, a graph of log N against time has a slope equal to:

A. 2.303λ

B. $+\frac{\lambda}{2.303}$

C. $-\frac{\lambda}{2.303}$

D. -2.303λ

Answer: c

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27. Two elements P and Q have half-line of 10 and 15 minutes repectively. Freshly preapared sample of mixuture containing equal number of atoms is allowed to decay for 30 minutes. The ratio of number of atoms of P and Q in left in mixture is:

A. 0.5

B. 2

C. 1

D. 3

Answer: a

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28. Select the wrong statement among the following

A. Antieutrino can be detected during β-emission

B. Neutrino was predicted to conserve the spin of a nuclear reaction.

C. Synchrotron can accelerate neutrons

D. Area of cross-section of nucleus is about 1 barn

(1 barn $= 10^{24} cm^2$)

Answer: c

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29. A radioactive atom X emits a $\beta -$ particle to produce an atom Y which then emits an Particle to give an atom Z

(1) the atomic number of X is less than that of Z.

(2) the atomic number of Y is less than that of Z.

(3) the mass number of X is the same as that of Y.

A. 1,2 and 3 are correct

B. 1 and 2 are correct

C. 2 and 3 are correct

D. 3 is correct

Answer: d

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30. Which one of the following is an exact example of article radioactive?

A. $._{11}^{23}Na + ._{0}^{1}n \rightarrow ._{11}^{24}Na + \gamma$

$._{11}^{24}Na + ._{1}^{1}H \rightarrow ._{12}^{24}Mg + ._{0}^{1}n$

B. $._{2}^{4}He + ._{7}^{14}N \rightarrow ._{8}^{17}O + ._{1}^{1}H$

$._{8}^{17}O + ._{0}^{1}n \rightarrow ._{7}^{18}O + ._{1}^{1}H$

C. $._{2}^{4}HE + ._{13}^{27}Al \rightarrow ._{15}^{30}P + ._{0}^{1}n$

$._{15}^{30}P \rightarrow ._{14}^{30}Si + ._{-1}^{0}e$

D. $._{238}^{89}Ac \rightarrow ._{90}^{224}Th + \beta$

$._{90}^{228}Th \rightarrow ._{88}^{224}Ra + \alpha$

Answer: c

View Text Solution

31. Consider the following decay series:

$A \rightarrow B \rightarrow C \rightarrow D$

Where, A,B and C are radioactive elements with half lives of 4,5 sec, 15 days and 1 sec respectively and D is non-radioactive element, Starting with 1 mole of A, the numbe of moles B,C and left after 30 days are:

A. One mole of D and none of A, B or C

B. 3/4 mole of B, 1/4 mole of D and none of A or C

C. 1/4 mol of B, 3/4 mol of D and none of A or C

D. 1/2 moe of B, 1/4 mol of C, 1/4 mol of D and noen of A

Answer: d

View Text Solution

32. Consider the following nuclear reactions:

$_{92}{}^{238}M \rightarrow ._{y}{}^{x}N + 2.{}_{2}{}^{4}He, {}_{x}{}^{y}N \rightarrow {}_{B}{}^{A}L + 2\beta^{+}$

The number of neutrons in the element L is

A. 142

B. 144

C. 140

D. 146

Answer: b

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33. If n_1 is the number of radio-atoms present at tiem 't' the following expression will be a constant,

A. $\frac{n_t}{t}$

B. $\frac{Inn_t}{t}$

C. $\frac{dInn_t}{dt}$

D. tn_t

Answer: c

View Text Solution

34.

$$._{83}^{214}Bi \xrightarrow{\alpha-\text{emission}} A \xrightarrow{\beta-\text{emission}} B \xrightarrow{\beta-\text{emission}} C \xrightarrow{\beta-\text{emission}} D \xrightarrow{\alpha-\text{emission}} C$$

'E' is an element of stable nuclues. What is the element 'E'?

A. $._{81}^{207}Th$

B. $._{82}^{206}Pb$

C. $._{80}^{206}Hg$

D. $._{79}^{206}Au$

Answer: b

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35. If time t is required for a radioactive substance to become one third of its initial amount, what fraction would be left after 0.5 t ?

A. $\frac{1}{\sqrt{3}}$

B. $\frac{1}{2}$

C. $\frac{1}{3}$

D. $\sqrt{\frac{2}{3}}$

Answer: a

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36. The radioactive isotopes A and B of atomic mass X and Y are mixed in equal amount by mass after 20 days, their mass ratio is formed to be 1 : 3.

Half life of 'A' is 1 day. What will be the half life of B?

A. 1.11 days

B. 0.6237 day

C. $0.11\frac{X}{Y}$ day

D. $1.11\frac{X}{Y}$ day

Answer: a

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37. A sample of rock from the moon was found to contain the elements X and Y in 1:7 ratio by mole. Element is radioactive it decays to Y with half life of 6.93×10^9 years

$X \rightarrow Y$

$t_{1/2} = 6.93 \times 10^9$ yrs

What is the age of the rock?

A. 2.079×10^{10} yrs

B. 1.33×10^9 years

C. 1.94×10^{10} years

D. 10^{10} years

Answer: a

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38. If the relation between time of decay (t) and half life period $\left(t_{1/2}\right)$ is $\left(t = 4t_{1/2}\right)$, the relation between r and mean life (T) is:

A. $\frac{In2}{T^2}$

B. 27^4 In 2

C. 4 T In 2

D. 2T In 2

Answer: c

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39. As accident in a nuclear laboratory resulting in deposition of a certain amount of radioactive material of half life 18days inside the laboratory Tests revealed that the radiation was 64 times more than the permissible level required for save operation of the laboratory what is the minimum number of days after which the laboratory can be considered safe for use?

A. 64

B. 90

C. 108

D. 120

Answer: c

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40. Which of the following nuclei are doubly magic? a). ${}_{92}U^{238}$ b). ${}_{2}He^{4}$ c) ${}_{8}O^{16}$ d). ${}_{82}Pb^{208}$

A. ${}^{4}_{2}He$

B. ${}^{16}_{8}O$

C. ${}^{208}_{82}Pb$

D. ${}^{238}_{92}U$

Answer: a,b,c

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41. Which of the following make up an isotonic triad?

A. ${}^{14}_{6}C$, ${}^{16}_{8}O$, ${}^{15}_{7}N$

B. ${}^{76}_{32}Ge$, ${}^{77}_{33}As$, ${}^{75}_{31}Ga$

C. ${}^{40}_{18}Ar$, ${}^{40}_{19}K$, ${}^{40}_{20}Ca$

D. ${}^{233}_{92}U$, ${}^{232}_{90}Th$, ${}^{239}_{94}Pu$

Answer: a,b

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42. In the decay process:

$A \xrightarrow{-\alpha} B \xrightarrow{-\beta} C \xrightarrow{-\beta} D$ a)A and B are isodiaphers b)A and C are isotones c)A and C are isotopes d)B, C and D are isobars

A. A and B are isodiapheres

B. A and D are isotope

C. B,C and D are isobars

D. A and C are isotones

Answer: a,b,c

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43. The nuclide X undergoes α-decay and another nuclides Y undergoes $\beta^{\ominus}$-decay, which of the following statement $\mathrm{is/are}$ correct? a)The $\beta^{\ominus}$-particles emitted by Y may have widely different speeds. b)The α-particles emitted by X may have widely different speeds. c)The α-particles emitted by X will have almost same speed. d)The β-particles emitted by Y will have the same speed.

A. The β-particles emitted by Y may have widely different speed

B. The α-particles emitted by X may have widely different speed.

C. The α particles emtted by X will have almost the same speed

D. The β-particle emitted by Y will have the same speed

Answer: a,c

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44. Which among the following nuclides $\mathrm{is/are}$ likely to be stable?

