CHEMISTRY

BOOKS - CENGAGE CHEMISTRY (HINGLISH)

NUCLEAR CHEMISTRY

Illustration

1. What may be the place of a doughter element in the periodic table, which is obtained after the nuclide $._{84}Po^{218}$ undergoes, an α-emission followed by two successive $\beta-$ emission?

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2. In the decay series $._{92}U^{238}$ to $._{82}Pb^{206}$, how many α-paritcles and how many $\beta^{\ominus}$-particles are emitted?

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3. 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) $Abete^{\oplus}$-decay

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

A. an α decay

B. an β + decay

C. a γ decay

D. a K capture

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4. Arrange in increasing order of:

a. The mass of α, β, and γ

b. The penetration power of α, β, and γ

c. The speed of α, β, and γ

d. The inoization capacity of gases of α, β, and γ

A. The mass of α β and γ

B. The penetration of α β and γ

C. The speed of α β and γ

D. The ionization capacity of gases of α β and γ

Answer: a) $\alpha > \beta > \gamma$ **b)** $\gamma > \beta > \alpha$ **c)** $\gamma > \beta > \alpha$ **d)** $\alpha > \beta > \gamma$

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5. 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. a. Lesser kinetic energy

B. b. Higher kinetic energy

C. c. Lesser penetration power

D. d. Higher penetration power

Answer: A

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

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7. The atomic mass of thorium 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 mass and atomic number of the atom?

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

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

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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9. How many moles of helium are produced when 1 mole of $._{92}U^{238}$ disintegrate into $._{82}Pb^{206}$?

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10. How many α-and β-particle will be emitted when $._{98}Th^{234}$ change into $._{84}Po^{218}$?

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11. Calculate the number of α- and β-particles emitted when $._{92}U^{238}$ into radioactive $._{82}Pb^{206}$.

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12. If a $._{92}U^{235}$ nucleus upon being struck by a neutron changes to $._{56}Ba^{145}$, three neutrons and an unknown product. What is the unknown product?

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13. $._{90}Th^{232}$ belongs to III group. It items an α-particle. The daughter element belongs to

a. I group b. II group

III. Group d. IV group

A. a. I group

B. b. II group

C. c. III Group

D. d. IV group

Answer: b. II group

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14. A heavier element containously emits α-and β-particles. The finally stable element may belong to:

a. 14th group b. 16th group

c. 10th group d. 12 th group

A. a. 14th group

B. b. 16th group

C. c. 10th group

D. d. 12 th group

Answer: a. 14th group

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15. Radioactive disintegratin 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 of periodic table for RaC.

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16. An atom has atomic mass 232 and atomic number 90. During the course of disintegration, it emits 2 β-particles and few β-particles 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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17. $._{92}U^{238}$ is a natural α-emitter. After α-emission the residual nucleus U_{X1} in turn emits a β-particle to produce another nucleus U_{X2}. Find out the atomic number and mass number of U_{X1} and U_{X2}.

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18. 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. a. K-electron capture

B. b. Nuclear transition from higher to lower energy

C. c. Presence of greater number of neutrons than protons

D. d. Presence of greater of protons than neutrons

Answer: b. Nuclear transition from higher to lower energy

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19. In which of the following transformers, the β-particles are emitted?

a. Proton ot neutron b. Neutron to proton

c. Proton to proton d. Neutron to neutron

A. a. Proton ot neutron

B. b. Neutron to proton

C. c. Proton to proton

D. d. Neutron to neutron

Answer: B

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20. During the transformation of $._c X^a$ to $._d Y^b$ the number of β-particles emitted are

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

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

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

B. b. $\frac{a-b}{c}$

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

D. d. $2c-d+a=b$

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

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21. Which of the following element is an isodiapher of $._{92} Pb^{212}$?

a.$_{92} U^{235}$ b. $._{90} Th^{231}$ c. $._{83} Bi^{209}$ d. $._{91} Pa^{231}$

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

B. b. $._{90} Th^{231}$

C. c. $._{83} Bi^{209}$

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

Answer: b. $._{90} Th^{231}$

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22. In the radioacitve decay

$$\cdot_{Z} X^{A} \rightarrow \cdot_{z+1} Y^{A} \rightarrow \cdot_{z-1}^{A-4} \rightarrow \cdot_{z-1} Z^{\cdot A-4}$$

The sequence of emission is

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

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23. In the sequence of the reaction

$A \xrightarrow{-\beta} B \xrightarrow{-\beta} C \xrightarrow{-\alpha} D$, what is the relationship between D and A?

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24. The radiationns from a naturally occuring radioactive substance as seen after deflection by a magnetic field in one direction are

Only α-rays b. Only β-rays

c. Both α-and $\beta -$ rays d. Either α-or β-rays

A. a.Only α-rays

B. b. Only β-rays

C. c. Both α-and $\beta -$ rays

D. d. Either α-or β-rays

Answer: d. Either α-or β-rays

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25. Which of the following radiations is most easily stopped by air?

a. α-rays b.γ-rays c. β-rays d.X-rays

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26. K-capture

a. Refers to capture by other nucleus of an electron from K-shell

b. Results in decrease in Z

c. Is of the type

$._{56} Ba^{133} + ._{-1} e^{0} \rightarrow ._{55} Cs^{133} \_$ γ-rays d. All of these

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27. The decay of a neutron to a proton also yields

a. $._{-1}e^{0}$ b. $._{+1}e^{0}$ c. $._{1}H^{2}$ d. $._{2}He^{4}$

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28. What may be the new neutron and proton ratio after a nuclide $._{92}U^{238}$ loses an α-particles?

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29. The atomic mass of F^{19} is 18.9984 m_u. If the masses of proton and neutron are $1.0078 m_u$ and $.0087 m_u$. Respectively, calculate the binding energy per nucleon (ignore the mass of electrons). $(1 m_u = 931) MeV)$

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30. Which of the following causes the emission of X-rays?

A. Electron capture

B. γ emission

C. α emission

D. β emission

Answer: A

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31. Calculate the packing fraction of Ar^{40} (isotopic weight of $Ar = 39.96238$).

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32. $.^{60m} Co \rightarrow .^{60} Co$ emits γ-radiations of wavelength 3×10^{-10}. Assuming each nuclei emits one wavelength, with what mass per mole of two nuclei differ?

a. $4.43 \times 10^{-9} g$ b. $4.43 \times 10^{-4} g$

c. $4.43 \times 10^{-3} g$ d. $4.43 g$

A. a. $4.43 \times 10^{-9} g$

B. b. $4.43 \times 10^{-6} g$

C. c. $4.43 \times 10^{-3} g$

D. d. $4.43g$

Answer: **b.** $4.43 \times 10^{-6}g$

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

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

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34. To which of the periodic table does the last number of following series belong?

a. $._{94} Pu^{239}$ b. . $(58)_C e^{140}$ c. $._{84} Po^{218}$

A. a. $._{94} Pu^{239}$

B. b. . $._{58} Ce^{140}$

C. c. $._{84} Po^{218}$

D.

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35. Calculate the neutron - proton ratio for each of the following radioactive nuclides.

a. $._{6} C^{14}$ b. $._{82} U^{238}$ c. $._{82} U^{232}$

A. a. $._{6} C^{14}$

B. b. $._{82}U^{238}$

C. c. $._{82}U^{232}$

D.

Answer: a 1.33 b 1.54 c 1.58

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36. Show that a mass of 1.00 amu is equivalent to 931.5 MeV.

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37. Calculate the mass defect and binding energy per nucleon for an alpha particle (containing two protons and two neutrons) whose actual mass is 4.0028 amu (mass of proton = 1.00759 amu, mass of nuetron = 1.00898 amu).

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38. Which of the following are radioacitve?

a. $._{48}\ Cd^{114}$ b. $._{49}\ In^{114}$ c. $._{50}\ Sn^{114}$

A. a. $._{48}\ Cd^{114}$

B. b. $._{49}\ In^{114}$

C. c. $._{50}\ Sn^{114}$

D.

Answer: b. $._{49}\,In^{114}$

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39. Which of the following is least stable?

a. $._{20}\,Co^{40}$ b. $._{13}\,Al^{30}$ c. $._{50}\,Sn^{119}$ d. $._{25}\,Mn^{55}$

A. a. $._{20}\,Co^{40}$

B. b. $._{13}\,Al^{30}$

C. c. $._{50}\,Sn^{119}$

D. d. $._{25}\,Mn^{55}$

Answer: b. $._{13}\,Al^{30}$

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40. Which of the following nuclides are $\beta^{\ominus}$ and $\beta^{\oplus}$ emitter, and stable nuclides?

$._{20}Ca^{49}$ b. $._{80}Hg^{195}$ c. $._{82}Pb^{208}$ d. $._{5}B^{8}$

e. $._{67}Ho^{150}$ f. $._{13}Al^{30}$ e. $._{50}Sn^{120}$ g. $._{36}Kr^{94}$

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41. An alkaline earth metal is radioactive. It and its daughter element decay by emitting 3 α- particles in succession. In what group should the resulting element be formed?

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42. If a nuclide of an element in group I A (1st group) undergoes radioactive decay be emitting $\beta^{\oplus}$, what will be the periodic group of the resulting element?

