CHEMISTRY

FOR IIT JEE ASPIRANTS OF CLASS 12 FOR CHEMISTRY

NUCLEAR CHEMISTRY

Examples

1. A Piece of wood, reportedly from king Tut's tomb was burnt and $7.32g.^{14}CO_2$ was collected. The total radioactivity in the $.^{14}CO_2$ was 10.8 dis $\min^{-1}$. How old was the wood sample? $t_{1/2} = 5730yrs$ and $.^{14}C$ isotope $= 15.3$ dis $\min^{-1} g^{-1}$.

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2. (a) On analysis a sample of uranium ore was found to contain $0.277g$ of $._{82}Pb^{206}$ and $1.667g$ of $._{92}U^{238}$. The half life period of U^{238} is 4.51×10^9 year. If all the lead were assumed to have come from decay of $._{92}U^{238}$, What is the age of earth?

(b) An ore of $._{92}U^{238}$ is found to contain $._{92}U^{238}$ and $._{82}Pb^{206}$ in the weight ratio of $1:0.1$ The half-life period of $._{92}U^{238}$ is 4.5×10^9 year. Calculate the age of ore.

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3. A solution contains a mixture of isotopes of $X^{A_1}\left(t_{1/2} = 14days\right)$ and $X^{A_2}\left(t_{1/2} = 25days\right)$. Total

activity is 1 curie at t=0. The activity reduces by 50% in 20 days. Find :

a) The initial activities of X^{A_1} and $X^{A}{}_{2}\Big)$.

b) The ratio of their initial number of nuclei.

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4. ${}_{84}Po^{210}$ decays with a particle to ${}_{82}Pb^{206}$ with a half life of 138.4 days. If 1.0 g of ${}_{84}Po^{210}$ is placed in a sealed tube, how much helium will accumulate in 69.2 days. Express the answer in cm^3 at STP

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5. Complete the folowing reactions:

$(i)_{90}{}^{234}Th \rightarrow ....7_2{}^4He + 6_{-1}\beta^0$

$(i)_{92}{}^{235}U + {}_0n^1 \rightarrow .... + {}_{52}{}^{137}Te + {}_{40}{}^{97}Zr$

(iii) ${}_{34}{}^{84}Se \rightarrow 2_{-1}r^0 + ...$

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6. ${}^{64}Cu(T_{50} = 12.8year)$ decays $\beta -$ emission (38%), β^+ decayproducts and calculate partial half-lives for each of the decay process.

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7. ${}_{92}U^{238}$ is radioactive and it emits α and β particles to form ${}_{82}Pb^{206}$. Calculate the number of α and β particles emitted in this conversion.

An ore of ${}_{92}U^{238}$ is found to contain ${}_{92}U^{238}$ and ${}_{82}Pb^{206}$ in the weight ratio of $1:0.1$. The half- life -period of ${}_{92}U^{238}$ is $4.5 \times 10^9 yr$. Calculate the age of the ore.

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8. Write a balanced equation for the reaction of N^{14} with $\alpha -$ particles.

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9. ^{227}Ac has a half-life of 22 years with respect to radioactive decay. The decay follows two prallel paths : $^{227}Ac \rightarrow {}^{227}Th$ and $^{227}Ac \rightarrow {}^{223}Fr$. If the percentage of the two daughter nuclides are 2.0 and 98.0, respectively, the decay constant (in year^{-1}) for $^{227}Ac \rightarrow {}^{227}Th$ path is closest to

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10. One of the hazards of explosion is the generation of Sr^{90} and its subsequent incoperation in bones. This nuclide has a half life of 2.81 years. Suppose one microgram was absorbed by a new born chiled,how much Sr^{90} will remain in his bone after 20 years?

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11. The nuclide ratio, $._1^3 H$ to $._1^1 H$ in a sample of water is $8.0 \times 10^{-18} : 1$ Tritium undergoes decay with a half-life period of $12.3yr$ How much tritium atoms would $10.0g$ of such a sample contains 40 year after the original sample is collected?

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12. An experiment requires minimum beta activity produced at the rate of 346 beta particles per minute. The half- life period of $_{}(42)Mo^{99}$, which is a beta emitter , is 66.6 h . Find the minimum amount of $_{}(42)Mo^{99}$ required to carry out the experiment in 6.909 h.

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13. ${}_{90}Thh^{234}$ disintegrates to give ${}_{82}Pb^{206}$ as final product. How many alpha and beta particles are emmited during the process?

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14. Radioactive decay is a first $-$ order process. Radioactive carbon in wood sample decays with a half $-$ life of 5770 years. What is the rate constant (in years) for the decay ? What fraction would remains after 11540 years ?

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15. Find (i) total number of neutrons, and (II) the total mass of neutrons in 7 mg of C^{14}(assume that mass of neutron=mass of a hydrogen atom)

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Ncert Based

1. Which of the following isotopes is likely to be most stable?

A. ${}_{30}{}^{71}Zn$

B. ${}_{30}{}^{66}Zn$

C. ${}_{30}{}^{64}Zn$

D. None of these

Answer: c

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2. The radiations having high penetrating power and not affected by electrical and magnetic field are

A. γ-rays

B. neutrons

C. β-rays

D. α-particles

Answer: a

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3. The order of penetration of three radioactive rays through metal sheet is

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

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

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

D. None of these

Answer: a

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4. The radioactive decay produces the species with fastest speed is

A. α

B. β

C. γ

D. Positron

Answer: c

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5. A nucleus with an excess of neutrons may decay with the emission of

A. a neutron

B. a proton

C. an electron

D. a positron

Answer: c

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6. $._{13}Al^{27}$ 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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7. $._{6}^{11}C$ on decay produces:

A. positron

B. β-particle

C. α-particle

D. None of these

Answer: a

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8. $\beta -$ particle in radioactivity is emitted by:

A. conversion of proton to neutron

B. outermost orbit

C. conversion of neutron to proton

D. β-particle is not emitted

Answer: c

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9. Hydrogen bomb is based on the principle of

A. nuclear fission

B. natural radioactivity

C. nuclear fusion

D. artificially radioactivity

Answer: c

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10. Complete the following nuclear reaction by choosing correct option :

$_{95}{}^{241}Am + {}_{4}{}^{2}He \rightarrow \ldots + 2_{0}{}^{1}n`$

A. $_{97}{}^{241}Bk$

B. $_{97}{}^{243}Bk$

C. $_{97}{}^{243}Am$

D. ${}_{96}^{242}Cm$

Answer: b

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11. Decrease in atomic number is not observed in

A. α-emission

B. β-emission

C. positron emission

D. electron emission

Answer: b

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12. 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. 146

B. 144

C. 140

D. 142

Answer: b

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13. In the following nuclear transmutation

$$_{92}{}^{238}U + X \rightarrow {}_{92}{}^{239}U \xrightarrow{-\beta^-} Y \xrightarrow{-\beta^-} . {}_{94}{}^{239}Pu$$

X and Y are respectively are

A. $_0{}^1n$, $_{92}{}^{239}Np$

B. $_0{}^1n$, $_{93}{}^{239}Np$

C. γ, $_{93}{}^{239}Np$

D. $_0{}^1H$, $_{92}{}^{239}Np$

Answer: b

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14. $_{88}{}^{224}Ra$ decays by a series emmision of three $\beta-$ particles and two $\alpha-$ particles. The end product of X is

A. ${}_{88}{}^{220}X$

B. ${}_{87}{}^{216}X$

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

D. ${}_{88}{}^{216}X$

Answer: b

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15. ${}_{90}{}^{228}Th \rightarrow {}_{83}{}^{212}Bi + \alpha + \beta$. The no. of α and β given out during the process are

A. $4\alpha, 7\beta$

B. $4\alpha, 1\beta$

C. 4α

D. 7β

Answer: b

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16. A radioactive isotope has a half-life of 10 day. If today there are 125 g of left, what was the original mass 40 day earlier?