A. $._{15}^{30} P$

B. $._{12}^{24} Mg$

C. $._{49}^{114} In$

D. $._{48}^{114} Cd$

Answer: b,d

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45. Which among the following is/are fissible? a)$._{92} U^{235}$ b)$._{92} U^{238}$ c) $._{94} Pu^{239}$ d)$._{94} Pu^{238}$

A. $._{92}^{235} U$

B. $._{92}^{238} U$

C. $._{94}^{239} Pu$

D. $._{94}^{238} Pu$

Answer: a.,c

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46. Select the correct statements among the following:

A. The decay of mass during nuclear fusion and nuclear fission are 0.1% and 0.231% respectively.

B. Lesser is the half life, more dangerous is the radioactive element.

C. K-electron capture emits γ-rays

D. Nuclear forces are about 10^{21} times stronger than coulombic forces.

Answer: a,b,d

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47. A radioactive element has atomic number 'Z' and mass number 'A'. Select the correct statement among the following:

A. Both 'A' and 'Z decrease in α-decay

B. Both 'A' and 'Z' remain unchanged in γ-decay

C. A'-remains unchanged and 'Z' decreases by one, the process is called

β^+ (positron) decay or K-electron capture

D. Both 'A' and 'Z' increases in the nuclear isomerism

Answer: a,b,c

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48. When nucleus of an electrically neutral atom undergoes a radioactive decay process, it will remain neutral after the decay if the process is

(a) An α- decay (b) $A\beta^{\oplus}$-decay

(c) $A\gamma$-decay (d) AK- capture process

A. an α-decay

B. a β-decay

C. aγ-decay

D. a K-capture process

Answer: c,d

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49. Which of the following is/are characteristics of nuclear forces?

A. These forces operate within small distance of 2×10^{-13} cm

B. These forces drop to zero rapidly at a distance greater than 1.4×10^{2} fermi

C. They follow inverse square law

D. They are stronger than electrostatic forces of attraction

Answer: a,b,d

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50. The correct starting material and product of different disintegration series is/are a)Th^{232}, Pb^{208} b)Np^{237}, Bi^{209} c)U^{235}, Pb^{206} d)U^{238}, Pb^{206}

A. .^{238} Th, .^{208} Pb

B. .^{235} U,^{206} Pb

C. .^{238} U, .^{207} Pb

D. .^{237} Np, .^{209} Bi

Answer: a,d

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51. Select the wrong statement (S):

A. Nuclear isomers contain the same number of protons and neutrons

B. The decay constant is independent of the amount of the substance taken

C. 1 curie $= 3.7 \times 10^{10}$ dis

D. actinium series starts with $.^{238}U$

Answer: a,b

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52. In a nuclear reactor, heavy water is used

A. transfer the heat from the reactor

B. provide high speed neutrons for the fission reaction

C. reduce the speed of fast moving neutorons

D. increase the speed of neutrons

Answer: a,c

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53. In the nuclear transmutation

${}_4^9Be + X \rightarrow {}_4^8Be + Y$, (X,Y) is(are):

A. (γ, n)

B. (p, D)

C. (n, D)

D. (γ, p)

Answer: a,b

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54. A plot of the number of neutrons (n) against the number of protons (p) of stable nuclei exhibits upward deviation from linearity for atomic number, $Z > 20$. For an unstable nucleus having n/p ratio less than 1, the possible mode (s) of decay is (are)

A. β^--decay (β emission)

B. orbital of K-electron capture

C. neutron emission

D. β^+-decay (positron emission)

Answer: b,d

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Assettion Reason

1. Statement-I : Mass numbers of most of the elements are fractional.

Because

Statemen-II Mass numbers are obtained by comparing with the mass number of carbon taken as 12.

A. If both (A) and (R) are correct and (R) is the correct explanation for (A).

B. If both (A) and (R) are correct but (R) is not the correct explanation for (A)

C. If both (A) and (R) are incorrect.

D. If both (A) and (R) are incorrect.

Answer: D

Watch Video Solution

2. (A) The activity of 1 g pure uranium-235 will be greater than the same amount present in U_3O_6

(R) In the combined state, the activity of the radioactive element decreases.

A. If both (A) and (R) are correct and (R) is the correct explanation for (A).

B. If both (A) and (R) are correct but (R) is not the correct explanation for (A)

C. If both (A) and (R) are incorrect.

D. If both (A) and (R) are incorrect.

Answer: D

View Text Solution

3. (A) α-rays have greater ionising power the β

(R) α-particles carry 2^{+} charge while β-particles carry only I^{-} charge.

A. If both (A) and (R) are correct and (R) is the correct explanation for (A).

B. If both (A) and (R) are correct but (R) is not the correct explanation for (A)

C. If both (A) and (R) are incorrect.

D. If both (A) and (R) are incorrect.

Answer: B

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4. Assertion (A) : β-particles have greater penetrating power than α-rays but less than γ-rays

Reason (R) : β-particles are lighter than α-rays but heavier than γ-rays

a)If both (A) and (R) are correct, and (R) is the correct explaination of (A) b)If both (A) and (R) are correct, but (R) is not the correct explaination of (A) c)If (A) is correct,but (R) is incorrect d)If both (A) and (R) are incorrect.

A. If both (A) and (R) are correct and (R) is the correct explanation for (A).

B. If both (A) and (R) are correct but (R) is not the correct explanation for (A)

C. If both (A) and (R) are incorrect.

D. If both (A) and (R) are incorrect.

Answer: A

Watch Video Solution

5. (A) During β-decay, a new element with atomic number greater than one is obtained.

(R) Protons and neutrons keep on changing into one another through meson.

A. If both (A) and (R) are correct and (R) is the correct explanation for (A).

B. If both (A) and (R) are correct but (R) is not the correct explanation for (A)

C. If both (A) and (R) are incorrect.

D. If both (A) and (R) are incorrect.

Answer: B

Watch Video Solution

6. Assertion (A) : The average life of a radioactive element is infinity

Reason (R) : As a radioactive element disinegrates, more of it is formed in nature by itself a)If both (A) and (R) are correct, and (R) is the correct explaination of (A) b)If both (A) and (R) are correct, but (R) is not the correct explaination of (A) c)If (A) is correct,but (R) is incorrect d)If both (A) and (R) are incorrect.

A. If both (A) and (R) are correct and (R) is the correct explanation for (A).

B. If both (A) and (R) are correct but (R) is not the correct explanation for (A)

C. If both (A) and (R) are incorrect.

D. If both (A) and (R) are incorrect.

Answer: C

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7. Assertion (A) : Hydrogen bomb is more powerful than atomic bomb. Reason (R) : In hydrogen bomb, fusion reaction is initiated. a)If both (A) and (R) are correct , and (R) is the correct explanation of (A) b)If both (A) and (R) are correct, but (R) is not the correct explanation of (A) c)If (A) is correct, but (R) is incorrect. d)If (A) is incorrect, but (R) is correct.

A. If both (A) and (R) are correct and (R) is the correct explanation for (A).

B. If both (A) and (R) are correct but (R) is not the correct explanation for (A)

C. If both (A) and (R) are incorrect.

D. If both (A) and (R) are incorrect.

Answer: B

Watch Video Solution

8. (A) The archaeological studies are based on the radioactive decay of carbon-14 isotope.

(R) The ratio of C-14 to C-12 in the animals of plants is the same as that in the atmosphere.

A. If both (A) and (R) are correct and (R) is the correct explanation for (A).

B. If both (A) and (R) are correct but (R) is not the correct explanation for (A)

C. If both (A) and (R) are incorrect.

D. If both (A) and (R) are incorrect.

Answer: A

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9. (A) The reactions taking place in the sun are nuclear fusion reactions.

(R) The main reason for nuclear fusion reaction in the sun is that H_2 is

present in the sun's atomosphere so that hydrogen nuclei can fuse to form helium.

A. If both (A) and (R) are correct and (R) is the correct explanation for (A).

B. If both (A) and (R) are correct but (R) is not the correct explanation for (A)

C. If both (A) and (R) are incorrect.

D. If both (A) and (R) are incorrect.

Answer: C

View Text Solution

10. Assertion : In a radioactive disintegration, an electron is emitted by the nucleus.

Reason : Electrons are always present inside the nucleus.

A. If both (A) and (R) are correct and (R) is the correct explanation for (A).

B. If both (A) and (R) are correct but (R) is not the correct explanation for (A)

C. If both (A) and (R) are incorrect.

D. If both (A) and (R) are incorrect.

Answer: C

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11. Assertion (A): In radioactive disintegrations, $._2He^4$ nuclei can come out of the nucleus but lighter $._2H^3$ cannot.

Reason (R): The binding energy of $._2H^3$ is more than that of $._2H^4$.

A. If both (A) and (R) are correct and (R) is the correct explanation for (A).

B. If both (A) and (R) are correct but (R) is not the correct explanation for (A)

C. If both (A) and (R) are incorrect.

D. If both (A) and (R) are incorrect.

Answer: C

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12. (A) Protons are better projectiles than neutrons.