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43. Which is more unstable of each of the following pairs, and in each case what type of process could the unstable nucleus undergo?

a. $._6 C^{16}$ b. $._9 F^{18}, ._{10} Ne^{18}$

A. a. $._6 C^{16}$,$._7 N^{16}$

B. b. $._9 F^{18}$ $._{10} Ne^{18}$

C.

D.

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44. To what stable isotope $._{103}Lr^{257}$ decay?

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45. Which one of the following processes $\alpha, \beta^{\oplus}, \beta^{\oplus}$, or K-capture cause

a. An increase in atomic number

b. A decrease in atomic number

c. Emission of X-rays

A. a. An increase in atomic number

B. b. A decrease in atomic number

C. c. Emission of X-rays

D.

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46. Out of the four series, which series distingrates in a least branching manner?

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47. IN radioactive series, an inner transition element $._{92}U^{238}$ loses one α-particles and one β-particle to produce a very unstable daughter nuclei $._{91}Pa^{234}$ with half life 1.14 min. Find out the displacement in group due to these emissions.

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48. Predict by what mole (s) spontaneous radioactive decay will proceed for each of the following unstable isotopes:

A. a. $._{2}He^{6}$

B. b $._{9}Fe^{18}$

C. c. $._{93}Np^{241}$

D. d. $._{91}Po^{235}$

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49. Calculate $t_{3/2}$ for Am^{241} in years given that it emits $1.2 \times 10^{11}\alpha$-particles per gram per second

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50. How many atoms of $0.1g$-atom of a radioacitve isotope $._{Z}X^{A}$ (half = 5 days) will decay during the 11th day?

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51. 10 g-atoms of an α-active radioisotope are disintegrating in a sealed container. In one hour the helium gas collected at STP is $11.2cm^2$. Calculate the half life of the radioisotope.

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

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53. A counter rate metre is used to measure the activity of a radioactive sample. At a certain instant, the count rate was recorded as 400 counters per minute. Five minutes later, the count recorded was 200 counts per min. Calculate the decay and half-period of the sample.

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54. $1g$ of $._{79}Au^{198}(t_{1/2}=65hr)$ decays by β-emission to produce stable Hg.

a. Write nuclear reaction for process.

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

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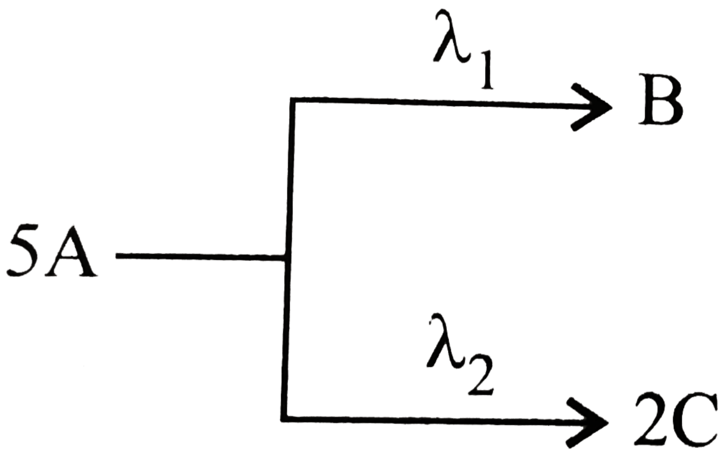
55. A follow parallel path of first-order reactions giving B and C as

If the initial concentration of A is $0.25M$, calculate the concentration of C after 5 hr of reaction.



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56. The activity of the hair of an Egyptian mummy is 7 disintegration $\min^{-1}$ of C^{14}. Find an Egyptian mummy. Given $t_{0.5}$ of C^{14} is 5770 year and disintegration rate of fresh sample of C^{14} is 14 disintegration $\min^{-1}$.

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

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58. Which among the following relations is correct?

A. a)$t_{3/4} = 2t_{1/2}$

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

C. c)$t_{3/4} = \frac{1}{2}t_{1/2}$

D. d)$t_{3/4} = \frac{1}{3}t_{1/2}$

Answer: A

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59. The half-life period of radium is 1600 years. Calculate the disintegrationd of radium.

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60. A radioactive element has half life of 4.5×10^{9} years. If $80g$ of this was taken, the time taken for it to decay to $40g$ will be

a. 2.25×10^{9} years b. 4.50×10^{9} years

c. 6.75×10^{9} years d. 8.75×10^{9} years

A. a. 2.25×10^{9} years

B. b. 4.50×10^{9} years

C. c. 6.75×10^{9} years

D. d. 8.75×10^{9} years

Answer: B

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61. The half-life period of a radioactive element is 140 days. After 560 days, $1g$ of the element will reduce to

a. $0.5g$ b. $0.25g$ c. $1/8g$ d. $1/16g$

A. a. $0.5g$

B. b. $0.25g$

C. c. $1/8g$

D. d. $1/16g$

Answer: d. $1/16g$

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62. A radioactive isotope decays at such a rate that after 96 min, only $1/8th$ of the original amount remains. The value of $t_{1/2}$ of this nuclide is

a. 12 min b. 32 min c. 24 min d. 48 min

A. a. 12 min

B. b. 32 min

C. c. 24 min

D. d. 48 min

Answer: b. 32 min

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63. 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

A. a. 64

B. b. 20

C. c. 46

D. d. 80

Answer: a. 64

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64. A radioactive substance has a half life of 5 days. After 20 days it was foundd the $3g$ of the isotope left in the container. The initial weight of the isotope was

a48 gb. 36 gc. 18 gd. 24 g`

A. a48 g`

B. b. $36g$

C. c. $18g$

D. d. $24g$

Answer: a**48 g`**

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65. The half life of radium (226) is 1620 years.

The time takend to convert $10g$ of radium to $1.25g$ is

a. 810 years b. 1620 years

c. 3240 years d. 4860 years

A. a. 810 years

B. b. 1620 years

C. c. 3240 years

D. d. 4860 years

Answer: d. 4860 years

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66. If equal numer of atoms of two radioactive elements are considered, the most dangerous would be the one with a half life of?

a. 4.0 million years b. 100 years

c. 0.01 second d. 1 second

A. a. 4.0 million years

B. b. 100 years

C. c. 0.01 second

D. d. 1 second

Answer: c. 0.01 second

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67. Radium has atomic weight 226 and half life of 1600 years. The number of disintegrationsd produced per second from one gram is

a. 4.8×10^{10} b. 3.7×10^{20}

c. 9.2×10^{6} d. 3.7×10^{8}

A. a. 4.8×10^{10}

B. b. 3.7×10^{20}

C. c. 9.2×10^{6}

D. d. 3.7×10^{8}

Answer: b. 3.7×10^{20}

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68. A sample of radioactive isotope with a half life of 20 days weighs $1g$. After 40 days the weight of the remaining elements is

a. $0.5g$ b. $0.0g$ c. $0.25g$ d. $1/6g$

A. a. $0.5g$

B. b. $0.0g$

C. c. $0.25g$

D. d. $1/6g$

Answer: c. $0.25g$

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69. One gram of Ra^{226} has an activity of nearly $1Ci$the half life of Ra^{226} is

a. 1500 years b. 300 years

c. 1582 years d. 200 years

A. a. 1500 years

B. b. 300 years

C. c. 1582 years

D. d. 200 years

Answer: c. 1582 years

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70. A chemist prepares $1.00g$ of pure $._{6}C^{11}$. This isotopes has half life of 21 min, decaying by the equation:

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

b. What is the activity and specific activity of $._{6}C^{11}$ at start?

c. How much of this isotope $\left(._{6}C^{11}\right)$ is left after 24 hr its preparation?

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71. A radioactive isotope Cs^{137} has a half life period of 30 years. Starting with $1mg$ of Cs^{137} how much would remain after 120 years?

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72. 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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73. A radioisotope has $t_{1/2} = 3$ years. After a given amount decays for 12 years, what fraction of the original isotope remains?

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

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75. 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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76. Calculate the average life of a radioactive substance whose half-life period is 100 years.

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

a. $10^{-6}g$ b. $10^{-8}g$ c. $10^{-20}g$ d. $10^{-15}g$

A. a. $10^{-6}g$

B. b. $10^{-8}g$

C. c. $10^{-20}g$

D. d. $10^{-15}g$

Answer: d. $10^{-15}g$

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78. The time of decay for the nuclear reaction is given by $t = 5t_{1/2}$. The relation between average life τ and time of decay (t) is given by

a. $3\tau \text{In} 2$ b. $4\tau \text{In} 2$ c. $5\tau \text{In} 2$ d. $6\tau \text{In} 2$

A. a. $3\tau \text{In} 2$

B. b. $4\tau \text{In} 2$

C. c. $5\tau \text{In} 2$

D. d. $6\tau \text{In} 2$

Answer: c. $5\tau \text{In} 2$

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79. 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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80. One mole of A present in a closed vessel undergoes decays as:

$._{Z}A^{m} \rightarrow ._{Z-4}B^{m-8} + 2(._{2}He^{4})$

What will be the volume of helium gas collocted at STP afterd 20 days $(t_{1/2}\text{of}A=10\text{ days})$?

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81. One mole of X present in a closed vessel undergoes decays as:

$._{Z}X^{A} \rightarrow ._{Z-2}Y^{A-4} + \left(._{2}He^{4}\right)$

What will be the volume of helium gas collected as $SATP$ and STP (1 bar pressures, $273K$ temperature) after 20 days $\left(t_{1/2}\text{of}A = 10\text{ days}\right)$?