A. 600 g

B. 1000 g

C. 1250 g

D. 2000 g

Answer: d

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17. 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

Answer: c

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18. If $\frac{1}{16}$th of a usbstance is left after 40 days then the half life is

A. 40 days

B. 30 days

C. 20 days

D. 10 days

Answer: d

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19. A radioative substance decays 10% in 5 days. The aamount remains after 20 days is [log 3 =0.4771]

A. 0.9

B. 0.81

C. 0.729

D. 0.6561

Answer: d

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20. Half life period of $_{53}I^{125}$ is 60 days. Percentage of radioactivity preent after 180 days is

A. 0.5

B. 0.75

C. 0.36

D. 0.125

Answer: d

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21. Among the following for which one rate of decay is maximum

A. 1 g radium

B. 1 g $RaCl_2$

C. 1 g $Ra_3(PO_4)_2$

D. equal for all

Answer: c

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22. During a negative β-decay

A. An atomic electron is ejected

B. An electron which is already present within the nucleus is ejected

C. A neutron in the nucleus deecays emitting an electron

D. A part of the binding energy of the nuckleus is converted into an elctron

Answer: a

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23. Identify the missingf product in the given reaction

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

A. $B_{56}{}^{143}$

B. $_{56}{}^{139}Ba$

C. $_{54}{}^{139}Ba$

D. $_{54}{}^{141}Ba$

Answer: a

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24. The half life period of a radioctive element is 140 days.

Afte 560 days, one gram of the element will reduced to :

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

B. $\frac{1}{4}g$

C. $\frac{1}{8}g$

D. $\frac{1}{16}g$

Answer: d

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25. 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 $(11)Na^{23}$

Answer: c

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26. Decrease in atomic number is observed during

A. α-emission

B. β-emission

C. positron emission

D. electron capture

Answer: a,c

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27. Which of the following pairs are isodiapteric pairs?

A. ${}_{29}Cu^{65}$ and ${}_{24}Cr^{55}$

B. ${}_{29}Cu^{65}$ and ${}_{24}Cr^{52}$

C. ${}_{92}U^{235}$ and ${}_{90}Th^{231}$

D. ${}_{92}U^{238}$ and ${}_{90}Th^{231}$

Answer: a,c

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28. The radius ${}_{Z}M^{4}$ nucleus is (outer most configuration $3s^2 3p^1$ and A+Z=40)

A. 4.2 FM

B. $1.4 \times \sqrt[3]{40}$

C. $1.4 \times \sqrt[2]{40}$

D. $1.4 \times 40FM$

Answer: a

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29. Correct statement is/are

A. when one mole of Radium converted to $Ra_3(PO_4)_2$ activity increase

B. when one mole of Radium converted to $Ra_3(PO_4)_2$ activity decreases.

C. when one mole of Radium converted to $Ra_3(PO_4)_2$ activity remains constant

D. among 1 mole radium and 1 mole $Ra_3(PO_4)_2$ samples, more activity is observed in $Ra_3(PO_4)_2$ sample.

Answer: c,d

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30. The half life of I^{131} is 8 day. Given a sample of I^{131} at t=0, we can assert that

A. No nucleus will decay at t=4day

B. No nucleus will decay before t=8day

C. All nucleus will decay before t=16day

D. A given nucleus may decay before

Answer: d

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31. Select the correct statement(s)

A. α-particles are simple helium nucleus

B. γ-rays travel with higher speed as compare to α particle and have higher ionization power as compare to β particle

C. A loss of β-particles results in the production of isobars

D. β-prticles are considered to the best bombarding particles

Answer: a,c

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

A. $\frac{22}{10}$

B. $\frac{22}{11}$

C. $\frac{23}{10}$

D. $\frac{23}{12}$

Answer: c

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33. 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^-

B. Two β^- and one β^-

C. One β^- and one γ

D. One β^+ and one β^-

Answer: a

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34. Which of the following pairs are isodiaphers

A. ${}_{29}Cu^{65}$ and ${}_{24}Cr^{55}$

B. ${}_{29}Cu^{65}$ and ${}_{24}Cr^{52}$

C. ${}_{92}U^{235}$ and ${}_{90}Th^{231}$

D. ${}_{92}U^{235}$ and ${}_{90}Th^{232}$

Answer: a

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35. $._{}^{23}$ Na is the more stable isotope of Na. Find out the process by which $._{11}^{24}$ Na can undergo radioactive decay.

A. β^- emission

B. α emission

C. β^+ emission

D. K electron capture

Answer: a

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36. The half life of ${}_6C^{14}$, if decay constant 6.31×10^{-4} year^(-1)` is

A. 1098 years

B. 109.8 years

C. 10.98 years

D. 1.098 years

Answer: a

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37. $._{13}Al^{27}$ 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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38. Which of the following is not correct

A. positron emission : increase n/p ratio

B. k electron capture : decrease n/p ratio

C. β-decay decrease n/p ratio

D. α-decay increases n/p ratio

Answer: b

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39. Identify the incorrect statements is/are

A. ${}_zX^A \xrightarrow{-\alpha} \xrightarrow{-\beta} \xrightarrow{-\beta}$ in the above nuclear disintegration the no. of nuclides having isotopic number are 2.

B. Activity of 1 gm $RaCl_2$ is more than that of 1gm $RaSO_4$

C. ${}_6C^{14}$ emits α-particle

D. ${}_{15}CP^{30}$ decays by emitting positron

Answer: c

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Comrehension

1. Several short-lived radioactive species have been used to determine the age of wood or animal fossils. One of the most intresting substance is ${}_6C^{14}$(half-life fossils, etc.). Carbon-14 is produced by the bombardment of nitrogen atoms present in the upper atmosphere with neutrons (from cosmic rays).

${}_7N^{14} + {}_0n^1 \rightarrow {}_6C^{14} + {}_1H_1$

Thus carbon-14 is oxidised, to CO_2 and eventually lingested by land animals. The death of plants or animals put an end to the intake of C_{14} from the atmosphere. After this the amount of C_{14} in the dead tissues starts decreasing due to its disintegration as per the following reaction :

${}_6C^{14} \rightarrow {}_7N^{14} + {}_{-1}\beta^0$

The C^{14} isotope enters the biosphjere when carbon dioxide is taken up in plant photosynthesis. Plants are eaten by animals, which exhale C^{14} as CO_2. Eventually, C^{14} participates in many aspects of carbon cycle. The C^{14} lost by radioactive decay-replenishment process, a dynamic rquillibrium is established whereby the ratio of C^{14} to C^{12} remains constant in living matter. But when an individual plant or an animal dies, the C^{14} isotpe inn it is no longer replenished, so the ratio decreases as C^{14} decays. So, ther number C^{14} nuclei after time t (after the death of living matter) would be less than in a livingthe following formula,

$t_{1/2} = 0.693/?$

The intensity of the cosmic rays have remain the same for 30,000 years. But since some years changes in this are observed due to excessive burning of fossil fuel and nuclear test?

Why do we use the carbon dating to calculate the age of the fossil?