(R) The neutrons being neutral do not experience repulsion from positively charged nucleus.

A. If both (A) and (R) are correct and (R) is the correct explanation for (A).

B. If both (A) and (R) are correct but (R) is not the correct explanation for (A)

C. If both (A) and (R) are incorrect.

D. If both (A) and (R) are incorrect.

Answer: D

View Text Solution

13. (A) Enrichement of U^{235} from a mixture containing more abundant U^{238} is based on diffusion of UF_6.

`UF_(6) is a gaseous compound under ordinary conditions.

A. If both (A) and (R) are correct and (R) is the correct explanation for (A).

B. If both (A) and (R) are correct but (R) is not the correct explanation for (A)

C. If both (A) and (R) are incorrect.

D. If both (A) and (R) are incorrect.

Answer: A

View Text Solution

14. The nucleus emits β-particles though it does't contain any electrons in it.

(R) The nucleus shows the transformation ${}_{0}n^{1} \rightarrow p + \beta$ + antineutrino for β-emission.

A. If both (A) and (R) are correct and (R) is the correct explanation for (A).

B. If both (A) and (R) are correct but (R) is not the correct explanation for (A)

C. If both (A) and (R) are incorrect.

D. If both (A) and (R) are incorrect.

Answer: A

View Text Solution

15. (A) Any kind of exchange force helps the nucleus to be more destabilised.

(R) π-mesons are exchanged between nucleons incessantly.

A. If both (A) and (R) are correct and (R) is the correct explanation for (A).

B. If both (A) and (R) are correct but (R) is not the correct explanation for (A)

C. If both (A) and (R) are incorrect.

D. If both (A) and (R) are incorrect.

Answer: D

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16. Statement: Nuclide $._{13}^{30}Al$ is less stable than $._{20}^{40}Ca$

Explanation: Nuclides having odd number of protons and neutrons are

general unstable.

A. If both (A) and (R) are correct and (R) is the correct explanation for (A).

B. If both (A) and (R) are correct but (R) is not the correct explanation for (A)

C. If both (A) and (R) are incorrect.

D. If both (A) and (R) are incorrect.

Answer: A

Watch Video Solution

17. (A) During β-decay, a new element with atomic number greater than one is obtained.

(R) Protons and neutrons keep on changing into one another through meson.

A. If both (A) and (R) are correct and (R) is the correct explanation for (A).

B. If both (A) and (R) are correct but (R) is not the correct explanation for (A)

C. If both (A) and (R) are incorrect.

D. If both (A) and (R) are incorrect.

Answer: B

View Text Solution

18. (A) The position of an element an element in periodic in table after emission of one α and two β-partilce remians unchanged.

(R) Emission of one α and two β particles gives isotope of the parent element which acquires same position in the periodic table.

A. If both (A) and (R) are correct and (R) is the correct explanation for (A).

B. If both (A) and (R) are correct but (R) is not the correct explanation for (A)

C. If both (A) and (R) are incorrect.

D. If both (A) and (R) are incorrect.

Answer: A

Watch Video Solution

19. (A) Nuclear isomers have same atomic number and same mass number but with different radioactive properties.

$U_{(A)}$ and $U_{(Z)}$ are nuclear isomers.

A. If both (A) and (R) are correct and (R) is the correct explanation for (A).

B. If both (A) and (R) are correct but (R) is not the correct explanation for (A)

C. If both (A) and (R) are incorrect.

D. If both (A) and (R) are incorrect.

Answer: A

View Text Solution

20. Assertion (A): The emission of $\alpha-$ particles results in the formation of isodiapher of parent element.

Reason (R): Isodiaphers have same isotopic number.

A. If both (A) and (R) are correct and (R) is the correct explanation for (A).

B. If both (A) and (R) are correct but (R) is not the correct explanation for (A)

C. If both (A) and (R) are incorrect.

D. If both (A) and (R) are incorrect.

Answer: C

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21. Assertion (A) : ${}_{92}U^{238}(IIIB) \xrightarrow{-\alpha} A \xrightarrow{-\alpha} B \xrightarrow{-\beta} C$

Reason (R) : Element B will be of IIA group. a)If both (A) and (R) are correct , and (R) is the correct explanation of (A) b)If both (A) and (R) are correct, but (R) is not the correct explanation of (A) c)If (A) is correct, but (R) is incorrect.

A. If both (A) and (R) are correct and (R) is the correct explanation for (A).

B. If both (A) and (R) are correct but (R) is not the correct explanation for (A)

C. If both (A) and (R) are incorrect.

D. If both (A) and (R) are incorrect.

Answer: B

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22. Assertion (A) : $\beta -$ particles are deflected more than $\alpha -$ particles in a given electric field.

Reason (R) : Charge on $\alpha -$ particles is larger than on $\beta -$ particles. a)If both (A) and (R) are correct , and (R) is the correct explanation of (A) b)If both (A) and (R) are correct, but (R) is not the correct explanation of (A) c)If (A) is correct, but (R) is incorrect. d)If (A) is incorrect, but (R) is correct.

A. If both (A) and (R) are correct and (R) is the correct explanation for (A).

B. If both (A) and (R) are correct but (R) is not the correct explanation for (A)

C. If both (A) and (R) are incorrect.

D. If both (A) and (R) are incorrect.

Answer: A

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23. (A) The nucleus of gold is stable even though there is a very strong coulombic repulsion among the protons.

(R) The inverse square coulomb force is exactly balanced by another inverse square force which is very powerful i.e., nuclear force

A. If both (A) and (R) are correct and (R) is the correct explanation for (A).

B. If both (A) and (R) are correct but (R) is not the correct explanation for (A)

C. If both (A) and (R) are incorrect.

D. If both (A) and (R) are incorrect.

Answer: C

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24. Assertion $(A): K-$ shell electron capture is detected by analyzing the wavelength of $X-$ ray emitted.

Reason $(R):$ The wavelength of the $X-$ ray is characteristic of the daughter element and not the parent element. a)If both (A) and (R) are correct , and (R) is the correct explanation of (A) b)If both (A) and (R) are correct, but (R) is not the correct explanation of (A) c)If (A) is correct, but (R) is incorrect. d)If (A) is incorrect, but (R) is correct.

A. If both (A) and (R) are correct and (R) is the correct explanation for (A).

B. If both (A) and (R) are correct but (R) is not the correct explanation for (A)

C. If both (A) and (R) are incorrect.

D. If both (A) and (R) are incorrect.

Answer: B

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25. Assertion (A) : Half life of a radioactive isotope is the time required to decrease its mass number by half

Reason (R) : Half life of radioactive isotope is independent of the initial amount of the isotope a)If both (A) and (R) are correct, and (R) is the correct explaination of (A) b)If both (A) and (R) are correct, but (R) is not the correct explaination of (A) c)If (A) is correct,but (R) is incorrect d)If both (A) and (R) are incorrect.

A. If both (A) and (R) are correct and (R) is the correct explanation for (A).

B. If both (A) and (R) are correct but (R) is not the correct explanation for (A)

C. If both (A) and (R) are incorrect.

D. If both (A) and (R) are incorrect.

Answer: D

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26. (A) In a nuclear fission process, the total mass of fragment is always greater than the mass of the original nucleus.

(R) Difference in the mass due to the fission of a heavy nucleus is converted into energy according to mass-energy conversion.

A. If both (A) and (R) are correct and (R) is the correct explanation for (A).

B. If both (A) and (R) are correct but (R) is not the correct explanation for (A)

C. If both (A) and (R) are incorrect.

D. If both (A) and (R) are incorrect.

Answer: D

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Integer Answer Type Question

1. The total number of α and β particles emitted in the nuclear reaction $^{238}_{92}U \rightarrow {}^{214}_{82}Pb$ is

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2. The $t_{1/2}$ of a radionuclide is 8 hours. Starting with 40 g of the isotope, the amount in gm remainig after one day will be:

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3. If $3/4$ quantity of a radioactive substance disintegrates in 2 hours, its half $-$ life period will be a)$15min$ b) $30min$ c)$60min$ d)$90min$

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4. ${}_4Be^7$ captures a K electron into its nucleus .What is the mass number and atomic number of the nuclide formed ?

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5. ${}_{90}^{232}Th$ disintegrates to ${}_{82}^{208}Pb$. How many of β-particle are evolved?

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6. What mass in milligram of radiation?