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

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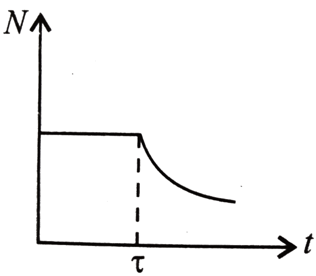
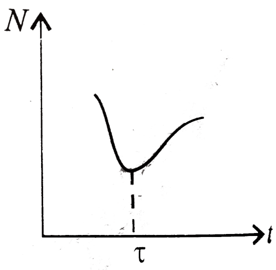
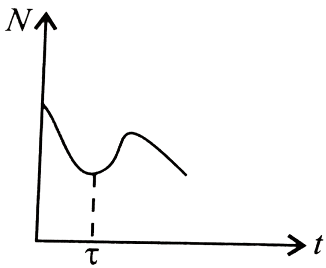
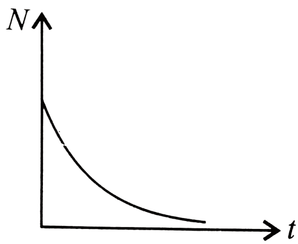
83. A radioactive substance consists of two distinct having equal number of atoms initially. The mean products in both cases are stable. A plot is made of total number of radioactive nuclei as a function of time. Which of the following figures best represents the form of this plot?

a. 

b. 

c. 

d. 

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84. In a smaple of radioactive material, what fraction of the initial number of active nuclei will remain undisingrated after half of a half-life of the sample?

a. $\frac{1}{4}$ b. $\frac{1}{2\sqrt{2}}$ c. $\frac{1}{\sqrt{2}}$ d. $\sqrt{2}-1$

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

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

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

D. d. $\sqrt{2}-1$

Answer: c. $\frac{1}{\sqrt{2}}$

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85. If 75% of a frist-order reaction is completed in 32 min, than 50% of the reaction would complete in?

a. 24 min b. 16 min c. 8 min d. 4 min

A. a. 24 min

B. b. 16 min

C. c. 8 min

D. d. 4 min

Answer: b. 16 min

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86. $1.0g$ of a radioactive isotope left $125mg$ after 24 hr.

The half-life period of the isotope is

a. 8 hr b. 24 hr c. 6 hr d. 4 hr

A. a. 8 hr

B. b. 24 hr

C. c. 6 hr

D. d. 4 hr

Answer: a. 8 hr

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87. If the amount of a radioactive substance is increased three times, the number of atoms disintegrated per unit time would

Be doulbe b.Be triple

c. Remian one-third d. Not change

A. a. Be double

B. b.Be triple

C. c. remain one-third

D. d. Not change

Answer: b.Be triple

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88. Three-fourth of a radioactive material decays in 2.5 days. How long will it take for $15/16th$ of the material to decay?

a. 2 days b. 5 days c. 7.5 days d. 10 days

A. a. 2 days

B. b. 5 days

C. c. 7.5 days

D. c. 7.5 days

Answer: b. 5 days

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89. Which of the following radio-isotope would you use to date object each one of them if the object is expected to be about 100 years old?

A. a) Pb half life=5.7 $\times$ 10^{10}years

B. b) C Half life= 5720years

C. c)Ni half life = 92 years

D. d) H half life=12.3 years

Answer: c)Ni half life = 92 years

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90. The half life of a radioactive element is 30 min. One sixteenth of the original quantity of element will be left after

a. 1 hr b. 16 hr c. 4 hr d. 2 hr

A. a. 1 hr

B. b. 16 hr

C. c. 4 hr

D. d. 2 hr

Answer: d. 2 hr

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

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

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93. What do you understand by the following notatins in respect of the types of artificial transmutation?

a. $\left(n, \beta^{\ominus}\right)$ b. $\left(p, \beta^{\ominus}\right)$ c. (α, n) d. (D, p)

A. a. $\left(n, \beta^{\ominus}\right)$

B. b. $\left(p, \beta^{\ominus}\right)$

C. c. (α, n)

D. d. (D, p)

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94. In artificial transumutation which has stronger striking ability and why proton or neutron move with the same speed?

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95. Complete the following nuclear equations:

a. $._{96}Cm^{246} + ._{6}C^{12} \rightarrow ._{102}No^{254} + \ldots\ldots$

b. $._{94}Pu^{239} + \ldots\ldots \rightarrow ._{96}Cm^{242} + ._{0}n^{1}$

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96. Calculate the energy released in the following:

$._{1}H^{2} + ._{1}H^{3} \rightarrow ._{2}He^{4} + ._{0}n^{1}$

(Given masses :

$H^{2} = 2.014, H^{3} = 3.016, He = 4.003, n = 1.009 m_{u})$

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97. The beta activity of $1g$ of carbon made from green wood is 15.3 counts per minute. If the activity of $1g$ of carbon derived from the wood of an Egyptian mummy case is 9.4 counts per minute under the same conditions, how old is the wood of the mummy case?

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98. Calculate the loss in mass during the change:

$._3 Li^7 + ._1 He^1 \rightarrow 2._2 He^4 + 17.25 MeV$

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99. The atomic mass of Li,He, and proton are 7.01823 amu, 4.00387 amu, and 1.00715 amu, respectively. Calculate the energy evolved in the reaction.

$._3\,Li^7 \to ._1\,P^1 \to 2._2\,He^4 + \Delta E$

Given 1 amu $= 931 MeV$.

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

$._1\,H^2 + ._1\,H^2 \to ._2\,He^3 + ._0\,n^1$

Assume that the masses of $._1\,H^2$, $._2\,He^3$, and neutron (n), respectively, are 2.40, 3.0160, and 1.0087 in amu.

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101. Calculate the binding energy for $._1 H^2$ atom. The mass of $._1 H^2$ atom is 2.014102 amu where $1n$ and $1p$ have their weights 2.016490 amu. Neglect mass of electron.

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102. The atomic mass of $._8 O^{16} = 15.9949$ amu. Calculate the $BE/\text{nucleon}$ for this atom. Mass $1n$ and $1p$ is 2.016490 amu and $m_e = 0.00055$ amu.

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103. Calculate the mass defect and binding energy per nucleon for an alpha particle (containing two protons and two neutrons) whose actual mass is 4.0028 amu (mass of proton = 1.00759 amu, mass of nuetron = 1.00898 amu).

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104. $U - 235$ is decayed by bombardment by neutron as according to the equation:

$${}_{92}U^{235} + {}_{0}n^{1} \rightarrow {}_{42}Mo^{98} + {}_{54}Xe^{136} + x.{}_{-1}e^{0} + y.{}_{0}n^{1}$$

Calculate the value of x and y and the energy released per uranium atom fragmented (neglect the mass of electron). Given masses (amu) $U - 235 = 235.044$,

$Xe = 135.907, Mo = 97.90, e = 5.5 \times 10^{-4}, n = 1.0086$

.

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105. A positron and an electron collide and annihilated to emit two gamma photons of same energy. Calculate the wavelengths corresponding to this gamma emission.

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106. The isotopic masses of $._1 H^2$ and $._2 He^4$ are 2.0141 and 4.0026 amu, respectively. Calculate the quantity of energy liberated when two moles of $._1 H^2$ undergo fission to form 1 mol of $._{2}He^{4}$. The velocity of light in vacuum is $3.0 \times 10^{8} ms^{-1}$.

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107. Why do radioactive element decay?

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108. How can a nucleus lose electrons (β-particles) even though free electrons are not present in it?

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109. Balance the following nuclear reactions:

a. $._3 Li^7 + ._0 n^1 \rightarrow 2._2 He^4 + ?$

b. $._{42} Mo^{94} + ._1 H^2 \rightarrow ._0 n^1 + ?$

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110. 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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111. Which of the following has magic number of protons and neutrons?

a. $._{82} Pb^{208}$ b. $._{2} He^{3}$ c. $._{50} Sn^{120}$ d. $._{82} Pb^{206}$

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

B. b. $._{2} He^{3}$

C. c. $._{50} Sn^{120}$

D. d. $._{82} Pb^{206}$

Answer: a. $._{82} Pb^{208}$

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112. A light nuclide that has n/p ratio 2 and has magic number of neutrons but still shows radioactivity

a. $._{2} He^{4}$ b. $._{1} He^{3}$ c. $._{1} H^{2}$ d. $._{2} He^{3}$

A. a. $._2 He^4$

B. b. $._1 He^3$

C. c. $._1 H^2$

D. d. $._2 He^3$

Answer: b. $._1 He^3$

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113. A barn is a unit in nuclear chemistry. One barn is

a. $10^{-24} cm^2$ b. $10^{-3} cm^2$ c. $10^{-26} cm^2$ d. $10^{-6} cm^2$

A. a. $10^{-24} cm^2$

B. b. $10^{-3} cm^2$

C. c. $10^{-26}cm^2$

D. d. $10^{-6}cm^2$

Answer: a. $10^{-24}cm^2$

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114. $._{15}P^{29}$ has n/p ratio too low for stability. Its stability can be increased by

a. Positron emission b. Beta-decay

c. Alpha-decay d. Electron capture

A. a. Positron emission

B. b. Beta-decay

C. c. Alpha-decay

D. d. Electron capture

Answer: a. Positron emission

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115. Efficiency of nuclear fusion as compared to nuclear fission is

a. More b. Less

c. Same d. None is correct

A. a. More

B. b. Less

C. c. Same

D. d. None is correct

Answer: a. More

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116. What is enriched uranium?

a. $U-238$ b. $U-235$

c. $U-235+$ Radium d. $U-235+U-238$

A. a. $U-238$

B. b. $U-235$

C. c. $U-235+$ Radium

D. d. $U-235+U-238$

Answer: d. $U-235+U-238$

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117. In a hydrogen bomb, hydrogen is converted into

a. Barium b. Uranium-235

c. Uranium-238 d. Helium

A. a. Barium

B. b. Uranium-235

C. c. Uranium-238

D. d. Helium

Answer: d. Helium

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118. Which one of the following nuclear transformation is (np) type?