A. Rate of exchange of carbon beween atmosphere and living is slower than decay of C^{14}

B. It is not appropriate to use C^{14} dating to determine image

C. Rate of exchange of C^{14} between atmosphere and living organism is so fast that an equilibrium is set up between the intake of C^{14} by organisms and its exponential decay

D. None of these

Answer: c

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What should be the age of the fossil meaningful determination of its age?

A. 6 years

B. 6000 years

C. 60000 years

D. can be used to determine any age

Answer: a

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3. Several short-lived radioactive species have been used to determine the age of wood or animal fossils. One of the most intresting substance is ${}_6C^{14}$(half-life fossils, etc.).

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The intensity of the cosmic rays have remain the same for 30,000 years. But since some years changes in this are observed due to excessive burning of fossil fuel and nuclear test?

A nuclear explosion has taken place leading to increase in concentration of C^{14} in nearby areas. C^{14} concentration is C_1 in nearly areas and C_2 in areas far away. If the age of the fossil is determined to be T_1 and T_2 at the respective places then

A. The age of the fossil will inrease at the where explosion has taken place and

$$T_1 - T_2 = \frac{1}{\lambda} \text{in} C \frac{1}{C_2}$$

B. The age of the fossil will decrease at the place where explosion has taken place and

$$T_1 - T_2 = \frac{1}{\lambda} \text{in} C \frac{1}{C_2}$$

C. The age of the fossil will determined to be same

D. $T \frac{1}{T} 2 = C \frac{1}{C} 2$

Answer: a

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4. Radioactive disintegration is a first order reaction and it's rate depends only upon the nature of nucleus and does not depend upon external factors like temoperature an pressure. The rate of radioactive disintigration (Activity) is respresented as $\frac{-d(N)}{dt} = \lambda N$

Where λ=decay consatant, N= number of nuclei at time t, N_0=initial no. of nucleei. The above equation after integration can be represented as

$\lambda = \frac{2.303}{t} \log. \frac{N_0}{N}$

Half-life period of U^{237} is 2.5×10^5 years. In how much time will the amount of U^{237} remaining be only 25% of the original amount?

A. 2.5×10^5 years

B. 1.25×10^5 years

C. 5×10^5 years

D. 10^6 years

Answer: c

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$$\lambda = \frac{2.303}{t} \log. \frac{N_0}{N}$$

Calculate the half-life period of a radioactive element which remains only 1/16 of it's original amount in 4740 years:

A. 1185 years

B. 2370 years

C. 52.5 years

D. 6700 years

Answer: a

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6. Radioactive disintegration is a first order reaction and it's rate depends only upon the nature of nucleus and does not

depend upon external factors like temoperature an pressure. The rate of radioactive disintigration (Activity) is respresented as $\frac{-d(N)}{dt} = \lambda N$

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What is the activity in Ci(curie) of 1.0 mole of plutonium-239?

A. 0

B. 14.9Cii

C. 5.153×10^{11}Ci

D. 2.09Ci

Answer: b

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7. Two substances A and B are present such that $[A_0] = 4[B_0$ and half-life of A is 5 minutes and that of B is 15 minutes. If they start decaying at the same time following first order kinetics after how much time the concentration of both of them would be same ?

A. 15 min

B. 60 min

C. 12 min

D. 180 min

Answer: d

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8. The nuclei of two radioactive isotopes of same substance A^{236} and A^{234} are present in the ratio of $4:1$ in an ore obtained from some other planet. Their half lives are $30\ \text{min}$ and $60\ \text{min}$ respectively. Both isotopes are alpha emitters and the activity of the isotope with half-life $30\ \text{min}$ is $10^6 dps$. Calculate after how much time their activites will become identical. Also calculate the time required to bring the ratio of their atoms to $1:1$.

A. 30 min

B. 60 min

C. 120 min

D. 150 min

Answer: c

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9. In addition to the popular fusion reaction we come across, a second process called the carbon-nitrogen cycle occurs in the sun:

$${}_1{}^1H + {}_6{}^{12}C \rightarrow {}_0{}^0\gamma + {}_7{}^{13}N, {}_{13}{}^7N \rightarrow {}_{+1}{}^0e + {}_{13}{}^6C$$

$${}_1{}^1H + {}_6{}^{13}C \rightarrow {}_0{}^0\gamma + {}_7{}^{14}N, {}_1{}^1H + {}_7{}^{14}N \rightarrow {}_0{}^0\gamma + {}_8{}^{15}O$$

$${}_8{}^{15}O \rightarrow {}_{+1}{}^0e + {}_7{}^{15}N, {}_1{}^1H + {}_7{}^{15}N \rightarrow {}_6{}^{12}C + {}_2{}^4He + {}_0{}^0\gamma$$

$$4{}_1{}^1H \rightarrow {}_2{}^4He + 2{}_{+1}{}^0e$$

The catalyst oin the process is

A. ${}_6{}^{12}C$

B. ${}_7{}^{13}N$

C. ${}_{8}{}^{15}O$

D. All of these

Answer: a

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${}_{1}{}^{1}H + {}_{6}{}^{12}C \rightarrow {}_{0}{}^{0}\gamma + {}_{7}{}^{13}N$,${}_{13}{}^{7}N \rightarrow {}_{+1}{}^{0}e + {}_{13}{}^{6}C$

${}_{1}{}^{1}H + {}_{6}{}^{13}C \rightarrow {}_{0}{}^{0}\gamma + {}_{7}{}^{14}N$,${}_{1}{}^{1}H + {}_{7}{}^{14}N \rightarrow {}_{0}{}^{0}\gamma + {}_{8}{}^{15}O$

${}_{8}{}^{15}O \rightarrow {}_{+1}{}^{0}e + {}_{7}{}^{15}N$, ${}_{1}{}^{1}H + {}_{7}{}^{15}N \rightarrow {}_{6}{}^{12}C + {}_{2}{}^{4}He + {}_{0}{}^{0}\gamma$

$4_{1}{}^{1}H \rightarrow {}_{2}{}^{4}He + 2_{+1}{}^{0}e$

$_{ss}Ra^{226} \rightarrow x + {}_2He^4$ The product x belongs to the group of

A. IA

B. IIA

C. VIIIA

D. Zero group

Answer: C

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$_1{}^1H + {}_6{}^{12}C \rightarrow {}_0{}^0\gamma + {}_7{}^{13}N$,$_{13}{}^7N \rightarrow {}_{+1}{}^0e + {}_{13}{}^6C$

$_1{}^1H + {}_6{}^{13}C \rightarrow {}_0{}^0\gamma + {}_7{}^{14}N$,$_1{}^1H + {}_7{}^{14}N \rightarrow {}_0{}^0\gamma + {}_8{}^{15}O$

$_8{}^{15}O \rightarrow {}_{+1}{}^0e + {}_7{}^{15}N$, $_1{}^1H + {}_7{}^{15}N \rightarrow {}_6{}^{12}C + {}_2{}^4He + {}_0{}^0\gamma$

$4_1{}^1H \rightarrow {}_2{}^4He + 2_{+1}{}^0e$

In the following nuclear reaction P and Q cannot be

$_7{}^{15}N + P \rightarrow {}_7{}^{14}N + Q$

A. (α, n)

B. (γ, n)

C. (d,t)

D. (p,d)

Answer: a

Watch Video Solution

12. Unstable nuclei attain stability through disintegration. The nuclear stability is related to neutron proton ratio (n/p). For stable nuclei n/p ratio lies close to unity for elements with low atomic numbers (20 or less) but it is more than 1 for nuclei having higher atomic numbers. Nuclei having n/p ratio either very high or low undergo nuclear transformation. when n/p ratio is higher than required for stabilioty, the nuclei have the tendency to emit β-rays. While when n/p ratio is lower than required for stability, the nucleieither emits α-particles or a position or capture K-electron.