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7. The number of neutrons emitted when ${}_{92}^{235}U$ undergoes controlled nuclear fission to ${}_{54}^{142}Xe$ and ${}_{38}^{235}U$ undergoes controlled nuclear fission to ${}_{54}^{142}Xe$ and ${}_{38}^{90}Sr$ is:

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8. The periodic table consists of 18 groups. An isotope of copper, on bombardment with protons, undergoes a nuclear reaction yielding

element X as shown below. To which group, element X belongs in the periodic table ?

$$._{29}Cu^{63} + ._1H^1 \rightarrow 6._0n^1 + ._2He^4(\alpha) + 2._1H^1 + ._ZX^A$$

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9. A freshly prepared sample of a radioisotope of half - life $1386s$ has activity 10^3 disintegrations per second Given that $\ln 2 = 0.693$ the fraction of the initial number of nuclei (expressed in nearest integer percentage) that will decay in the first $80s$ after preparation of the sample is

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10. A closed vessel with rigid walls contains 1 mole of $._{92}^{238}U$ and 1 mole of air at $298K$. Considering complete decay of $._{92}^{238}U$ to $._{82}^{206}Pb$the ratio of the final pressure to the initial pressure of the system at $298K$ is

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Psg I

1. There are four radioactive decay series called thorium $(4n)$, uranium $(4n+2)$ actinium $(4n+3)$ and neptunium $(4n+1)$ series. Neptunium series is artificial while other three series are natural. The end productsd of each radioacitve decay series have stable nuclei. All natural decay series terminate at lead but neptunium or artificial series terminate at bismuth.

The end product formed in the disintegration of $._{88}Ra^{222}$ is a)$._{81}TI^{304}$ b)$._{82}Pb^{206}$ c)$._{86}Rn^{222}$ d)$._{83}Bi^{207}$

A. $._{81}^{204}TI$

B. $._{82}^{206}Pb$

C. $._{86}^{222}Rn$

D. $._{83}^{207}Bi$

Answer: b

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Watch Video Solution

2. There are four radioactive decay series called thorium $(4n)$, uranium $(4n+2)$ actinium $(4n+3)$ and neptunium $(4n+1)$ series. Neptunium series is artificial while other three series are natural. The end productsd of each radioacitve decay series have stable nuclei. All natural decay series terminate at lead but neptunium or artificial series terminate at bismuth.

Actinium series begins with an isotope of a)Actinium b)Radium c)Uranium d)Polonium

A. actinium

B. radium

C. uranium

D. polonium

Answer: c

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3. There are four radioactive decay series called thorium $(4n)$, uranium $(4n+2)$ actinium $(4n+3)$ and neptunium $(4n+1)$ series. Neptunium series is artificial while other three series are natural. The end productsd of each radioacitve decay series have stable nuclei. All natural decay series terminate at lead but neptunium or artificial series terminate at bismuth.

$._{86}Rn^{219}$ is a member of actinium series. Another member of same series is a)$._{92}U^{235}$ b)$._{89}Ac^{222}$ c)$._{90}Th^{212}$ d)$._{84}Po^{212}$

A. $._{92}^{235}U$

B. $._{89}^{222}Ac$

C. $._{90}^{212}Th$

D. $._{84}^{212}Po$

Answer: a

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4. There are four radioactive decay series called thorium $(4n)$, uranium $(4n+2)$ actinium $(4n+3)$ and neptunium $(4n+1)$ series. Neptunium series is artificial while other three series are natural. The end productsd of each radioacitve decay series have stable nuclei. All natural decay series terminate at lead but neptunium or artificial series terminate at bismuth.

The end products of uranium and actinium series are, respectively a) $Pb-206, Pb-207$ b)$Pb-206, Pb-208$ c)$Pb-207, Pb-208$ d) $Pb-206, Bi-208$

A. $._{}^{206}Pb, ._{}^{207}Pb$

B. $._{}^{206}Pb, ._{}^{208}Pb$

C. $._{}^{207}Pb, ._{}^{208}Pb$

D. $._{}^{206}Pb, ._{}^{208}Bi$

Answer: a

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5. There are four radioactive decay series called thorium (4n), uranium (4n + 2), actinium (4n + 3) and neptunium (4n + 1) series. Neptunium series is artifical while other three series are natural. End products of each radioactive decay series have stable nuclei. All natural decay series terminate at lead but neptunium or artificial series terminates at bismuth.

The starting isotope and the end product isotope of actinium series are:

A. $._{88}^{227}Ac$ and $._{82}^{208}Pb$

B. $._{92}^{235}U$ and $._{82}^{207}Pb$

C. $._{92}^{238}U$ and $._{82}^{207}Pb$

D. $._{92}^{235}U$ and $._{82}^{208}Pb$

Answer: b

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Psg Ii

1. Uranium $(_{92}U^{238})$ decayed to $_{82}Pb^{206}$. The process is

$_{92}U^{238} \xrightarrow[x\alpha\,,y\beta]{} \cdot\, _{82}Pb^{206}$

$t_{1/2}ofU^{238} = 4.5 \times 10^{9}$ years

x and y in above decay series are

A. 6,8

B. 8,6

C. 8,8

D. 6,6

Answer: b

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2. Uranium $(_{92}U^{238})$ decayed to $_{82}Pb^{206}$. The process is

$_{92}U^{238} \xrightarrow[x\alpha\,,y\beta]{} \cdot\, _{82}Pb^{206}$

$t_{1/2}ofU^{238} = 4.5 \times 10^{9}$ years

A sample of rock from South America contains equal number of atoms of U^{238} and Pb^{206}. The age of the rock will be

A. 4.5×10^9 years

B. 9×10^9 years

C. 13.5×10^9 years

D. 2.25×10^9 years

Answer: a

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3. Uranium $._{92}U^{238}$ decayed to $._{82}Pb^{206}$. They decay process is

$._{92}U^{238} \rightarrow \underset{x\alpha}{._{82}} \underset{y\beta}{Pb^{206}}$

$t_{1/2}$ of $U^{238} = 4.5 \times 10^9$ years

Atomic mass of U^{238} is 238.125 amu. Its packing fraction will be

A. 5.25

B. 0.125

C. 12.5

D. 1.25

Answer: a

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4. Uranium $._{92}U^{238}$ decayed to $._{82}Pb^{206}$. They decay process is

$._{92}U^{238} \underset{x\alpha}{\rightarrow} \underset{y\beta}{._{82}Pb^{206}}$

$t_{1/2}$ of $U^{238} = 4.5 \times 10^9$ years

The analysis of a rock shows the relative number of U^{238} and Pb^{206} atoms $(Pb/U = 0.25)$ The age of rock will be

A. $\frac{2.303}{0.693} \times 4.5 \times 10^9 \log 1.25$

B. $\frac{2.303}{0.693} \times 4.5 \times 10^9 \log 0.25$

C. $\frac{2.303}{0.693} \times 4.5 \times 10^9 \log 4$

D. $\frac{2.303}{4.5 \times 10^9} \times 0.693 \log 4$

Answer: a

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5. Nathan Thomson, one of the the first inhabitants of lord howe Island. Decided to plant some eruopean deciduous trees in his garden. Unifortunately the exact timing of planting the seeds is not known, over the years, pollen produced by the trees accumulated at the bottom of the lake near Nathan,s house. Very small quantities of radioactive $.^{210}Pb$ ($t_{1/2}$ = 22.3 years) were deposited at the same time. Note that european deciduous trees pollinate in their first year of growth.

In 1995, a team of researchers sampled a sediment core from the bottom of the lake. the examination of sediment core of found that:

(a) Pollen of trees first occurs at the depth of 50 cm.

The activity of $.^{210}Pb$ at the top of sediment core is 356 Bq/kg and at 50 cm depth 1.40 Bq/kg.

In what year did Nathan Thomson plant the seeds?

A. 1719 ± 2

B. 1819 ± 2

C. 1519 ± 2

D. 1919 ± 2

Answer: b

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6. Nathan Thomson, one of the the first inhabitants of lord howe Island. Decided to plant some eruopean deciduous trees in his garden. Unifortunately the exact timing of planting the seeds is not known, over the years, pollen produced by the trees accumulated at the bottom of the lake near Nathan,s house. Very small quantities of radioactive $.^{210}Pb$ ($t_{1/2}$ = 22.3 years) were deposited at the same time. Note that european deciduous trees pollinate in their first year of growth.

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(a) Pollen of trees first occurs at the depth of 50 cm.