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

b. $._{33}As^{75} + ._{5}He^{4} \rightarrow ._{35}Bi^{78} + ._{0}n^{1}$

c. $._{83}Bi^{209} + ._{1}H^{2} \rightarrow ._{84}Po^{210} + ._{0}n^{1}$

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

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

B. b. $._{33}As^{75} + ._{5}He^{4} \rightarrow ._{35}Bi^{78} + ._{0}n^{1}$

C. c. $._{83}Bi^{209} + ._{1}H^{2} \rightarrow ._{84}Po^{210} + ._{0}n^{1}$

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

Answer: d. $._{21}Sc^{45} + ._{0}n^{1} \rightarrow ._{20}Ca^{45} + ._{1}H^{1}$

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119. Insert the missing figure in the following

$._{25}Mn^{55}(n, \gamma) \rightarrow$

a. $._{25}Mn^{56}$ b. $._{24}Cr^{56}$ c. $._{24}Mn^{56}$ d. $._{24}Cr^{56}$

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120. Write the equations for the following transformations.

a. $._{10}\,K^{39}(p, d)$ b. $(7)N^{14}(n, p)$

c. $._{11}\,Na^{23}(\alpha, p)$ d. $._{4}\,Be^{9}(\alpha, n)$

A. a. $._{10}\,K^{39}(p, d)$

B. b. $(7)N^{14}(n, p)$

C. c. $._{11}\,Na^{23}(\alpha, p)$

D. d. $._{4}\,Be^{9}(\alpha, n)$

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121. Which one of the following is an artificial fuel for nuclear reactor?

a. U^{238} b. Pu^{239} c. U^{235} d. Th^{232}

A. a. U^{238}

B. b. Pu^{239}

C. c. U^{235}

D. d. Th^{232}

Answer: b. Pu^{239}

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

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123. Which of the following notations shows the products 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. $._{14} Si^{28} (d, n) ._{15} p^{29}$

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

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

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

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

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

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124. Respresentation of following nuclear reactions are as shown below:

$._7 N^{14} + ._2 \alpha^4 \rightarrow ._8 O^{17} + ._1 p^1, \left\{._7 N^{14}(\alpha, p)._8 O^{17}\right\}$

$._{13} Al^{27} + ._2 \alpha^4 \rightarrow ._{15} P^{30} + ._0 n^1, \left\{._{13} A^{27}(\alpha, n)._{15} P^{30}\right\}$

Write the missing particles in representation given below.

$._{13} Al^{27}, ._8 O^{17}(- -), ._7 N^{14}, ._{15} P^{30}$. Also write the corresponding nuclear reaction.

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125. Does hydrogen bomb invole only number fusionn? Why or why not?

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126. What is the role of heavy water in a nuclear reactor?

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127. How is plutonium obtained?

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128. What is the source of radioactive CO_2 in the atmosphere?

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129. How can the circulation of blood be tested by using radioisotope?

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130. Why a huge amount of energy is released in nuclear fission of nuclear fusion solution.

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131. An old piece of wood has 25.6% as much C^{14} as ordinary wood today has. Find the age of the wood. Half-life period of C^{14} is 5760 years?

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132. The $._6C^{14}$ and $._6C^{12}$ ratio in a piece of woods is $1/16$ part of atmosphere. Calculate the age of wood. $t_{1/2}\text{of}C^{14}$ is 5577 years?

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133. The half-life period of C^{14} is 5760 years. A piece of woods when buried in the earth had $1\%\,C^{14}$. Now as charcoal it has only $0.25\%\,C^{14}$. How long has the piece of wood been buried?

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134. 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 $(t_{1/2} \text{of} C^{14} = 5760$ years)

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135. 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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136. 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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137. Which of the following radioactive isotopes is used for the diagnosis of hyperthy roidism?

a. Co^{60} b. P^{32} c. 1^{131} c. C^{14}

A. a. Co^{60}

B. b. P^{32}

C. c. 1^{131}

D. d. C^{14}

Answer: c. 1^{131}

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Solved Example

1. How may $\alpha -$ and $\beta -$ particles will be emitted when $._{90}Th^{232}$ changes into $._{82}Pb^{208}$?

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2. The actual atomic mass of $._{20}Ca^{40}$ is 39.96259 amu. Find the binding energy for this nuclide, using 1.008665 amu for the mass of a neutron and 1.007825 amu for the mass of atomic hydrogen. Also calculate the binding energy per nucleon.

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3. $14g$ of a radioactive substance decays to $7g$ in 20 min. Will the time required be more or less the following processes:

i. $20g$ decreases by $8g$

ii. $20g$ decreases to $8g$. Explain

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4. The final product of U^{238} is Pb^{206}. A sample of pitchblende contains $0.0453g$ of Pb^{206} for every gram of U^{238} present in it. Supposing that the mineral pitchblende formed at the time of formation of the earth did not contain any Pb^{206}, calculate the age of the earth (half-life period of $U^{238} = 4.5 \times 10^9$ years).

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5. An old piece of wood has 25.6T as much C^{14} as ordinary wood today has. Find the age of the wood. Half-life period of C^{14} is 5760 years.

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6. The half-life of cobalt-60 is 5.26 years. Calculate the percentage activity remaining after 4 years.

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7. The activity of $1g$ radium is found to be 0.5. Calculate the half-life period of radium and the time required for the decay of $2g$ of radium to give $0.25g$ of radium (atomic mass off radium = 226).

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8. It is found that $3.125 \times 10^{-8} g$ atoms of Rn exist in equilibrium with $1g$ of radium at $0^{\circ} C$ and 1 atm pressure. The disintegration Constant of Ra is $1.48 \times 10^{11} s^{-1}$. Calculate the disintegration cosntant of Rn.

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9. What mass of C^{14} with $t_{1/2} = 5730$ years has activity equal to curie?

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10. 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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11. A radioisotope $._Z A^m \left(t_{1/2} = 10 \text{ days}\right)$ 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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12. 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?

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13. The mean lives of a radioactive substance are 1620 years and 405 years of α-emission and β-emission respectively. Find out the time during which three-fourth of a sample will decay if it is decaying both by α-emission and β-emission simultaneously.

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14. Calculate the effective neutron capture radius of a nucleus having a cross section of 1.0 barn.

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15. A $0.20mL$ sample of a solution containing $1.0 \times 10^{-7} Ci$ of $._1 H^3$ is injected into the blood stream of a laboratory animal. After sufficient time of of a circulatory equilibrium to be established, $0.10mL$ of blood is found to have an activity of 20 dpm. Calculate the blood volume of the animal.

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16. A sample of $._{53} I^{131}$, as iodide ion, was administered to a patient in a carrier consisting of $0.10mg$ of stable iodide ion. After 4.00 days 67.7% of the initial radiactivity was detected in the thyroid gland of the patient. What mass of the stable iodide ion had migrated to the thyroid gland? Of what diagnostic value of is such an experiment?

$(t_{1/2} = 8$ days)

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17. $1mg$ of Th emits 22 α-particles per unit solid angle per minute. Calculate $t_{1/2}$ or $Th(Th = 232)$.

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18. A solution contains $1mCi$ of L-phenylalanine C^{14} labelled in $2.0mL$ solution. The specific activity of labelled sample is given as $150mCi\,\mathrm{mmol}^{-1}$. Calculate

(a) The concentration of the sample in the solution in $\mathrm{mol}L^{-1}$

(b). The activity of solution in terms of counting per minute per mL at counting of 80%

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Ex6.1 Objective

1. An element X loses one $\alpha -$ and two $\beta -$ particles in three successive stages. The resulting element will be

A. An isobar of X

B. An isotope of X

C. X itself

D. An isotone of X

Answer: B

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2. Which of the following detects radiations by flashes produced on a phosphorscreen ?

A. GM counter

B. Bubble chamber

C. Ionization chamber

D. Scintillation counter

Answer: A

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3. Decrease in atomic number is observed during :

A. Alpha emission

B. Beta emission

C. Positron emission

D. Electron emission

Answer: A::C::D

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4. Particles having energy of several hundred MeV are known as

A. Electrons

B. Nucleons

C. Fast particles

D. Super fast particles

Answer: D

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5. The triad of nuclei that is isotonic is:

A. $._6C^{14}, ._7N^{15}, ._9F^{17},$

B. $._6C^{12}, ._7N^{14}, ._9F^{19},$

C. $._6C^{14}, ._7N^{14}, ._9F^{17},$

D. $._6C^{14}, ._7N^{14}, ._9F^{19},$

Answer: A

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6. Natural radioactivity was discovere by

A. Schmidt

B. Curie

C. Becquerel

D. Rutherford

Answer: C

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7. Radioactivity is due to

A. Stable electronic configuration

B. Unstable electronic configuration

C. Stable nucleus

D. Unstable nucleus

Answer: D

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8. 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.