Unstable substance exhibit high radioactivity due to

A. Low p/n ratio

B. high p/n ratio

C. p/n=1

D. None

Answer: a

Watch Video Solution

13. Unstable nuclei attain stability through disintegration. The nuclear stability is related to neutron proton ratio (n/p). For stable nuclei n/p ratio lies close to unity for elements with low atmoic numbers (20 or less) but it is more than 1 for nuclei having higher atomic numbers. Nuclei having n/p ratio either very high or low undergo nuclear transformation. When n/p ratio is higher than required for stability, the nuclei have the tendency to emit β -rays. while when n/p ratio is lower than required for stability, the nuclei either emits α-particles or a positron or

capture K-electron.

β-particle is emitted in radioactivity by

A. conversion of proton to neutron

B. Conversion of neutron to proton

C. β-particle is not emmited

D. None

Answer: b

Watch Video Solution

14. Unstable nuclei attain stability through disintegration. The nuclear stability is related to neutron proton ratio (n/p). For stable nuclei n/p ratio lies close to unity for

elements with low atmoic numbers (20 or less) but it is more than 1 for nuclei having higher atomic numbers. Nuclei having n/p ratio either very high or low undergo nuclear transformation. When n/p ratio is higher than required for stability, the nuclei have the tendency to emit β -rays. while when n/p ratio is lower than required for stability, the nuclei either emits α-particles or a positron or capture K-electron.

For reaction

$$._{92}M^{238} \rightarrow ._{y}N^{x} + 2._{2}He^{4}, ._{y}N^{x} \rightarrow ._{B}L^{A} + 2._{-1}e^{0}$$

The number of neutrons in the element L is

A. 140

B. 145

C. 138

D. 160

Answer: a

Watch Video Solution

15. Unstable nuclei attain stability through disintegration. The nuclear stability is related to neutron proton ratio (n/p). For stable nuclei n/p ratio lies close to unity for elements with low atomic numbers (20 or less) but it is more than 1 for nuclei having higher atomic numbers. Nuclei having n/p ratio either very high or low undergo nuclear transformation. when n/p ratio is higher than required for stabilioty, the nuclei have the tendency to emit β-rays. While when n/p ratio is lower than required for stability, the nucleieither emits α-particles or a position or

capture K-electron.

The order of radioactive disinigration is

A. 0

B. 1

C. 3

D. 2

Answer: b

Watch Video Solution

16. Uranium ($_{92}U^{238}$) decayed to $_{82}Pb^{206}$. The process is

$$_{92}U^{238} \xrightarrow[x\alpha\,,y\beta]{} \cdot\, _{82}Pb^{206}$$

$t_{1/2} of U^{238} = 4.5 \times 10^9$ years

x and y in above decay series are

A. 6.8

B. 9.6

C. 8.8

D. 8.6

Answer: d

Watch Video Solution

17. Uranium $(_{92}U^{238})$ decayed to $_{82}Pb^{206}$. The process is

$$_{92}U^{238} \xrightarrow[x\alpha, y\beta]{} \cdot {}_{82}Pb^{206}$$

$t_{1/2} of U^{238} = 4.5 \times 10^9$ 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. $4.5 \times 10^9 years$

B. ?

C. $13.5 \times 10^9 years$

D. $2.25 \times 10^9 years$

Answer: a

Watch Video Solution

18. Uranium $._{92}U^{238}$ decayed to $._{82}Pb^{206}$. They decay process is $._{92}U^{238} \underset{x\alpha}{\rightarrow} ._{82}\underset{y\beta}{Pb^{206}}$

$t_{1/2}$ of $U^{238} = 4.5 \times 10^9$ years

Atomic mass of U^{238} is 238.125 amu. Its packing fraction will be

A. 6.25

B. 0.125

C. 12.5

D. 5.25

Answer: d

Watch Video Solution

19. Uranium ($_{92}U^{238}$) decayed to $_{82}Pb^{206}$. The process is

$$_{92}U^{238} \xrightarrow[x\alpha, y\beta]{} \cdot\ _{82}Pb^{206}$$

$t_{1/2} of U^{238} = 4.5 \times 10^9$ 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

Watch Video Solution

20. 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. $1.34 \times 10^{9} years$

B. $2.01 \times 10^{9} years$

C. $1.41 \times 10^{9} years$

D. $4.47 \times 10^{9} years$

Answer: b

Watch Video Solution

21. 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.

Estimated isotopic ratio of Pb^{206}/U^{238} in the monazite sample will be

A. 0.166

B. 0.266

C. 0.366

D. 0.466

Answer: c

Watch Video Solution

22. 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 belonges to third group of actinide deries

B. Th^{232} is a fissile material

C. It is a fissile matrial

D. It belonges to 4n series

Answer: b

Watch Video Solution

23. A small amount of solution containing a radioactive nucleide A^x was administrated into the blood of a patient. The activity of the nucliede id 2×10^3dps. Its half life is 15 hours. After 5 hours a sample of the blood drawn out from the patient. It,s activity was 16 dpm per mL.

What is the volume of the 'blood' in the patient? (Log(1.26)=0.1)

A. 2.92 lit

B. 3.95 lit

C. 4.92 lit

D. 5.95 lit

Answer: d

Watch Video Solution

24. A small amount of solution containing a radioactive nucleide A^x was administrated into the blood of a patient. The activity of the nucliede id 2×10^3dps. Its half life is 15 hours. After 5 hours a sample of the blood drawn out from the patient. It,s activity was 16 dpm per mL.

What is the activity of the sample after another 5 hours time?(L og1.59=0.2)

A. 11.18 dpm per mL

B. 1.118 dpm per mL

C. 12.71 dpm per mL

D. 1.271 dpm per mL

Answer: c

Watch Video Solution

25. A small amount of solution containing a radioactive nucleide A^x was administrated into the blood of a patient. The activity of the nucliede id 2×10^3dps. Its half life is 15 hours. After 5 hours a sample of the blood drawn out from the patient. It,s activity was 16 dpm per mL.

Radioactive nuclide A^x decays by $\beta -$ emission (42%), $\beta +$ emission (58%) in the patient body.

Then half life value of $\beta -$ decary path is

A. 27.2 hours

B. 10.2 hours

C. 3.57 hours

D. 35.72 hours

Answer: d

Watch Video Solution

26. A small amount of solution containing a radioactive nucleide A^x was administrated into the blood of a patient. The activity of the nucliede id 2×10^3dps. Its half life is 15 hours. After 5 hours a sample of the blood drawn out from the patient. It,s activity was 16 dpm per mL.

At A^x emits α ray. how many helium atoms present in hours?

A. 1.558×10^8 atoms

B. 1.168×10^8 atoms

C. 7.79×10^7 atoms

D. 3.895×10 atoms

Answer: b

Watch Video Solution

27. A small amount of solution containing a radioactive nucleide A^x was administrated into the blood of a patient. The activity of the nucliede id 2×10^3 dps. Its half life is 15

hours. After 5 hours a sample of the blood drawn out from the patient. It,s activity was 16 dpm per mL.