The activity of $.^{210}Pb$ at the top of sediment core is 356 Bq/kg and at 50 cm depth 1.40 Bq/kg.

Which step in the decay scheme explains how $.^{210}Pb$ ends up in rain water while its parent $.^{238}U$ is only present in earth's crust?

A. $.^{238}U - .^{234}U$

B. $.^{234}U - .^{230}Th$

C. $.^{230}Th - .^{226}Ra$

D. $.^{226}Ra - .^{222}Rn$

Answer: d

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Psg Iii

1. In the atmosphere, carbon dioxide is found in two forms, i.e., $.^{12}CO_2$ and $.^{14}CO_2$. Plants absorb CO_2 during photosynthesis. In presence of chlorophyll, plants synthesise glucose.

$6CO_2 + 6H_2O \rightarrow \xrightarrow{h\nu} C_6H_{12}O_6 + 6O_2 \uparrow$

Half life of $.^{14}C$ is 5760 years. The analysis of wooden artifacts for $.^{14}C$ and $.^{12}C$ gives useful information for deermination of its age. all living organisms, because of their constant exchange of CO_2 with the surrounding have the same ratio of $.^{14}C$ to $.^{12}C$, i.e., 1.3×10^{-12}. When an organism dies, the $.^{14}C$ in it keeps on decaying as follows:

$._6^{14}C \rightarrow ._7^{14}N + ._{-1}^{0}e$ + Energy

Thus, the ratio $.^{14}C/^{12}C$ decrease with the passage of time. we can be used to date anything made of organic matter, e.g., bone, skeleton, wood, etc. Using carbon dating material have been dated to about 50,000 years with accuracy.

$.^{14}C$ exists in atmosphere due to

A. conversion of $.^{12}C$ to $.^{14}C$

B. Combustion of fossil fuel

C. bombardement of atmosphere nitrogen by cosmic ray neutrons

D. none of the above

Answer: c

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A wooden piece is 11520 yrs old. What is the fraction of $.^{14}C$ activity left in the piece?

A. 0.12

B. 0.25

C. 0.5

D. 0.75

Answer: b

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In the process of photosythesis, O_2 gas is released form:

A. CO_2

B. H_2O

C. both H_2O and CO_2

D. mechanism is not confirmed

Answer: b

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4. In the atmosphere, carbon dioxide is found in two forms, i.e., $.^{12}CO_2$ and $.^{14}CO_2$. Plants absorb CO_2 during photosynthesis. In presence of chlorophyll, plants synthesise glucose.

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Thus, the ratio $.^{14}C/^{12}C$ decrease with the passage of time. we can be used to date anything made of organic matter, e.g., bone, skeleton, wood, etc. Using carbon dating material have been dated to about 50,000 years with accuracy.

A piece of wood from an archaeological source shows a $.^{14}C$ activity which is 60% of the activity found in fresh wood today. The age of archaeological sample will be:

A. 4246 yrs

B. 4624 yrs

C. 4628 yrs

D. 6248 yrs

Answer: a

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5. In the atmosphere, carbon dioxide is found in two forms, i.e., $.^{12}CO_2$ and $.^{14}CO_2$. Plants absorb CO_2 during photosynthesis. In presence of chlorophyll, plants synthesise glucose.

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$._6^{14}C \rightarrow ._7^{14}N + ._{-1}^{0}e$ + Energy

Thus, the ratio $.^{14}C/^{12}C$ decrease with the passage of time. we can be used to date anything made of organic matter, e.g., bone, skeleton, wood, etc. Using carbon dating material have been dated to about 50,000 years with accuracy.

A sample of ancient wooden boat is found to undergo 9 dpm g^{-1} of $.^{14}C$

What is the approximate age of the boat? The rate of disintegration of wood recently cut down is 15 dpm g^{-1} of $.^{14}C$

A. 4246.5 years

B. 5384 yrs

C. 4628 yrs

D. 2684 yrs

Answer: a

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Psg Iv

1. The mineral monazite is a rich source of thorium, available in large quantity in kerala. A typical monazite sample contains 9% ThO_2 and 0.35% U_3O_8. $.^{208}Pb$ and $.^{206}Pb$ are the stable end products in the radioactive decay series of $.^{232}Th$ and $.^{238}U$ respectively. All the lead in monazite is of radiogenic origin.

The isotopic ratio of $.^{208}Pb/^{232}Th.$ was found to be 0.104. The half lives of Th and U are 1.41×10^{10} years adn 4.47×10^{9} years respectively.

The time elapsed since the formation of monazite sample will be:

A. 1.34×10^{9} years

B. 2.01×10^{9} years

C. 1.41×10^{9} years

D. 4.47×10^{9} years

Answer: b

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2. The mineral monazite is a rich source of thorium, available in large quantity in kerala. A typical monazite sample contains 9% ThO_2 and 0.35% U_3O_8. $.^{208}Pb$ and $.^{206}Pb$ are the stable end products in the radioactive decay series of $.^{232}Th$ and $.^{238}U$ respectively. All the lead in monazite is of radiogenic origin.

The isotopic ratio of $.^{208}Pb/^{232}Th.$ was found to be 0.104. The half lives

of Th and U are 1.41×10^{10} years adn 4.47×10^{9} years respectively.

Estimated isotopic ratio of $.^{206} Pb/^{238} U$ in the monazite sample will be:

A. 0.166

B. 0.266

C. 0.366

D. 0.466

Answer: c

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3. Monazite sample contains 9% ThO_2 and 0.35% U_3O_8. Pb^{208} and Pb^{206} are the stable and products in the radioactive decay series of Th^{232} and U^{238} respectively. All the lead in mozaite is of radiogenic origin.

The isotopic ratio of $Pb\frac{^{208}}{T}h^{232}$ was found to be 0.104. The half lives of Th and U are 1.41×10^{16} years and 4.47×10^{9} years respectively.

Select the information incorrect about Th^{232}

A. It belongs to third group of actinide series

B. . ^{232}Th is fissile material

C. It is a fertile material

D. It belongs to 4n series

Answer: b

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Psg V

1. The activity of a nucleus is inversely proportional to its half of average life. Thus, shorter the half life of an element, greater is its radioactivity, i.e., greater the number of atomsd disintegrating per second. The relation between half life and average life is $t_{1/2} = \frac{0.693}{\lambda} = \tau \times 0.693$

or $\tau = 1.44 t_{1/2}$

The half-life periods of four isotopes are given 1 = 6.7 years, II = 8000

years, III = 5760 years, $IV = 2.35 \times 10^5$ years. Which of these is most stable?

A. I

B. II

C. III

D. IV

Answer: d

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or $\tau = 1.44 t_{1/2}$

Mark the incorrect relation. a) $N_0 = Ne^{\lambda t}$ b) $\tau = 1.44 t_{0.5}$ c) $N = N_0 \left(\frac{1}{2}\right)^n$

d) $t_{1/2} = 2.303 \lambda \log 2$

A. $N_0 = Ne^{\lambda t}$

B. $\tau = 1.44t_{0.5}$

C. $N = N_0\left(\frac{1}{2}\right)^n$

D. $t_{1/2}\lambda In2$

Answer: d

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3. The activity of a nucleus is inversely proportional to its half of average life. Thus, shorter the half life of an element, greater is its radioactivity, i.e., greater the number of atomsd disintegrating per second. The relation between half life and average life is $t_{1/2} = \frac{0.693}{\lambda} = \tau \times 0.693$

or $\tau = 1.44t_{1/2}$

The half life of a radioactive element is 10 years. What percentage of it will decay in 100 years? a).999 b).1 c).5 d).665

A. 0.001

B. 1

C. 0.999

D. 0.1

Answer: c

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Psg Vi

1. It has been estimated that the total energy ratiated by sun is 3.8×10^{26} j per second. The source of energy of stars is a thermonuclear reaction called nuclear fusion. Fusion reactions are not controlled. It is presumed that the energy of stars is due to two processes called proton-proton cycle and carbon-nitrogen cycle and carbon-nitrogen cycle. Fusion cannot take place at ordinary temperature. Thus, hydrogen bomb uses a small fission bomb, which on explosin causes the temperature to rise very high, about 10^7 K. We have yet to see how a hydrogen bomb can be used

for peaceful life-sustaining purpose. Energy released in the process of fusion is due to mass defect. It is also called Q-value

$Q = \Delta mc^2$, ΔM = mass defect

The binding energy per nucleon of ${}_1^2 H$ and ${}_2^4 He$ are 1.1 MeV and 7 MeV respectively. If two deuteron nuclei react to form a single helium nucleus, then the energy released is:

A. 13.9 MeV

B. 26.9 MeV

C. 23.6 MeV

D. 19.2 MeV

Answer: c

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2. The source of energy of stars is nuclear fusion. Fusion reaction occurs at very high temperature, about 10^7. Energy released in the process of fusion is due to mass defect. It is also called Q-value. $Q = \Delta mc^2$, $\Delta m =$

mass defect.