Answer: C

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9. Alpha rays are

A. Positively charged

B. Negatively charged

C. Neutral

D.

Answer: A

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10. Which of the following does not characteristic X -rays

?

A. Radiation can ionize gases.

B. Radiation causes ZnS to fluorence.

C. Deflected by electric and magnetic field.

D. Wavelengths are shorter than those of ultraviolet

rays.

Answer: C

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11. The rays are given off by a radioactive element from

A. Nucleus

B. Valence electrons

C. All the orbits

D. Outer orbit

Answer: A

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12. 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.

Answer: D

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13. 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 :

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

Answer: D

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14. A radioactive substance emanates :

A. Alpha article

B. Beta particle

C. Gamma particle

D. All of these

Answer: D

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15. A particle which is four times in mass and two times in charge that of proton is called

A. Helium atom

B. An alpha particle

C. Deuteron

D. Tritium

Answer: B

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Ex6.2 Objective

1. In $\alpha-$ decay , n/p ratio :

A. May inrease or decrease

B. Remains constant

C. Decreases

D. Increases

Answer: D

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2. In $\beta-$ decay n/p ratio :

A. Remain unchanged

B. Decreases

C. Increases

D. May increase or decrease

Answer: D

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3. If n/p ratio is high, the nucleus tends to stabilize by :

A. The emission of a $\beta -$ particle

B. Neutron capture

C. Losing a positron

D. Any one of the above

Answer: A

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4. Who presented the theory of radioactive disintegration ?

A. Rutherford and Soddy

B. Soddy and Fajan

C. Thomson and Rutherford

D. Halhn and Strassmann

Answer: A

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5. Starting from radium, the radioactive disintegration process terminates when the following is obtained

A. Radon

B. Lead

C. Uranium

D. Thorium

Answer: B

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6. $._{92}U^{238}$ 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. $\frac{62}{42}$

Answer: A

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7. The end product of $(4n+3)$ series if ?

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

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

C. $._{83}Pb^{206}$

D. $._{83}Bi^{208}$

Answer: B

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8. In which of the following decays n/p remains constant ?

A. $\alpha-$ emission

B. $\beta-$ emission

C. $\gamma -$ emission

D. None

Answer: C

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Ex6.3 Objective

1. Radiactive decay is a reaction of

A. Zero order

B. First order

C. Second order

D. Third order

Answer: B

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2. Quantity of radiactive material which undergoes 10^6 disintegrations per second is called

A. Becquerel

B. Rutherford

C. Curie

D. Faraday

Answer: B

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3. One curie of activity is equivalent to

A. 3.7×10^{17} disintegrations per second

B. 3.7×10^{10} disintegrations per second

C. 3.7×10^{14} disintegration per second

D. 3.7×10^{3} disintegration per second

Answer: B

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4. The unit for radioactive constant is

A. time

B. time mol^{-1}

C. $time^{-1}$

D. $moltime^{-1}$

Answer: C

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5. The relation between half $-$ life period $(t_{1/2})$ and disintegration constant (λ) is expressed as

A. $\lambda = \dfrac{0.693}{t_{1/2}}$

B. $\lambda = 0.693 t_{1/2}$

C. $\lambda = \frac{693}{t_{1/2}}$

D. $\lambda = 693 t_{1/2}$

Answer: A

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6. If $2g$ of an isotope has a half $-$ life of 7 days, the half life of $1g$ sample is

A. 3.5 days

B. 7 days

C. 14 days

D. 2 days

Answer: B

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7. Half – life of a radioactive disintegration $(A \to B)$ having rate constat $231s^{-1}$ is

A. $3.0 \times 10^{-2}s$

B. $3 \times 10^{-3}s$

C. $3.3 \times 10^{-2}s$

D. $3.3 \times 10^{-3}s$

Answer: B

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8. C^{14} has a half $-$ life of 5760 years. $100 mg$ of the sample containing $.^{14}C$ is reduced to $25 mg$ in

A. 11520 years

B. 2880 years

C. 1440 years

D. 17128 years

Answer: A

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9. If $3/4$ quantity of a radioactive substance disintegrates in 2 hours, its half $-$ life period will be

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10. The initial mass of a radioactive element is $40g$. How many grams of it would be left after 24 years if its half $-$ life period I s of 8 years ?

A. 2

B. 5

C. 10

D. 20

Answer: B

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11. A radioisotope has a half life of 10 days. If tofay there is $125g$ of it left, what was its mass 40 days earlier ?

A. $600g$

B. $1000g$

C. $1250g$

D. $2000g$

Answer: D

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12. 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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13. Ra^{226} has half life of 1600 years. The number of disintegration per second per gram is

A. 3.7×10^{10}

B. 9.2×10^{6}

C. 3.7×10^{9}

D. 3.7×10^{8}

Answer: A

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14. 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} atoms

B. 3.7×10^{17} atoms

C. 2.05×10^{15} atoms

D. 4.7×10^{10} atoms

Answer: A

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15. The number of $\alpha -$ particles emitted per second by $1g$ of Ra^{226} is 3.7×10^{10}. The decay constant is

A. $1.39 \times 10^{-11} s^{-1}$

B. $13.9 \times 10^{-11} s^{-1}$

C. $139 \times 10^{-11} s^{-1}$

D. $0.139 \times 10^{-11} s^{-1}$

Answer: A

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16. 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. 693

D. 0.693

Answer: D

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17. 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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18. 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 deys ?

A. 2.89×10^{-19}

B. 1.298×10^{19}

C. 8.219×10^{19}

D. None of these

Answer: B

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19. What percentage of decay takes place in the average life of a substance ?

A. 63.21%

B. 36.79%

C. 90%

D. 99%

Answer: A

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20. The half life of Ra is 1600 years. The fraction of a sample of Ra that would remain after 6400 years is

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

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

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

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

Answer: D

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Ex6.4 Objective

1. In a chain reaction uranium atom gets fissioned forming two different material. The total weight of these put together is

A. More than the weight of parent uranium atom

B. Less than the weight of parent uranium atoms

C. More of less depends upon experimental conditions

D. Neither more nor less

Answer: B

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2. Which one of the following nuclear transformation is (np) type?

a. $._3 Li^7 + ._1 H^1 \rightarrow ._4 Be^7 + ._0 n^1$

b. $._{33} As^{75} + ._5 He^4 \rightarrow ._{35} Bi^{78} + ._0 n^1$

c. $._{83} Bi^{209} + ._1 H^2 \rightarrow ._{84} Po^{210} + ._0 n^1$

d. $._{21} Sc^{45} + ._0 n^1 \rightarrow ._{20} Ca^{45} + ._1 H^1$

A. $._3 Li^7 + ._1 H^1 \rightarrow ._4 Be^7 + ._0 n^1$

B. $._{33} As^{75} + ._2 He^2 \rightarrow ._{35} Br^{78} + ._0 n^1$

C. $._{83} Bi^{209} + ._1 H^2 \rightarrow ._{84} Po^{210} + ._0 n^1$

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

Answer: D

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3. An example of nuclear fusion reaction is

A. $._{90}Th^{233} + ._{0}n^{1} \rightarrow ._{90}Th^{234}$

B. $._{13}Al^{27} + ._{2}He^{4} \rightarrow ._{15}p^{30} + ._{0}n^{1}$

C. $._{2}He^{3} + ._{2}He^{3} \rightarrow H_{2}He^{4} + 2._{1}H^{1}$

D. $._{92}U^{239} \rightarrow ._{93}Np^{239} + ._{0}e^{1}$

Answer: C

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4. 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 fussion

C. Nuclear fusion

D. None of these

Answer: B

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

A. $._{7}N^{14} + ._{1}H^{1} \rightarrow ._{6}C^{14} + ._{+1}e^{0} + ._{1}H^{1}$

B. $._{7}N^{14} \rightarrow ._{6}C^{14} + ._{+1}e^{0}$

C. $._{7}N^{14} + ._{0}n^{1} \rightarrow ._{6}C^{14} + ._{1}H^{1}$

D. $._{7}N^{14} + ._{1}H^{1} \rightarrow ._{6}C^{11} + ._{2}He^{4}$

Answer: C

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6. In a nuclear reactor, chain reaction is controlled by introducing

A. Iron rod

B. Cadmium rod

C. Graphite rod

D. Gold rod

Answer: B

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7. In a nuclear explosion, the energy is released in the form of

A. Thermal energy

B. Kinetic energy

C. Potential energy

D. Electrical energy

Answer: A

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Ex6.5 Objective

1. Which one of the following is a major hurdle in finding ways to property harness nuclear fusion energy on a commercial scale in an effort to solve nuclear crisis?

A. Purifications of raw material

B. Finding safe ways to disposing off the waste products

C. To maintain high temperature for the reaction

D. Non-availability of skilled scientists

Answer: C

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2. Breeder reactors are nuclear reactors that are capable of converting non-radioactive isotopes into radioactive fissionable isotopes, which can be used for generating energy, $U-238$, a non-radioactive isotope is thus converted into radioactive.