If A^x decays and finally B^y unradioactive element obtained. After some time the sample contains $\%A^x$ and $10\,\% B^y$ gm atoms present in it. The time taken for the attainment of conversion is

A. 8.78 hours

B. 15.0 hours

C. 30.1 hours

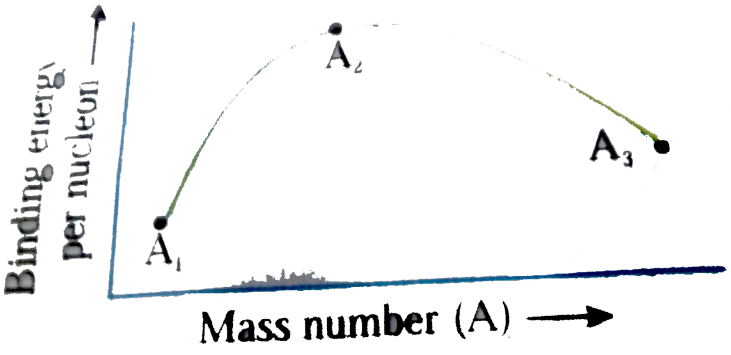
D. 40.2 hours

Answer: a

Watch Video Solution

28. A small amount of solution containing a radioactive nucleide A^x was administrated into the blood of a patient. The activity of the nucliede id 2×10^3dps. Its half life is 15 hours. After 5 hours a sample of the blood drawn out from the patient. It,s activity was 16 dpm per mL.

In the following graph, binding energy per nucleon is plotted against mass number (a). three elements A_1, A_2 and A_3 are located in the graph. Select the false statement about the graph.



A. elment A_2 is more stable

B. element A_3 is less stable than A_2

C. element A_1 is more stable than both A_2 and A_3

D. A_2 is metallic element

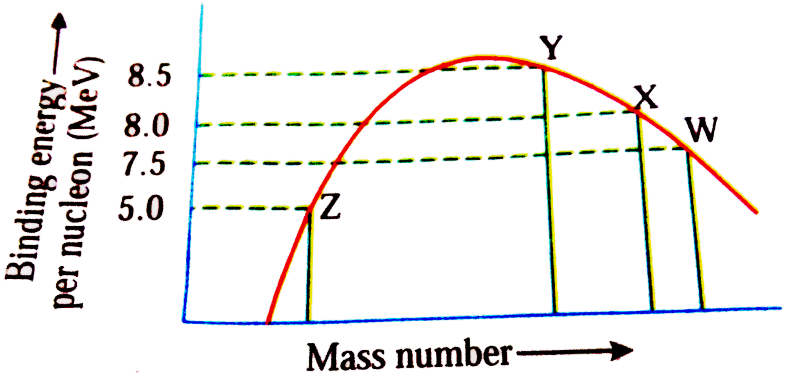
Answer: c

Watch Video Solution

29. A small amount of solution containing a radioactive nucleide A^x was administrated into the blood of a patient. The activity of the nucliede id 2×10^3dps. Its half life is 15 hours. After 5 hours a sample of the blood drawn out from the patient. It,s activity was 16 dpm per mL.

Binding energy per nucleon versus mass number for W,X,Y,Z

are indicated on the curve.



A. $Y \rightarrow 2Z$

B. $W \rightarrow X + Z$

C. $W \rightarrow 2Y$

D. $X \rightarrow Y + Z$

Answer: c

Watch Video Solution

Statement

1. S : When n/p ratio is high, nuclei emits $\beta -$ particles

E : The nuclear change is : $n \rightarrow p^{+} + e^{-} + \bar{v}$

A. Both S and E are correct and E is cporrect explaination of S

B. Both S and E are correct and E not correct explaination of S

C. S is correct but E is wrong

D. S is wrong but the E is correct

Answer: a

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2. S : ^{60}Co and ^{60m}Co are nuclear isomers

E : The two different nuclear energy state

A. Both S and E are correct and E is cporrect explaination of S

B. Both S and E are correct and E not correct explaination of S

C. S is correct but E is wrong

D. S is wrong but the E is correct

Answer: a

Watch Video Solution

3. S : Neutrons are best projectiles in nuclear reactions.

E : Being neutral, they can penetrate through nucleus easily.

A. Both S and E are correct and E is cporrect explaination of S

B. Both S and E are correct and E not correct explaination of S

C. S is correct but E is wrong

D. S is wrong but the E is correct

Answer: a

Watch Video Solution

4. S : ^{14}C is β-emiter.

E : Its electrons are loosely bonded in comparison to ^{12}C and ^{13}C

A. Both S and E are correct and E is cporrect explaination of S

B. Both S and E are correct and E not correct explaination of S

C. S is correct but E is wrong

D. S is wrong but the E is correct

Answer: c

Watch Video Solution

Single Answer

1. The half life period of radio active element is 140 days. After 560 days 1gm of element will reduce to

A. 0.5

B. 0.25

C. $1/8$

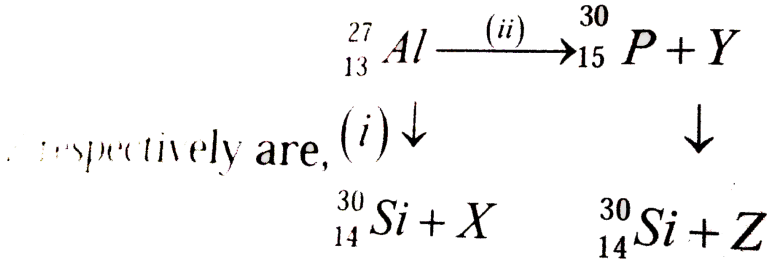
D. $1/16$

Answer: d

Watch Video Solution

2. Bombardment of aluminium by α-particle leads to its artifical 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

Watch Video Solution

3. The radioactive nuclide ${}_{90}{}^{234}Th$ shows two succesive β-decay followed by one α-decay. The atomic nuimber and mass number respectively of the resulting atom is

A. 90 and 230

B. 92 and 230

C. 92 and 234

D. 94 and 230

Answer: a

Watch Video Solution

4. Activity of 1g carbon obtained from ancient Egyptian wooden article is 3.5 count/min/g. Activity of 1 g carbon obtained from fresh wooden sample at Japan near to horishima Nagasaki is 15.5 counts/min/g. This fresh sample has 10% more activity than other fresh samples (not affected by any radiation) due to atom bomb blst during the second world war. Half life of C^{14} is 5770 years. Age of Egyptian wooden article is nearly

A. 2885 years

B. 5770 years

C. 11540 years

D. 12500 years

Answer: c

View Text Solution

5. The activity of radionuclide $\left({}^{100}X\right)$ is 6.023 curie. If the disintegration constatnt is $3.7 \times 10^{4}\text{sec}^{-1}$,the mass of radionuclide is

A. 10^{-14}g

B. 10^{-6}g

C. 10^{-15}g

D. 10^{-3}g

Answer: c

Watch Video Solution

6. The half life of a radio -isotope is four hour. If the initial mass of the isotope was 20g,the mass left after 24 hours undecayed is

A. 4.167 g

B. 2.084g

C. 3.125g

D. 1.042g

Answer: c

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7. A radioactive element gets spilled over the floor of a room. Its half-life period is 30 days. If the initial activity is

ten times the permissible value, after how many days will it be safe to enter the room ?