Mass equivalent to the energy $931MeV$ is a)$6.02 \times 10^{-27}kg$ b) $1.662 \times 10^{-27}kg$ c)$16.66 \times 10^{-27}kg$ d)$16.02 \times 10^{-27}kg$

A. $6.02 \times 10^{-27}kg$

B. $1.662 \times 10^{-27}kg$

C. $16.66 \times 10^{-27}kg$

D. $16.02 \times 10^{-27}kg$

Answer: b

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3. The source of energy of stars is nuclear fusion. Fusion reaction occurs at very high temperature, about 10^7. Energy released in the process of fusion is due to mass defect. It is also called Q-value. $Q = \Delta mc^2$, $\Delta m =$ mass defect.

Fusion reaction takes place at about a)$9 \times 10^2 K$ b)$3 \times 10^3 K$ c)$3 \times 10^4 K$ d)$3 \times 10^4 K$

A. $3 \times 10^2 K$

B. $3 \times 10^3 K$

C. $3 \times 10^4 K$

D. $3 \times 10^6 K$

Answer: d

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4. The source of energy of stars is nuclear fusion. Fusion reaction occurs at very high temperature, about 10^7. Energy released in the process of fusion is due to mass defect. It is also called Q-value. $Q = \Delta mc^2$, $\Delta m =$ mass defect.

A star has 10^{40} deutrons. It produes via the process

$$._1 H^2 + ._1 H^2 \rightarrow ._1 He^3 + ._1 H^1$$

$$._1 H^3 + ._1 H^3 \rightarrow ._2 He^4 + ._0 n^1$$

If the average power radiated by the star is $10^{16} W$, when the deutron

supply of the star is exhausted in a time of the order of a)$10^6 s$ b)$10^8 s$ c) $10^{12} s$ d)$10^{16} s$

A. 10^6 sec

B. 10^8 sec

C. 10^{12} sec

D. 10^{16} sec

Answer: c

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5. The source of energy of stars is nuclear fusion. Fusion reaction occurs at very high temperature, about 10^7. Energy released in the process of fusion is due to mass defect. It is also called Q-value. $Q = \Delta m c^2$, $\Delta m =$ mass defect.

In a nuclear reaction

$._1 H^2 + ._1 H^2 \rightarrow ._2 He^3 + ._0 n^1$

If the masses of ._(1)H^(2) and ._(2)He^(3)

$are 2.014741$ and $3.016977 a\mu, respectively. then the$ Q`-value of the reaction is nearly.

A. 0.00352 MeV

B. 3.27 MeV

C. 0.82 MeV

D. 2.45 MeV

Answer: b

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Psg Vii

1. Moderator is a material which is used to slow down the neutrons produced during nuclear fission. The neutrons from the source are of high speed and energy. Heavy water or graphite moderators slow down the speed of the neutrons. The energy of fast moving neutrons decreases from 2MeV to 0.02535 eV, it corresponds to the velocity of 220 m $\sec^{-1}$.

At this velocity, the neutrons are in thermal equilibrium with the moderator. such neutrons are called thermal neutrons. Thermal neutrons cause further fission reaction. The essential characterstices of moderators are:

(i) Its molar mass must be low,

(ii) It should not absorb neutrons.

(iii) It should undergo elastic collisions with neutrons.

The moderator in a reactor:

A. absorbs neutrons

B. acclerates neutrons

C. slows down neutrons

D. absorbs thermal energy. Produced in the reactors

Answer: c,d

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2. Moderator is a material which is used to slow down the neutrons produced during nuclear fission. The neutrons from the source are of high speed and energy. Heavy water or graphite moderators slow down the speed of the neutrons. The energy of fast moving neutrons decreases from 2MeV to 0.02535 eV, it corresponds to the velocity of 220 m $\sec^{-1}$. At this velocity, the neutrons are in thermal equilibrium with the moderator. such neutrons are called thermal neutrons. Thermal neutrons cause further fission reaction. The essential characterstices of moderators are:

(i) Its molar mass must be low,

(ii) It should not absorb neutrons.

(iii) It should undergo elastic collisions with neutrons.

A good moderator should:

A. not be a gas only

B. not have appertite for neutrons only

C. be light in mass number only

D. be all the above three

Answer: d

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3. Moderator is a material which is used to slow down the neutrons produced during nuclear fission. The neutrons from the source are of high speed and energy. Heavy water or graphite moderators slow down the speed of the neutrons. The energy of fast moving neutrons decreases from 2MeV to 0.02535 eV, it corresponds to the velocity of 220 m $\sec^{-1}$. At this velocity, the neutrons are in thermal equilibrium with the moderator. such neutrons are called thermal neutrons. Thermal neutrons cause further fission reaction. The essential characterstices of moderators are:

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(ii) It should not absorb neutrons.

(iii) It should undergo elastic collisions with neutrons.

Which of the following is not used as a moderator?

A. Heavy water

B. Graphite

C. Beryllium

D. Sodium

Answer: d

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4. Moderator is a material which is used to slow down the neutrons produced during nuclear fission. The neutrons from the source are of high speed and energy. Heavy water or graphite moderators slow down the speed of the neutrons. The energy of fast moving neutrons decreases from 2MeV to 0.02535 eV, it corresponds to the velocity of 220 m $\sec^{-1}$. At this velocity, the neutrons are in thermal equilibrium with the moderator. such neutrons are called thermal neutrons. Thermal neutrons cause further fission reaction. The essential characterstices of moderators are:

(i) Its molar mass must be low,

(ii) It should not absorb neutrons.

(iii) It should undergo elastic collisions with neutrons.

Moderator in the reactor yields:

A. fast moving neutrons

B. thermal neutrons

C. magnetic neutrons

D. electric neutrons

Answer: b

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5. Moderator is a material which is used to slow down the neutrons produced during nuclear fission. The neutrons from the source are of high speed and energy. Heavy water or graphite moderators slow down the speed of the neutrons. The energy of fast moving neutrons decreases from 2MeV to 0.02535 eV, it corresponds to the velocity of 220 m $\sec^{-1}$. At this velocity, the neutrons are in thermal equilibrium with the

moderator. such neutrons are called thermal neutrons. Thermal neutrons cause further fission reaction. The essential characterstices of moderators are:

(i) Its molar mass must be low,

(ii) It should not absorb neutrons.

(iii) It should undergo elastic collisions with neutrons.

Which among the following characters make graphite a good moderator?

A. Cross-sectional area of graphite is very high

B. Graphite is a good conductor of electricity

C. There is elastic collision between graphite and neutron

D. Graphite has weak van der Waal's force between two layers

Answer: a,c

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Psg Viii

1. Radioactive decay follows first-order kinetic. The mean life and half-life of nuclear decay process are $\tau = 1/\lambda$ and $t_{1/2} = 0.693/\lambda$. Therefore are a number of radioactive elements in nature, their abundance is directly proportional to half life. The amount remaining after n half lives of radioactive elements can be calculated using the relation:

$$N = N_0\left(\frac{1}{2}\right)^n$$

Which is/are true about the decay cosntant? a)Unit of λ is time^{-1} b)λ is independent of temperature c)λ depends on the initial amount of element taken. d)λ depends on the nature of radioactive element.