A. $U-234$

B. $Pu-94$

C. $I-131$

D. $C-13$

Answer: B

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3. In which of the following radioactive isotopes $I-131$ is not used?

A. In the diagnosis of lever and kidney disorder

B. Treatment of thyroid diseases

C. Increasing absorption of calcium in the body

D. For locationg tumors in brain.

Answer: C

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4. An atom of radium combines with two atoms of chlorine of form $RaCl_2$ molecule. The radioactivity of $RaCl_2$ will be

A. Zero

B. $1/3$ of the same quantity of radium

C. As much as that of same quantity of radium

D. $1/4$ of the same quantity of radium

Answer: C

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5. Mass number of a nuclide is 216, its approxmiamte radius in fermi units is

A. 6.0

B. 7.0

C. 8.0

D. 8.4

Answer: D

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6. 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

Answer: C

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7. The radioactivity due to $C-14$ isotope (half-life = 6000 years) of a sample of wood form an ancient tomb was found to be nearly half that of fresh wood. The bomb is there for about

A. 3000 year old

B. 6000 year old

C. 9000 year old

D. 12000 year old

Answer: B

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8. Which of the following ages cannot be determined by radioactive carbon dating?

A. Remains of the animal

B. Samples of rock from old mountain

C. A 100- years-old tree

D. An old piece of wood

Answer: B

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9. The age of most ancient geological formations is estimated by

A. $C-14$ dating method

B. $K-Ag$ method

C. $U-Pb$ method

D. $Ra-Rn$ method

Answer: C

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10. 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

Answer: A

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Exercises Link Comprehension

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. $._{83}Bi^{207}$

Answer: B

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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

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.

$\cdot_{86} Rn^{219}$ is a member of actinium series. Another member of same series is

A. $\cdot_{92} U^{235}$

B. $\cdot_{89} Ac^{222}$

C. $\cdot_{90} Th^{212}$

D. $\cdot_{84} Po^{212}$

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. $Pb - 206, Bi - 208$

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 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 starting isotope and the end product: isotope of actinium series are

A. $._{88}\,Ac^{227}$ and $._{82}\,Pb^{208}$

B. $._{92}\,U^{235}$ and $._{82}\,Pb^{207}$

C. $._{92}\,U^{238}$ and $._{82}\,Pb^{207}$

D. $._{92}\,U^{235}$ and $._{82}\,Pb^{208}$

Answer: B

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6. 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 of a radioactive element is 10 years. What percentage of it will decay in 100 years?

A. 0.999

B. 0.1

C. 0.5

D. 0.665

Answer: A

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7. 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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8. 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 $\tau = 1.44 t_{1/2}$

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. $t_{1/2} = 2.303 \lambda \log 2$

Answer: D

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9. 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.

Unstalbe substance exhibit high radioactivity due to

A. Low p/n ratio

B. high p/n ratio

C. $p/n = 1$

D. None

Answer: A

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10. 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 emitted

D. None

Answer: B

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11. 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

$$\cdot_{92} M^{238} \rightarrow \cdot_y N^x + 2._2 He^4, \cdot_y N^x \rightarrow \cdot_B L^A + 2._{-1} e^0$$

The number of neutrons in the element L is

A. 140

B. 145

C. 138

D. 160

Answer: A

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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 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.

A. Cu_{68}

B. Cu^{59}

C. Cu^{68}

D. Cu^{67}

Answer: D

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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.

A. β-emission

B. α-emission

C. γ-emission

D. Positron emission

Answer: A

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14. In the disintegration of a radioactive element, α- and β-particles are evolved from the nucleus.

$\cdot_0 n^1 \rightarrow \cdot_1 H^1 + \cdot_{-1} e^0 +$ Antineutrino + Energy

$4 \cdot_1 H^1 \rightarrow \cdot_2 He^4 + 2 \cdot_{+1} e^0 +$ 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. α, α, β

B. α, γ, α

C. α, β, β

D. β, γ, α

Answer: C

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15. 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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16. In the disintegration of a radioactive element, α- and β-particles are evolved from the nucleus.

$._0 n^1 \to ._1 H^1 + ._{-1} e^0 +$ Antineutrino + Energy

$4._1 H^1 \to ._2 He^4 + 2._{+1} e^0 +$ 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. Decreases by 1 unit

B. Increases by 1 unit

C. Decreases by 2 units

D. Remains unaffected

Answer: D

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17. 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.

How many α- and β-particle should be emitted from a radioactive nuclide so that an isobar is formed?

A. $1\alpha, 1\beta$

B. $1\alpha, 2\beta$

C. $2\alpha, 2\beta$

D. $n\beta$

Answer: D

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18. In the disintegration of a radioactive element, α- and β-particles are evolved from the nucleus.

$\cdot_0 n^1 \rightarrow \cdot_1 H^1 + \cdot_{-1} e^0 +$ Antineutrino + Energy

$4 \cdot_1 H^1 \rightarrow \cdot_2 He^4 + 2 \cdot_{+1} e^0 +$ 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.

Select the correct statements among the following:

A. Emission of a β-particle results into an isobar of parent element.

B. Emission of α-particles results into an isodiapher of parent element.

C. Emission of one α-and two β-particles results into an isotope of the parent element.

D. Emission of γ-radiations may yield a nuclear isomer.

Answer: A::B::C::D

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19. In the decay series $._{92}U^{238}$ to $._{82}Pb^{206}$, how many α-paritcles and how many $\beta^{\ominus}$-particles are emitted?

A. 6,8

B. 9,6

C. 8,8

D. 8,6

Answer: D

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

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

A sample of rock south America contains equal number of atoms of U^{238} and Pb^{206}. The age of 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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21. Uranium $._{92}U^{238}$ decayed to $._{82}Pb^{206}$. They decay process is $._{92}U^{238} \rightarrow \underset{x\alpha\ \ y\beta}{._{82}Pb^{206}}$

$t_{1/2}$ 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

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

$t_{1/2}$ 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. $\frac{2.303}{0.693} \times 4.5 \times 10^{9} \log 1.25$

Answer: A

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23. 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.

The binding energy per nucleon of $._1 H^2$ and $._2 He^4$ 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. $19.3 MeV$

Answer: C

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24. 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 $931 MeV$ is

A. $6.02 \times 10^{-27} kg$

B. $1.662 \times 10^{-27} kg$

C. $16.66 \times 10^{-27} kg$

D. $16.02 \times 10^{-27} kg$

Answer: B

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25. 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. $3 \times 10^6 K$

Answer: D

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26. 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. $10^{16} s$

Answer: C

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27. 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.

In a nuclear reaction

$\cdot_1 H^2 + \cdot_1 H^2 \rightarrow \cdot_2 He^3 + \cdot_0 n^1$

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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28. 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.

Answer: A

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29. 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

Answer: A

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30. 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. 0.53 years

B. 53 years

C. 530 years

D. 5300 years

Answer: B

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31. 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 lime

B. Independent of temperature

C. Dependent on catalyst

D. Dependent on the amount of elementsd not yet decayed

Answer: B

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32. 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. $\tau = \frac{t_{1/2}}{0.693}$

Answer: C

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Exercises Multiple Correct

1. Which of the following statements about radioactivity are correct?

A. It is a nuclear property

B. It does not involve any rearragement of electrons.

C. It is not affected by the presence of other elements.

D. Its rate is affected by the change in temperature and/or pressure.

Answer: A::B::C

Watch Video Solution

2. A radioactive element A decays by the sequence and with half-lives given below:

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

Which of the following statement about this system are correct?

A. The mass number of B is greater then A.

B. After two hours, less 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 of A.

D. The atomic numbers of A and C are the same.

Answer: B::D

Watch Video Solution

3. Half-life period for radioactive element is

A. Always constant

B. Variable

C. Independent of final concentrationn

D. Independent of initial concentration

Answer: A::D

Watch Video Solution

4. Which of the following are α-emitters?

A. Po^{213}

B. Pb^{215}

C. Rn^{222}

D. Ra^{226}

Answer: A::D

View Text Solution

5. Which of the following nuclides belong to actinium (U^{235}) series?

A. Pb^{207}

B. Po^{215}

C. Po^{213}

D. $._1 H^3$

Answer: A::B

Watch Video Solution

6. Which among the following nuclides is/are likely to be stable?

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

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

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

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

Answer: B::C

Watch Video Solution

7. In a nuclear reactor, heavy water is used to

A. Increase the speed of neutorns

B. Decreases the speed of neutrons

C. Transfer the heat from the reactor

D. None of above

Answer: B::C

Watch Video Solution

8. Which of the following nuclei are doubly magic?

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

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

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

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

Answer: B::C::D

Watch Video Solution

9. 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

Answer: A::C::D

Watch Video Solution

10. Which of the following is/are incorrect?

A. 1 curie -3.7×10^{10} dis

B. Actinium series starts withs U^{238}

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

D. The decay constant is independent of the number of the substance taken.

Answer: C::D

Watch Video Solution

11. 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. $A\gamma$-decay

C. AK-capture process

D. $A\beta$-decay

Answer: B::C

Watch Video Solution

12. Which among the following is/are fissible?

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

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

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

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

Answer: A::C

Watch Video Solution

13. The half life period of a radioactive elements does not depend upon:

A. Temperature

B. Pressure

C. Initial amount of radioactive element taken

D. Nature of radioactive element

Answer: A::B::C

Watch Video Solution

14. Which of the following is/are correct?

A. 1 Fermi $= 10^3 dps$

B. 1 curie $= 3.7 \times 10^{10} dps$

C. 1 rutherford $= 10^6 dps$

D. 1 becquerel $= 1 dps$

Answer: C::D

View Text Solution

15. Which of the following is/are ture?

A. The most radioactive element present in pitchblende is uranium.

B. $P - 32$ is used for the treatment of leukaemia.

C. CO_2 present in the air contains $C - 12$ only.

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

Answer: B::C

Watch Video Solution

16. Which of the following is/are the examples of induced radioactivity?

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

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

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

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

Answer: A::B::C::D

Watch Video Solution

17. 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.