A. ~1000 days

B. ~300 days

C. ~10 days

D. ~100 days

Answer: d

Watch Video Solution

8. A sample of rock from moon contains equal number of atoms of uranium and lead $\left(t_{1/2}f \text{ or } U = 4.5 \times 10^9 \text{year}\right)$. The age of the rock would be

A. 4.5×10^9 year

B. 9×10^9 year

C. 13.5×10^9 year

D. 2.25×10^9 year

Answer: a

Watch Video Solution

9. 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. $5760 \times 15.2 - 7.6 year$

Answer: a

Watch Video Solution

10. One mole of a present in a closed vessel undergoes decay as ${}_{z}^{m}A \rightarrow {}_{Z-4}^{m-8}B + 2_{2}^{4}He$. 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

Answer: c

Watch Video Solution

11. If 50 gms of radio active substance has half life period of 14 hrs. 2 gms of the same substance will have half life of

A. 56 hrs

B. 3.5 hrs

C. 14 hrs

D. 28 hrs

Answer: c

Watch Video Solution

12. The half life period of a radioactive substance is 10 year. The amount of the substance decayed after 40 years would be

A. 0.25

B. 0.125

C. 0.9375

D. 0.0625

Answer: c

Watch Video Solution

13. One microgram of phosphorus-32 was injected into a live syetm for biological studies. The half life $_{15}P^{32}$ is 14.3 days,

calculate the time it will take the radioactivity to fall to 10% of the initial value

A. 47.52 days

B. 57.52 days

C. 100 days

D. 4.7 days

Answer: a

Watch Video Solution

14. 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

Watch Video Solution

15. If $_{92}U^{235}$ nucleus absorbes neutron and disintegrates $_{54}X^{139}$. $_{38}Sr^{95}$ and X. Then what will be the product X

A. α-particles

B. β-particle

C. 2-neutron

D. 3-neutron

Answer: c

Watch Video Solution

16. 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

Answer: d

Watch Video Solution

17. 75 atoms of radio active species are decayed in 2 half lives ($t_{1/2} = 1hr$) if 100 atoms are taken initially. Number of atoms decayed if 200 atoms are taken in two hours are

A. 75

B. 150

C. 50

D. 200

Answer: b

Watch Video Solution

18. 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

Answer: b

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19. An element group-III with atomic number 92 and mass number 238 undergoes decay of one α particle. The newly formed element belongs to

A. I

B. II

C. III

D. III

Answer: c

Watch Video Solution

20. In the following emission of $\alpha a -$ and $\beta -$ particle, groups G_1, G_2, G_3 and G_4 are

$$_{92}{}^{235}U \xrightarrow{-\alpha} A \xrightarrow{-\alpha} B \xrightarrow{-\alpha} C \xrightarrow{-\alpha} D$$

A. IB VIIA VIIIA IA

B. IB VIIA 0 IA

C. IIIB IB IIB IIIB

D. IIIB IA IIIB IIIB

Answer: d

Watch Video Solution

21. In a first order reaction, the concentration of the reactants is reduced to $25\,\%$ in one hour. The half-life

period of the reactions is

A. 2 hr

B. 4hr

C. 1/2 hr

D. 1/4 hr

Answer: c

Watch Video Solution

22. The decay constant of a radioactive sample is $'\lambda'$. The half-life and mean life of the sample are respectively

A. $\frac{1}{\lambda}, \frac{\text{in}2}{\lambda}$

B. $\frac{\text{in}2}{\lambda}, \frac{1}{\lambda}$

C. $\text{in}2, \frac{1}{\lambda}$

D. $\frac{\lambda}{\text{in}2}, \frac{1}{\lambda}$

Answer: d

Watch Video Solution

23. An element X decays first by positron emission and then two α-particles are emitted in succesive radioactive decay. If the product nucleus has a mass number 229 andd atomic number 89, the mass number and atomic number of element X are

A. 273,93

B. 237,94

C. 238,93

D. 237,92

Answer: b

Watch Video Solution

24. In the reaction represented by,

$$_{Z}{}^{A}X \rightarrow \cdot\, _{Z-2}{}^{A-4}Y \rightarrow \cdot\, _{Z-2}{}^{A-4}Y \rightarrow \cdot\, _{Z-1}{}^{A-4}K$$

the decays in the sequence are

A. α, β, γ

B. β, γ, α

C. γ, α, β

D. α, γ, β

Answer: d

Watch Video Solution

25. The number of β-particles emitted during the change ${}_{a}^{c}X \rightarrow {}_{d}^{b}Y$ is

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

B. $d + \left[\frac{a-b}{2}\right] + c$

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

D. $d + \left[\frac{a-b}{2}\right] - c$

Answer: c

Watch Video Solution

26. The decay constant of a radioactive substance is 0.173 $(year)^{-1}$. Therefore

A. nearly 63% of the radioactive substance will decay in $\left(\frac{1}{0.173} years\right)$

B. half life of the radio active substance is $\left(\frac{1}{0.173} years\right)$

C. One sixth of the radioactive substance will be left after 8 year

D. all the above statements are true

Answer: a

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27. 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. $(R_1T_1 - R_2T_2)$

B. $(R_1 - R_2)$

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

D. $\frac{(R_1 - R_2)T}{0.693}$

Answer: d

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

A. be double

B. be triple

C. remain one third

D. not change

Answer: b

Watch Video Solution

29. The intergrated rate equation is

$Rt = \log, C_0 - \log C_t$. The straight line graph is obtained

by plotting:

A. $tvs.\ \log C_t$

B. $\frac{1}{t} vs.\ \log C_t$

C. $tvs.\ C_t$

D. $\frac{1}{t} vs.\ 1/\mathrm{C}_t$

Answer: a

Watch Video Solution

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

A. 0

B. 2

C. 1

D. 3

Answer: d

Watch Video Solution

31. The numberr of neutrons emitted when ${}_{92}{}^{235}U$ undergoes controlled nuclear fission to ${}_{54}{}^{142}Xe$ and ${}_{38}{}^{90}Sr$ is

A. 2

B. 3

C. 5

D. 0

Answer: b

Watch Video Solution

32. Two radioactive elements X and Y half-live pf 50 and 100 minute respectiv ely. Intial sample of both the elements have same number of atoms. The ratio of the reamaining number of atoms of X and Y after 20 minute is:

A. 2

B. $1/2$

C. 4

D. $1/4$

Answer: d

Watch Video Solution

33. The time in which activity of an element is reduced to 90% of its original value is (given $t_{1/2} = 1.4 \times 10^{10} yr$)

A. $1.128 \times 10^{9} year$

B. $2.128 \times 10^{9} year$

C. $3.128 \times 10^{9} year$

D. None of these

Answer: b

Watch Video Solution

34. The half of ${}_{92}{}^{238}U$ against α-decay is 4.5×10^9year. The time taken in year for the decay of $\frac{15}{16}$ part of the isotope is

A. 9.0×10^9

B. 1.8×10^{10}

C. 4.5×10^9

D. 2.7×10^{10}

Answer: b

Watch Video Solution

35. Two isotopes P and Q atomic weight 10 and 20, respectively are mixed in equal amount by weight. After 20

days their weight ratio is found to be $1:4$. Isotope P has a half-life of 10 days. The half-life of isotope Q is

A. Zero

B. 5 day

C. 20 day

D. Infinite

Answer: c

Watch Video Solution

36. A rock is found to contain U-238 and Pb-206 in the ratio of 3 : 2. If $t_{1/2}$ of U-238 is 4.5×10^{-9} years. Calculate the age rock?

A. $3.71 \times 10^{-9} years$

B. $3.71 \times 10^{9} years$

C. $31.7 \times 10^{9} years$

D. $3.71 \times 10^{9} days$

Answer: b

Watch Video Solution

37. Half life of a radioactive substance is 60 min. After 3 hours, the fraction of total number of atoms that have decayed would be

A. 0.125

B. 0.875

C. 0.085

D. 0.25

Answer: b

Watch Video Solution

38. The activity of a sample of radioactive material A_1 at time t_1 and A_2 at time $t_2(t_2 > t_1)$. Its mean life is T.