A. Unit of λ is time^{-1}

B. λ is independent of temperature

C. λ depends on initial amount of element taken

D. λ depend on the nature of radioactive element

Answer: a,d

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2. Radioactive decay follows first-order kinetic. The mean life and half-life of nuclear decay process are $\tau = 1/\lambda$ and $t_{1/2} = 0.693/\lambda$. Therefore are a number of radioactive elements in nature, their abundance is directly proportional to half life. The amount remaining after n half lives of radioactive elements can be calculated using the relation:

$$N = N_0\left(\frac{1}{2}\right)^n$$

Amount of radioactive elements (activity) decreases with passage of time as a)Linearly b)Exponentially c)Parabolically d)All of these

A. linearly

B. exponentially

C. parabolically

D. all of these

Answer: b

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3. Radioactive decay follows first-order kinetic. The mean life and half-life of nuclear decay process are $\tau = 1/\lambda$ and $t_{1/2} = 0.693/\lambda$. Therefore are a number of radioactive elements in nature, their abundance is directly proportional to half life. The amount remaining after n half lives of radioactive elements can be calculated using the relation:

$$N = N_0\left(\frac{1}{2}\right)^n$$

Half life of $.^{60}Co$ is 5.3 years, the time taken for 99.9% decay will be a).53years b)53years c)530years d)5300years

A. 0.53 yrs

B. 53 yrs

C. 530 yrs

D. 5300 yrs

Answer: b

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4. Radioactive decay follows first-order kinetic. The mean life and half-life of nuclear decay process are $\tau = 1/\lambda$ and $t_{1/2} = 0.693/\lambda$. Therefore are a number of radioactive elements in nature, their abundance is directly proportional to half life. The amount remaining after n half lives of radioactive elements can be calculated using the relation:

$$N = N_0\left(\frac{1}{2}\right)^n$$

The rate of radioactive decay is a)Independent of time b)Independent of temperature c)Dependent on catalyst d)Dependent on the amount of elementsd not yet decayed

A. independent of time

B. independent to temperature

C. dependent of catalyst

D. dependent on the amount of element not yet decayed

Answer: b,d

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5. Radioactive decay follows first-order kinetic. The mean life and half-life of nuclear decay process are $\tau = 1/\lambda$ and $t_{1/2} = 0.693/\lambda$. Therefore are a number of radioactive elements in nature, their abundance is directly proportional to half life. The amount remaining after n half lives of radioactive elements can be calculated using the relation:

$$N = N_0\left(\frac{1}{2}\right)^n$$

Select the correct relation. a)$t_{1/2} = \frac{0.693}{\lambda}$ b)$\tau = \frac{1}{\lambda}$ c)$\tau = 1.44 \times t_{1/2}$ d)$\tau = \frac{t_{1/2}}{0.693}$

A. $t_{1/2} = \frac{0.693}{\lambda}$

B. $\tau = \frac{1}{\lambda}$

C. $\tau = 1.44 \times t_{1/2}$

D. $\tau = \frac{t_{1/2}}{0.693}$

Answer: a,b,c,d

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Psg Ix

1. In the disintegration of a radioactive element, α- and β-particles are evolved from the nucleus.

$._0 n^1 \rightarrow ._1 H^1 + ._{-1} e^0 +$ Antineutrino + Energy

$4._1 H^1 \rightarrow ._2 He^4 + 2._{+1} e^0 +$ Energy

Then, emission of these particles changes the nuclear configuration and results into a daughter nuclide. Emission of an α-particles results into a daughter element having atomic number lowered by 2 and mass number by 4, on the other hand, emission of a β-particle yields an element having atomic number raised by 1.

Which of the following combinations give finally an isotope of the parent element? a)alpha, alpha, beta$b$)alpha, gamma, alpha$c$)alpha, beta, beta$d$) beta, gamma, alpha`

A. α, α, β

B. α, γ, α

C. α, β, β

D. β, γ, α

Answer: c

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2. In the disintegration of a radioactive element, α- and β-particles are evolved from the nucleus.

$._0 n^1 \rightarrow ._1 H^1 + ._{-1} e^0 +$ Antineutrino + Energy

$4._1 H^1 \rightarrow ._2 He^4 + 2._{+1} e^0 +$ Energy

Then, emission of these particles changes the nuclear configuration and results into a daughter nuclide. Emission of an α-particles results into a daughter element having atomic number lowered by 2 and mass number by 4, on the other hand, emission of a β-particle yields an element having atomic number raised by 1.

A radioactive element belongs to $IIIB$ group, it emits ona α- and β-particle to form a daughter nuclide. The position of daughter nuclide will be in

A. IIA

B. IA

C. IIB

D. IVB

Answer: a

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3. In the disintegration of a radioactive element, α- and β-particles are evolved from the nucleus.

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$4._1 H^1 \rightarrow ._2 He^4 + 2._{+1} e^0 +$ Energy

Then, emission of these particles changes the nuclear configuration and results into a daughter nuclide. Emission of an α-particles results into a daughter element having atomic number lowered by 2 and mass number by 4, on the other hand, emission of a β-particle yields an element having

atomic number raised by 1.

During β-decay, the mass of atomic nucleus

A. decrease by 1 unit

B. increases by 1 unit

C. decreases by 2 unit

D. remains unaffected

Answer: d

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4. In the disintegration of a radioactive element, α- and β-particles are evolved from the nucleus.

$._0 n^1 \rightarrow ._1 H^1 + ._{-1} e^0 +$ Antineutrino + Energy

$4._1 H^1 \rightarrow ._2 He^4 + 2._{+1} e^0 +$ Energy

Then, emission of these particles changes the nuclear configuration and results into a daughter nuclide. Emission of an α-particles results into a daughter element having atomic number lowered by 2 and mass number

by 4, on the other hand, emission of a β-particle yields an element having atomic number raised by 1.

During β-decay, the mass of atomic nucleus

A. $1\alpha, 1\beta$

B. $1\alpha, 2\beta$

C. $2\alpha, 2\beta$

D. $n\beta$

Answer: d

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5. In the disintegration of a radioactive element, α and β-particles are evolved from the nucleus:

$._0^1 n \rightarrow ._1^1 H + ._{-1}^0 e$ + Antineutrino + Energy

$4._1^1 H \rightarrow ._2^4 He + 2._{+1}^0 e$ + Energy

Then, emission of these particles changes the nuclear configuration and results into a daughter nuclide. Emission of an α-particles results into a

daughter element having atomic number lowered by 2 and mass number by 4, on the order hand, emission of a β-particle yields an element having atomic number raised by one. soddy and Fajan proposed that the daughter nuclide may occupy different positions in the periodic talbe.

Select the correct statements amont the following:

A. Emission of a β particle results into isobar of parent element

B. Emission of a β-particles results into isodiaphere of parent element

C. Emisson of one α and two β particle results into isotope of the parenet element

D. Emission of γ-radiations may yield nuclear isomer

Answer: a,b,c,d

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Section I

1. If $3/4$ quantity of a radioactive substance disintegrates in 2 hours, its half $-$ life period will be a)$15min$ b) $30min$ c)$60min$ d)$90min$

A. 1 hour

B. 45 minutes

C. 30 minutes

D. 15 minutes

Answer: c

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2. Radio carbon dating is done by estimating in the specimen:

A. the amount of ordinary carbon still present

B. the amount of radio carbon still present

C. the ratio of amount of $._{6}^{14}C$ to $._{6}^{12}C$ still present

D. The ratio of amount of $._{6}^{12}C$ to $._{6}^{14}C$ still present

Answer: c

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3. Which of the following are correct with respect to the unit of radioactivity?

(i) The SI unit of radioactivity is curie (Ci)

(ii) $1Ci = 3.7 \times 10^{-10}$ dis s^{-1}

(iii) 1 Bq $= 3.7 \times 10^{-10} Ci$

(iv) The SI unit of radioactivity is becquerel (Bq)

(v) 1 Ci $= 3.7 \times 10^{10}$ Bq

A. (i) and (iii)

B. (iv) and (v)

C. (i) and (ii)

D. (ii) and (iv)

Answer: b

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4. A freshly cut tree and a wooden artifact have 30.4 and 15.2 conuts g^{-1} $\min^{-1}$ of C^{14} of half of 5700 years. The age of the artifact in years would be:

A. 2850

B. 5700

C. 570

D. 6930

Answer: b

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5. The radioactive isotope of cerium - 137 of weigh 8g was collected on 1st Feb. 2006 kept in a sealed tube. On 1st July, 2006, it was found that only 0.25g of it remained. The half life period of the isotope is:

A. 37.5 days

B. 30 days

C. 25 days

D. 50 days

Answer: b

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6. The number of α-and β-particles emitted in the nuclear reaction, ${}_{.90}Th^{228} \rightarrow {}_{.83}Bi^{212}$, respectively are

A. 4α and 1β

B. 3α and 7β

C. 8α and 1β

D. 4α and 7β

Answer: a

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7. Cyclotron is used to accelerate

A. protons

B. deutrons

C. neutrons

D. electrons

Answer: c

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8. The $I - 128$ has no therapeutic value because a.)It is poisonous b.)It is very stable c.)It decays quickly and loses radioactivity. d.)It is not radioactive

A. it is non-radioactive

B. it is poisonous

C. it is radioactive

D. none of these

Answer: a

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9. The decay of mass during nuclear fission and fusion are:

A. 0.1% and 0.231%

B. 0.231% and 0.01%

C. 0.4% and 0.2%

D. 0.3% and 0.3%

Answer: a

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10. On large scale, tritium is produced by which of the following nuclear reaction?