Answer: B::C::D

Watch Video Solution

18. For emission of α-particle from uranium nucleus:

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

Shortage of two electrons in thorium is due to

A. Conversion of electron to positron

B. Adsorption in the nucleus

C. Annihilation

D. Combustion with position to evolve energy

Answer: C::D

View Text Solution

19. Radioactivity is generally not found in

A. Light nuclei

B. Stable nuclei

C. Heavy nuclei

D. Nuclei of intermediate mass

Answer: A::B::D

Watch Video Solution

20. 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.

Answer: B::C::D

Watch Video Solution

21. Which of following contains (s) material particles?

A. α-rays

B. β-rays

C. γ-rays

D. Anode rays

Answer: A::B::D

Watch Video Solution

22. Which one of the following statements is/are correct?

A. Neutron was discovered by Chadwick.

B. Nuclear fission was discovered by Hahn and Strassmann.

C. Polonium was discovered by Madam Curie.

D. Nuclear was discovered by Fermi.

Answer: A::B::C

Watch Video Solution

23. Which of the following is/are not radioactive element(s)?

A. Sulphur

B. Tellurium

C. Selenium

D. Polonium

Answer: A::B::C

Watch Video Solution

24. 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}

Answer: A::D

Watch Video Solution

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

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

B. A remains unchanged and Z decreases by 1. The process is called $\beta^{\oplus}$ 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.

Answer: A::B::C

Watch Video Solution

26. 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.

Answer: B::C

Watch Video Solution

27. The mass defect of the nuclear reaction $._{5}B^{8} \rightarrow ._{4}Be^{8} + ._{1}e^{0}$ is Δm, the wrong expression is/are

A. $\Delta m =$ atomic mass of $\left(._{4}Be^{8} - ._{5}B^{8}\right)$

B. $\Delta m =$ atomic mass of $\left(._{4}Be^{8} - ._{5}B^{8}\right) +$ mass of one electron

C. $\Delta m =$ atomic mass of $\left(._{4}Be^{8} - ._{5}B^{8}\right) +$ mass of one positron

D. $\Delta m =$ atomic mass of $\left({}_{\cdot 4} Be^8 - {}_{\cdot 5} B^8\right) +$ mass of two electrons

Answer: A::B::C

View Text Solution

Exercises Single Correct

1. A radioisotope has half life of 10 years. What percentage of the original amount of it would you expect to remain after 20 years?

A. 0

B. 12.5

C. 25

D. 8

Answer: C

Watch Video Solution

2. $._{92}U^{238}$ is a natural α-emitter. After α-emission the residual nucleus U_{X1} in turn emits a β-particle to produce another nucleus U_{X2}. Find out the atomic number and mass number of U_{X1} and U_{X2}.

A. 234 and 91

B. 234 and 96

C. 232 and 88

D. 234 and 88

Answer: A

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3. Which of the following projectiles is the best for bombarding the nuclide?

A. α-particle

B. Proton

C. Deuteron

D. Neutron

Answer: D

Watch Video Solution

4. Which of the following has the maximum penetrating power?

A. α-particle

B. Proton

C. γ-particle

D. Positron

Answer: C

Watch Video Solution

5. Which of the following nuclear change is incorrect?

A. $._{20}Ca^{40} + ._{0}n^{1} \rightarrow ._{19}K^{40} + ._{1}H^{1}$

B. $._{12}Mg^{24} + \alpha \rightarrow ._{14}Si^{27} + ._{0}n^{1}$

C. $._{48}Cd^{113} + ._{0}n^{1} \rightarrow ._{48}Cd^{112} + ._{-1}e^{0}$

D. $._{20}Co^{43} + \alpha \rightarrow ._{21}Si^{46} + ._{1}H^{1}$

Answer: C

Watch Video Solution

6. Which of the following particles is emitted in the nuclear reaction: $._{13}Al^{27} + ._{2}He^{4} \rightarrow ._{14}P^{30+} \ldots .?$

A. $._{0}n^{1}$

B. $._{-1}e^{0}$

C. $._{1}H^{1}$

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

Answer: C

Watch Video Solution

7. The phenomenon of radioactivity is associated with

A. Decay of nucleus

B. Fussion of nucleus

C. Emission of electrons or protons

D. Rearragement in the in the extra nuclear electron

Answer: A

Watch Video Solution

8. If $._{92}U^{235}$ assumed to decay only by emitting two α- and one β-particles, the possible product of decays is

A. $._{89}Ac^{231}$

B. $._{89}Ac^{235}$

C. $._{89} Ac^{236}$

D. $._{89} Ac^{227}$

Answer: D

Watch Video Solution

9. When passing through a magnetic field the largest degflection is experienced by

A. α-rays

B. β-rays

C. γ-rays

D. All equal

Answer: B

Watch Video Solution

10. Which of the following nuclei is unstable?

A. $._5\,B^{10}$

B. $._4\,Be^{10}$

C. $._7\,N^{14}$

D. $._8\,O^{16}$

Answer: B

Watch Video Solution

11. When $._{17}Cl^{35}$ undergoes (n, p) reaction, the radioisotope formed is

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

B. $._{16}S^{35}$

C. $._{16}S^{34}$

D. $._{15}P^{34}$

Answer: B

Watch Video Solution

12. $._{89}Ac^{227}$ is a member of actinium series. Another member of the same series of

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

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

C. $._{89}Ac^{235}$

D. $._{15}P^{34}$

Answer: A

Watch Video Solution

13. Neutrons are more effective projectiles than protons because they

A. Are attracted by the nuclei

B. Are not repelled by the nuclei

C. Travel with high speed

D. None of these

Answer: B

Watch Video Solution

14. The instability of a nucleus is due to

A. High proton electron ratio

B. High electron neutron ratio

C. Low proton electron ratio

D. Low proton neutron ratio

Answer: D

Watch Video Solution

15. Atom with the same atomic number and different mass numbers are called

A. Isobars

B. Isomers

C. Isotones

D. Isotopes

Answer: D

Watch Video Solution

16. A method which uses radioactivity for determining the age of prehistorie materials is called

A. Carbon dating

B. Deuterium dating

C. Radium dating

D. Uranium dating

Answer: A

Watch Video Solution

17. Which of the following nuclear reaction occurs in nature for the formation of tritium?

A. $._3 Li^6 + ._0 n^1 \rightarrow ._2 He^4 + ._1 H^3$

B. $._5 B^{10} + ._0 n^1 \rightarrow 2._2 He^4 + ._1 H^3$

C. $._7 N^{14} + ._0 n^1 \rightarrow ._6 C^{12} + ._1 H^3$

D. $._4 Be^9 + ._1 D^2 \rightarrow 2._2 He^4 + ._1 H^3$

Answer: C

Watch Video Solution

18. How many α-particles are emitted in the nuclear transformation: $._{84} Po^{215} \rightarrow ._{82} Pb^{211} + ?._2 He^4$

A. 0

B. 1

C. 2

D. 3

Answer: B

Watch Video Solution

19. Which one of the following does not consist of charged particles of matter?

A. α-particle

B. β-rays

C. γ-rays

D. Anode rays

Answer: C

Watch Video Solution

20. If a radioactive element is placed in an evacuated container, its rate of disintegration

A. Will be increased

B. Will be decreased

C. Will change very slightly

D. Will remain unchanged

Answer: D

Watch Video Solution

21. The cheimst who helped in the discovery of the maximum number of transurnic Robinson

A. Sir Robert Robinson

B. Sir J J Thomos

C. Professor Sea Borg

D. Sir N.C. Hishelwood

Answer: C

Watch Video Solution

22. Artificial radioactivity was discovered by ....

A. Sea Borg

B. Rutherford

C. Eisstein

D. Irene Curie

Answer: D

Watch Video Solution

23. Group displacement law was given by

A. Beequerel

B. Rutherford

C. Mendeleef

D. Soddy and Fazan

Answer: D

Watch Video Solution

24. What is X in the nuclear reaction

$$._7 N^{14} + ._1 H^1 \rightarrow ._8 O^{15} + X$$

A. $._1 H^2$

B. $._0 n^1$

C. γ

D. $._{-1}e^{0}$

Answer: C

Watch Video Solution

25. From the reaction given below, deduce the group of polonium in the periodic table (Pb belongs to group 14)

$._{84}Po^{210} \rightarrow ._{82}Pb^{206} + ._{2}He^{4}$

A. 2

B. 14

C. 6

D. 16

Answer: D

Watch Video Solution

26. $1g$ atom of an α-emitting $._{z}X^{4}$ (half life = 10 hr) was placed in sealed containers, 4.52×10^{25}. Helium atoms will accumulate in the container after

A. 4.52 hr

B. 10.00 hr

C. 9.40 hr

D. 20.00 hr

Answer: D

Watch Video Solution

27. 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

Watch Video Solution

28. The reaction

$$._{1}D^{2}+._{1}T^{3}\rightarrow ._{1}He^{2}+._{0}n^{1}$$

is an example of

A. Nuclear fission

B. Nuclear fusion

C. Artifical radioactivity

D. Radioactive disintegration

Answer: B

Watch Video Solution

29. The equipment used to carry out nuclear reaction in a controlled manner is called

A. Breeder reactor

B. Nuclear reactor

C. Thermonuclear fission

D. Cyclotron

Answer: B

Watch Video Solution

30. Which of the following is used as neutron absorber in the nuclear reactor?

A. Water

B. Deuterium

C. Some compound of uranium

D. Cadmium

Answer: D

Watch Video Solution

31. Which of the following elements belongs to $4n$-series?

A. $Pb-207$

B. $Bi-209$

C. $Pb - 208$

D. $Pb - 206$

Answer: C

Watch Video Solution

32. The age of rocks on earth or the samples of rocks and dust brought back from the moon can be found by determining the proportion of radioactive...........in the rock of dust.