A. $\frac{t_2 - t_1}{\text{in}(R_1 / R_2)}$

B. $(t_2 - t_1)\text{in}(R_1 / R_2)$

C. $\frac{(t_2 - t_1)}{\text{in}(R_2 / R_2)}$

D. $\frac{\text{in}(R_2 / R_2)}{(t_2 - t_1)}$

Answer: a

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39. An old chair of wood show ${}_6C^{14}$ activity which is 80% of the activity which is 80% of the activity found today. Calculate the age of the old chair of wood.

$(t_{1/2} of.\ {}_6C^{14} = 5770 yr)$?

A. $t = \frac{2.303}{5770} \log \frac{100}{80}$

B. $t = \frac{5770}{0.301} \log \frac{100}{80}$

C. $t = \frac{5770}{0.693} \log \frac{100}{80}$

D. $t = \frac{0.693}{5770} \log \frac{100}{80}$

Answer: b

Watch Video Solution

40. For nuclide ${}_{Z}X^{A}$, which of the following changes snot take place in respective decay:

A. Both (A) and (Z) decreases in α-decay

B. Both (A) and (Z) do not change in γ-decay

C. (A) does not change but (Z) decreases by one unitun positrondecay or k-electron capture

D. Both (A) and (Z) increases in β-decay

Answer: 4

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Multi Answer

1. A radioactive element A decays by the sequuence with the half-lives given below :

$$A \xrightarrow[30\,\min]{\alpha} B \xrightarrow[2days]{2\beta} C$$

Which of the following statements about this correct?

A. The mass number of B is greater than A

B. After two jhours, lesss than 10% of the initial A is left

C. maximum amount of B present at any time is less than 50% of the initial amount bof A

D. The atomic numbers of A and C are same

Answer: b,d

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2. Which of the following statements is/are correct?

A. the decay constant is independent of external factor like temperature and pressure

B. nuclear isomers have same numbers of protons and neutrons

C. the decay constant is indepndent of the amount of substance used

D. the value of decay constant generally decreases with rise in temperature

Answer: b,c,d

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3. It is observed that only 0.39% of the original radioactive sample remains ndecayed after eighrt hours. Hence:

A. the half-life of that substance is 1 hour

B. the mean life of the substance is $\frac{1}{\log_e 2} hour$

C. decay constant of the substance is $(\log_e 2) hour^{-1}$

D. if the number of the radioactive nuclei of this substance at a given instant is 10^8 then the number left after 30 min would be $\sqrt{2} \times 10^9$

Answer: a,b,c

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4. Which of the following is/are correct for nuclear reactor?

A. A typical fission is represented by

$$_{92}{}^{235}U = {}_{0}{}^{1}n \rightarrow {}_{54}{}^{140}Ba + {}_{36}{}^{93}Kr + \text{ Energy}$$

B. Heavy water (D_2O) is used as moderator in preference to orduinary water (H_2O) because hydrogen may capture neutrons, while D would not do that

C. Cadmium rods increse the reactor power when they go in and decrease when they go outwards

D. Slower neutrons are more effective in causing fission than faster neutrons in the case of $_{235}U$

Answer: b,d

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5. In the nuclear transmutation

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

A. (γ,n)

B. (p,D)

C. (n,D)

D. (γ,p)

Answer: a,b

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6. 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 isodiaphers

B. A and C are isotones

C. A nand D are isotopes

D. B,C and D are isobars

Answer: a,c,d

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7. Which of the following is/are correct?

A. 1 Fermi=10^3dps

B. 1 curie=3.7×10^{10} dps

C. 1 rutherford $=10^6$ dps

D. 1 becquerel=1 dps

Answer: c,d

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8. Which of the folowing is/are correct when a nuclide of mass number (A) and atomic number (Z) undergoes radioactive process?

A. Both A and Z decrease, the process is called α-decay

B. A remains unchanged and Z decreases by 1. The process is called $\beta^{\oplus}$ or positron decay or K^{-} electron capture.

C. Both A and Z increases, the process is called nuclear isomerism

D. Both A and Z increases, the process is called nuclear isomerism

Answer: a,b,c

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9. β-decay from a radioactive nuclide leads to

A. α-decay

B. β-decay

C. Positron decay

D. K-electron decay

Answer: a,b

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10. Pick out the correct statements from among the following:

A. One gram each of radium element and $RaSO_4$ will have the same activity

B. The beat particle emmited by a radioactive element is from valance shell of the atom.

C. Nuclear isomers will have the same mass numbers as well as atomic numbers

D. The fraction decayed during 'n' half lives is $\frac{2^n-1}{2}{}^n$

Answer: c,d

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11. The nuclear reactions accompanied with emission of neutron (s) are

A. ${}_{13}{}^{27}Al + {}_{2}{}^{4}H \rightarrow {}_{15}{}^{30}P$

B. ${}_{12}{}^{6}C + {}_{1}{}^{1}H \rightarrow {}_{7}{}^{13}N$

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

D. ${}_{96}{}^{241}Am + {}_{2}{}^{4}He \rightarrow {}_{97}{}^{244}Bk$

Answer: a,d

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12. In case of radiactive radiations:

A. some are deviated by electric and magnetic field

B. some carry negative charge

C. all are electronegative waves

D. all produce X-rays when suddenly stopped

Answer: a,b

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13. ${}_{92}{}^{238}U$ is the element of IIIB group, it undergoes decay as follows, ${}_{92}{}^{238}U \xrightarrow{-\alpha} A \xrightarrow{-\alpha} B \xrightarrow{-\beta} C$

Which of the following statement is/are correct?

A. A will be of IIIB group

B. A will be IB group

C. B will of IIA (alkaline earth metal group)

D. C is the isotope of ${}_{92}{}^{238}U$

Answer: a,c

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14. 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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15. From the following equations pick out the possible nuclear fusion reaction:

A. ${}_6{}^{13}C + {}_1{}^1H \rightarrow {}_6{}^{14}C + {}_1{}^0e + 4.3MeV$

B. ${}_6{}^{12}C + {}_1{}^1He \rightarrow {}_7{}^{13}N + 2MeV$

C. ${}_7{}^{14}C + {}_1{}^1He \rightarrow {}_8{}^{15}O + 7.3MeV$

D.

${}_{92}{}^{235}U + {}_0{}^1n \rightarrow {}_{54}{}^{140}Xe + {}_{38}{}^{94}Sr + {}_0{}^1n + \gamma + 200MeV$

Answer: b,c

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Matrix Match

1. Match column I with column II

Column I	Column II
(A) ${}_{11}Na^{23} + \ldots\ldots \rightarrow {}_{11}Na^{24} + \ldots\ldots$	(p) ${}_{0}n^{1}$
(B) ${}_{2}{}_{1}H^{3} \rightarrow {}_{2}He^{4} + 2\ldots\ldots$	(q) ${}_{1}H^{1}$
(C) ${}_{92}U^{238} \rightarrow {}_{90}Th^{234} + \ldots\ldots$	(r) ${}_{2}He^{4}$
(D) ${}_{29}Cu^{63} \rightarrow {}_{28}Ni^{63} + \ldots\ldots$	(s) ${}_{1}e^{0}$
	(t) ${}_{1}H^{2}$

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2. Match the following columns

Column -I	Column -II
A) $^{40}_{20}Ca$	p) Unstable, α – emitter
B) $^{133}_{53}I$	q) Unstable, β – emitter
C) $^{121}_{53}I$	r) Unstable, positron emitter
D) $^{232}_{90}Th$	s) Stable

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3. Match the following columns