A. $._{3}^{6}Li + ._{0}^{1}n \rightarrow ._{2}^{4}He + ._{1}^{3}T$

B. $._{1}^{2}D + ._{1}^{2}D \rightarrow ._{1}^{3}T + ._{1}^{1}H$

C. $._{7}^{14}N + ._{0}^{1}n \rightarrow ._{6}^{12}C + ._{1}^{1}T$

D. $._{7}^{14}N + ._{1}^{1}H \rightarrow ._{1}^{3}T$ + other fragments

Answer: b

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Section Ii

1. Which of the following will emit positron?

A. $._{15}^{30}P$

B. $._{7}^{13}N$

C. ${}_{1}^{3}H$

D. ${}_{6}^{14}C$

Answer: a,b

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2. If $\frac{n}{p}$ ratio is less than I, the nuclide can:

A. K-caputure

B. emits positron

C. emit β-particle

D. emit α-particle

Answer: a,b

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3. For radioactive decay:

A. $t_{3/4} = 2t_{1/2}$

B. $t_{7/8} = 3t_{1/2}$

C. $t_{99\%} = 2t_{90\%}$

D. $t_{90\%} = \frac{10}{3} t_{50\%}$

Answer: a,b,c,d

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4. Which of the following statement is/are correct?

A. Nuclear fusion produces more energy than nuclear fission

B. Nuclear fusion take place at very high temperature $\left(10^6 K\right)$

C. Nuclear fusion yields radioactive product

D. Nuclear fusion involves chain reaction

Answer: a,b,c

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5. Decrease in atomic number is observed during a)α-emission b)β-emission c)positron emission d)electron capture

A. α-emission

B. β-emission

C. positron emission

D. K-capture

Answer: a,c,d

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Section Iii

1. Statement-2 β particle are emitted by nucleus

Because

Statement-2 : Following transformation take place in β-emission.

$$._0^1 n \rightarrow ._1^1 H + ._{+1}^0 e$$

A. Statement-1 is true, Statement-2 is ture, statement-2 is a correct explanation for statement -1

B. Statement-1 is true, statement-2 is true, statement-2 is not a correct explanation for statement-1

C. Statement-1 is ture, statement-2 is false

D. Statement-2 is false, statement-2 is true

Answer: a

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2. Statement-1 : Phosphours-32 decays to sulphur-32 with emission of a β-particle.

Because

Statement-2: The neutron to proton ratio is less than 1.0 for all light stable nuclides.

A. Statement-1 is true, Statement-2 is ture, statement-2 is a correct explanation for statement -1

B. Statement-1 is true, statement-2 is true, statement-2 is not a correct explanation for statement-1

C. Statement-1 is ture, statement-2 is false

D. Statement-2 is false, statement-2 is true

Answer: c

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3. Statement-1 : Energy is released in the nuclear fusion of hydrogen nuclei to form helium nuclei

Because

Statement-2 : Binding energy per nucleon of helium greater than hydrogen.

A. Statement-1 is true, Statement-2 is ture, statement-2 is a correct explanation for statement -1

B. Statement-1 is true, statement-2 is true, statement-2 is not a correct explanation for statement-1

C. Statement-1 is ture, statement-2 is false

D. Statement-2 is false, statement-2 is true

Answer: a

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4. Statement-1 : $._{56}^{133}Ba + e^- \rightarrow ._{55}^{133}Cs +$ X-ray

Because

State-2 : Atomic number of daughter nuclide decreses by one unit in K-electron capture.

A. Statement-1 is true, Statement-2 is ture, statement-2 is a correct explanation for statement -1

B. Statement-1 is true, statement-2 is true, statement-2 is not a correct explanation for statement-1

C. Statement-1 is ture, statement-2 is false

D. Statement-2 is false, statement-2 is true

Answer: b

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5. Statement : The plot of atomic number (y -axis) versus number of neutrons (x -axis) for stable nuclei shows a curvature towards x-axis fron the line of 45° slope as the atomic number is increased .

Explanation : proton -proton electrostatic repulsions begin to overcome attracive forces involving protons and neutrons in heavier nuclides.

A. Statement-1 is true, Statement-2 is ture, statement-2 is a correct explanation for statement -1

B. Statement-1 is true, statement-2 is true, statement-2 is not a correct explanation for statement-1

C. Statement-1 is ture, statement-2 is false

D. Statement-2 is false, statement-2 is true

Answer: c

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Section Iv

1. Match the Column-I with Column-II:

Column-I	Column-II
$(a).^{2}_{1}D+.^{3}_{1}T\rightarrow.^{4}_{2}He+.^{1}_{0}n+\text{Energy}$	$(p)\beta-\text{emission}$
$(b).^{9}_{4}Be+.^{4}_{2}He\rightarrow.^{12}_{6}C+.^{1}_{0}n$	$(q)\text{Artificial transmutation}$
$(c).^{24}_{12}Mg+.^{4}_{2}He\rightarrow.^{27}_{14}Si+.^{1}_{0}n$	$(r)\text{Discovery of neutrons}$
$(d).^{1}_{0}n\rightarrow.^{1}_{1}H+.^{0}_{+1}e$	$(s)\text{Hydrogen bomb}$

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2. Match the Column-I with Column-II:

$(\text{Column-I, Column-II}),\left((a)n\rightarrow p^{+}+\ldots\ldots,(p)\text{Positron emission}\right),\left((b)p\right.$

4[._(1)^(1)H] to ....+ 2 beta^(+) + "Energy",(s) alpha - "emission"):}`

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Section V

1. The number of neutrons accompanying the formation of $._{54}Xe^{139}$ and $._{38}Sr^{94}$ from the absorption of a slow neutron by $._{92}U^{235}$, followed by

nuclear fission is

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2. Half life of radioactive element ${}_{92}^{238}U$ is independent of the initial amount of radioactive element taken. What will be the decay order of the element?

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3. Initial amount of the radioactive element with half life 10 days is 16 g. What amount in gm of this element will remain after 40 days?

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Section Vi

1. Nucleus of an atom resembles with a drop of liquid. Density of nucleus is very high, i.e., 10^8 tonne/cc or 130 trillion tonnes m^{-3}. This density is about a trillion times greater than that of water. Density of nuclei of all elements are same, it is independent of atomic number or atomic mass. However, the radius of nucleus depends on the mass number . Surface However, the radius of nucleus depends on the mass number. Surface tension of nucleus is also very high. i.e., about 1.24×10^{18} times, the suface tension of water.

The radius of ${}_6^{12}C$ nucleus is:

A. $5 \times 10^{-15} m$

B. $1.4 \times 10^{-15} m$

C. $3.5 \times 10^{-15} m$

D. $6 \times 10^{-15} m$

Answer: c

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2. Nucleus of an atom resembles with a drop of liquid. Density of nucleus is very high, i.e., 10^8 tonne/cc or 130 trillion tonnes m^{-3}. This density is about a trillion times greater than that of water. Density of nuclei of all elements are same, it is independent of atomic number or atomic mass. However, the radius of nucleus depends on the mass number . Surface However, the radius of nucleus depends on the mass number. Surface tension of nucleus is also very high. i.e., about 1.24×10^{18} times, the suface tension of water.

Ratio of volume of atom and nucleus is:

A. $10^8 : 1$

B. $10^{15} : 1$

C. $10^{13} : 1$

D. $10^{12} : 1$

Answer: b

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3. Nucleus of an atom resembles with a drop of liquid. Density of nucleus is very high, i.e., 10^8 tonne/cc or 130 trillion tonnes m^{-3}. This density is about a trillion times greater than that of water. Density of nuclei of all elements are same, it is independent of atomic number or atomic mass. However, the radius of nucleus depends on the mass number . Surface However, the radius of nucleus depends on the mass number. Surface tension of nucleus is also very high. i.e., about 1.24×10^{18} times, the suface tension of water.

Radius of nucleus is directly proportional to:

A. A^2

B. $A^{1/3}$

C. $[A]^3$

D. A

Answer: c

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