Column -I	Column -II
A) Isotones	p) $_{91}Pa^{234}$ and $_{90}Th^{234}$
B) Isobars	q) $_{6}C^{12}$ and $_{6}C^{14}$
C) Isotopes	r) $_{19}K^{39}$ and $_{9}F^{19}$
D) Isodiaphers	s) $_{18}Ar^{39}$ and $_{19}K^{40}$

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4. Match the following columns

Column-I	Column-II
A) 2/3 rd life	p) 63.2% decay
B) Average life	q) .75% decay
C) $1/\lambda$	r) $2 \times t_{1/2}$
D) Ten times of half life	s) 99.9% decay
E) X-rays	t) Radiation undeviated in electric field

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5. Match the following columns

Column I	Column-II
A) ${}_4Be^{9} + {}_2He^{4} \rightarrow {}_6C^{12} + \ldots$	p. ${}_2He^{4}$
B) ${}_6C^{12} + \ldots \rightarrow {}_5Be^{10} + {}_2He^{4}$	q. ${}_0n^{1}$
C) ${}_7N^{14} + \ldots \rightarrow {}_8O^{17} + {}_1H^{1}$	r. ${}_1D^{2}$ d.
D) ${}_{20}Ca^{40} + \ldots \rightarrow {}_{19}K^{37} + {}_2He^{4}$	s. ${}_1H^{1}$
E) ${}_{83}Bi^{209} + {}_2He^{4} \rightarrow {}_{85}At^{211} + \ldots$.	t. ${}_1T^{3}$

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6. Match the following columns

Column I	Column II
A) One α particle	p.Isobar
B) One α and two β particles	q.Isotope.
C) One β -particle	r.Isodiapher
D) γ - radiation	s.Atomic number reduced by two and mass number by four
	t.Nuclear de-excitation

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7. Match the following columns

Column -I	Column -II
A) N / N_0	p) $1/\lambda$
B) t_{av}	q) a^0
C) $t_{1/2}$	r) $e^{-\lambda t}$
D) $N_0 - N$	s) $\frac{N_0\left(2^n - 1\right)}{2^n}$

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8. Match the following columns

Column -I	Column -II
A) co_2 and N_2O	p) Isodiaphers
B) U_A and U_Z	q) Iostope
C) ${}^{Z}_{A}p$ and ${}^{Z-4}_{A-2}Q$	r) Nuclear isomers
D) ${}^{2}_{1}H$ and ${}^{3}_{2}He$	s) Isomers

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9. Match the following columns

Column -I	Column -II
A) Z increases	p) α – *emission*
B) n/p increases	q) β – *emission*
C) n/p decreases	r) β^+ – *emission*
D) X- ray emission	s) K- electron capture
E) Z decreases	

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Integer

1. Calculate difference between number of a β particles emmited in the nuclear reaction

$_{92}U^{23} \rightarrow {}_{82}Pb^{206}$

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2. How many α-particles will be emmited when ${}_{90}Th^{234}$ change into ${}_{84}Po^{218}$?

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3. After 20 min, the amount of certai radioactive substance disintegrate was 15/16 original amount. What is the half-life ofg the radioactive substance?

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4. At 27° C 100mL of 0.1 M radium chloride is 10^{-3} Curies active. The activity of 500mL of 0.2 M radium phosphate

solution at 77° C is $x \times 10^{-2}$ Curie then 'x' is

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5. Iiodine -131 is a radioactive isdotpe. If 1.0 mg of ^{131}I has an activity of 4.6×10^{12}Bq. What is the half-life of ^{131}I (in days)

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6. The average life of a radioactive element is 7.2 min. Calculate the time travel (in min) between the stages of 33.33% and 66.66% decay

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7. A,B and C are isodiaphers while C,D and E are isobers. Calculate the difference of protons between and $E_{82}{}^{206} \cdot A \to B \to C \to D \to E$

Given: Isodiaphers and isobers are formed in succesive α and $(\beta -)$ emmision respectively.

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8. A radioactivity sample had an initial activity of 56dpm. After 69.3 minutes, it was found to have an activity of 28dpm, the number of atoms in a sampple having an activity of 10dpm, is 10^x. The value of x is

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9. Na^{22} has half life of 2.68 years. It decays both by positron emission and electron capture with a ratio of 86% of the former to 14% of the later. The half life for positron emission in years (nearly) is

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10. In how many ways among the following given, a nuicleus with high n/p ratio is expected to decay α-decay,β-decay, positron decay,K-electron capture.

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11. A mixture of Pu^{239} and Pu^{240} has specific activity of 6×10^9dps. The half lves of isotopes are 2.44×10^4 and

6.58×10^3years respectively. The percent of Pu^{239} in the mixture is x/10% (nearly). Then 'x' is

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12. How many types of particles among the following are emitted during the decay of sulphur-35 nucleus. β-emission, e^- capture,positron emission,neutron emissipon

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13. Assuming the age of the earth to be 10^{10} yaers, the perccentage of original amount of U^{238} is still in existance on earth is x/10% (nearly)($T_{1/2} of U^{238} is 4.5 \times 10^9$years). Then 'x' is

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14. The periosic table consists of 18 groups. An isotope of copper, on bombardment with protons, undergoes a nuclear reaction reaction yielding eklement X as shown as below. To which group, element X belongs in the periodic table?

$$_{29}{}^{63}Cu + {}_{1}{}^{1}H \rightarrow 6_{0}{}^{1}n + \alpha + 2_{1}{}^{1}H + X$$

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15. Assertion (A) : Nucleus of the atom does not contain electrons,yet it ewmits β-particles in the form electrons

Reason (R) : In the nucleus, protons and neutrons exchange mesons frequently

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.

Answer: c

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16. Assertion (A) : γ-rays have very high penetrating power.

Reason (R) : γ-rays are high energy elctromagnetic radiations

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.

Answer: a

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17. 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.

Answer: a

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18. 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.

Answer: c

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19. 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.

Answer: c

20. Assertion (A) : K-shell electron capture is detected by anylizing the wavelength of X-ray emmited

Reason (R) : The wavelength of X-ray is characterstics of the daughter elment and not the parent element

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.

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 II A group

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.

Answer: b

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22. STATEMENT-1 : Specific activity of the same radioactive substance is same for 10g radioactive substance as well as 50 g radiactive subsatnce.

STATEMENT-2 : Specific activity of a radioactive subsance is its activity per g.

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.

Answer: a

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23. $_{92}U^{238}$ distinguish to give 4α,6β-particles. The atomic number of daughter element is 10x. X is

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24. 100 mL of a saturated solution of M_2SO_4 is giving 24 disintegrations per hour due to radio active metal "M" $\left(\lambda = 2 \times 10^{-17} hour^{-1}, N_0 = 6 \times 10^{23} a\right)$. If the solubility product of the salt is $\mathrm{x} \times 10^{-3y}$. What is (x+y)?

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25. ${}_{92}U^{235}$ nucleus absorbes a neutron and disintegrate into ${}_{54}Xe^{139}$, ${}_{38}Sr^{94}$, and x neutrons x is

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26. The half life of C-14 is 5600 years. A sample of freshely cut wood from a tree contains 10 mg of C-14. The amopunt left in the sample after 50000 years is (a-x) $\times$ 100. The value of $(a-x) \times 100$ is

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27. The charge of γ-particle is""_""_""_""_""_""_""_""_""_""_

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28. Calculate the number of neutrons emitted when $._{92}U^{235}$ undergoes controlled nuclear fission to $._{54}Xe^{142}$ and $._{38}Sr^{90}$.

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