A. Potassium and stable calcium

B. Uranium and stable lead

C. Carbon and stable carbon

D. Radium and stable lead

Answer: B

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33. Which is different in isotopes of an element?

A. Atomic number

B. Mass number

C. Number of protons

D. Number of electrons

Answer: B

Watch Video Solution

34. The radioisotope used in the treatment of cancer is

A. $C - 12$

B. $Co - 60$

C. $I - 31$

D. $P - 31$

Answer: C

Watch Video Solution

35. The end product of $(4n+2)$ disintegration series is

A. $\cdot_{82} Pb^{204}$

B. $\cdot_{62} Pb^{208}$

C. $\cdot_{52} Pb^{208}$

D. $\cdot_{82} Pb^{209}$

Answer: C

Watch Video Solution

36. $\cdot_{6} C^{14}$ in the upper atmosphere is formed by the action of neutron on

A. $._7 N^{14}$

B. $._8 O^{17}$

C. $._6 C^{12}$

D. $._8 O^{18}$

Answer: A

Watch Video Solution

37. Atoms with the same mass number but having different nuclear charges are called

A. Isotopes

B. Isobars

C. Isohores

D. Isotones

Answer: B

Watch Video Solution

38. One curie of activity is equivalent to a)3.7×10^{17} disintegrations per second b)3.7×10^{10} disintegrations per second c)3.7×10^{14} disintegration per second d) 3.7×10^{3} disintegration per second

A. 3.7×10^{7} disingration per second

B. 3.7×10^{10} disingration per second

C. 3.7×10^4 disingration per second

D. None

Answer: B

Watch Video Solution

39. Hydrogen bomb is based on the principle of

A. Nuclear fission

B. Nuclear fusion

C. Nuclear explosion

D. Chemical reaction

Answer: B

Watch Video Solution

40. Which of the radioactive isotopes is used for temperature control in blood disease?

A. P^{32}

B. H^{3}

C. Rn^{233}

D. I^{131}

Answer: A

Watch Video Solution

41. When the quantity of a radioactive substance is increased two times, the number of atoms disintegrating per unit time is

A. Doubled

B. Increased by square of two

C. Increased but not a great extent

D. Not affected

Answer: A

Watch Video Solution

42. When a radioactive substance is subjected to a vacuum, the rate of disintegration per second

A. Increases considerably

B. Increases only if the products are gaseous

C. Suffers a slight decrease

D.

Answer: C

View Text Solution

43. The half life of Ra is 1600 years. The fraction of a sample of Ra that would remain after 6400 years is

A. $1/16$

B. $1/4$

C. $1/8$

D. $1/2$

Answer: A

Watch Video Solution

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

A. U^{238}

B. U^{233}

C. Pu^{239}

D. U^{235}

Answer: A

Watch Video Solution

45. Which of the following pairs represents isobars?

A. $._{19}K^{40}$ and $._{11}Na^{23}$

B. $._{2}He^{3}$ and $._{2}He^{4}$

C. $._{12}Mg^{24}$ and $._{12}Mg^{25}$

D. $._{19}K^{40}$ and $._{20}Ca^{40}$

Answer: D

Watch Video Solution

Watch Video Solution

46. A cyclotron is used to

A. Accelerate neutrons

B. Accelerate electrons

C. Accelerate protons

D. Accelerate α-particles

Answer: C

View Text Solution

47. The end product of $4n$ series is

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

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

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

D. $._{82}Pb^{204}$

Answer: A

Watch Video Solution

48. Radioactive disintegration differs from a chemical change in being

A. An exothermic change

B. A spontaneous process

C. A nuclear process

D. A unimolecular first-order reaction

Answer: C

Watch Video Solution

49. One atomic unit is equal to

A. 1.492×10^{-3} ergs

B. 1.492×10^{-2} ergs

C. 1.492×10^{-10} ergs

D. None of these

Answer: A

Watch Video Solution

50. An element is isobaric with the inert gas atom $._{18}A^{40}$. The electronic arrangement of the element is $1s^2 2s^2 2p^6 3s^2 3p^2 4s^2$. How many neutrons does each atom of the element carry in its nucleus?

A. 22

B. 20

C. 18

D. 16

Answer: B

Watch Video Solution

51. If $8.0g$ of radioactive isotope has a half life of 10 hours, the half life of $2.0g$ of the same substance is

A. 2.5 hours

B. 5.0 hours

C. 10 hours

D. 40 hours

Answer: C

Watch Video Solution

52. If two light nuclei are fused together in nuclear reaction, the average energy per nucleon

A. Increases

B. Decreases

C. Cannot be determined

D. Remains same

Answer: B

Watch Video Solution

53. A certain nuclide has a half life period of 30 min. If a sample containing 600 atoms is allowed to decay for 90 min, how many atoms will remains?

A. 200 atoms

B. 450 atoms

C. 75 atoms

D. 150 atoms

Answer: C

Watch Video Solution

54. A substance is kept for 2 hours and three-fourth of that substance disintegrates during this period. The half life of the substance is

A. 2 hr

B. 1 hr

C. 30 min

D. 4 hr

Answer: B

Watch Video Solution

55. The energy released during the fussion of 1 kg uranium is

A. 9×10^{23} ergs

B. 9.0×10^{10} ergs

C. 9.0×10^{18} ergs

D. 9.0×10^{8} ergs

Answer: A

Watch Video Solution

56. Two nuclei are not identical but have the same number of nucleons. These are

A. Isotopes

B. Isobars

C. Isotones

D. None

Answer: B

Watch Video Solution

57. The density of nucleus is about.............times the density of atom.

A. 10^{-14}

B. 10^{12}

C. 10^{-8}

D. 10^{10}

Answer: B

Watch Video Solution

58. The negative value of packing fraction indicates that the isotope is

A. Unstable

B. Very stable

C. Artifical

D. Stable

Answer: D

Watch Video Solution

59. In nuclear reactors heavy water is used as a

A. Fuel

B. Prohectile

C. Moderatord

D. Arrester

Answer: C

Watch Video Solution

60. The ratio of the radii of the atom to the nucleus is

A. $10^4 : 1$

B. $10^{-4} : 1$

C. $10^2 : 1$

D. $10^3 : 1$

Answer: A

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61. The distance between nucleons is atomic nucleus is the order of (1 Fermi $= 13^{-13} cm$)

A. 2 Fermi

B. 25 Fermi

C. 100 Fermi

D. 40 Fermi

Answer: A

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62. The number of protons and neutrons for most stable elements is

A. Even-odd

B. Even-even

C. Odd-odd

D. Odd-Even

Answer: B

Watch Video Solution

63. The binding energy of an element of $64MeV$. If $BE/\text{nucleon}$ is 6.4, then the number of nucleons are

A. 10

B. 64

C. 16

D. 6

Answer: A

Watch Video Solution

64. Slow neutrons can bring about the fussion of

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

B. $._{82}U^{238}$

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

D. $._{88}U^{226}$

Answer: A

Watch Video Solution

65. Living things contain C^{12} and C^{13}. C^{12} is stable and C^{13} decays and declines in proportional quantity. The techinique that used this particles for determining the age of fossils skeletons, old trees, and dinosaurs is called

A. $C - 12$ dating

B. Radiocarbon dating

C. Carbon age

D. Fossil carbon

Answer: B

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66. Calculate the mass defect and binding energy per nucleon for an alpha particle (containing two protons and two neutrons) whose actual mass is 4.0028 amu (mass of proton = 1.00759 amu, mass of nuetron = 1.00898 amu).

A. $28.3 MeV$

B. $2.83 MeV$

C. $20.5 MeV$

D. $0.238 MeV$

Answer: A

Watch Video Solution

67. The nuclear process that takes place when a hydrogen bomb is exploded is of the same nature as the process

A. In the centre of the earth

B. In the sum and stars

C. During a red dust storm

D. During energy equivalent fission

Answer: B

Watch Video Solution

68. The energy equivalent to 1 amu is?

A. $931.5 MeV$

B. $93.15 MeV$

C. $460 MeV$

D. $554 MeV$

Answer: A

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69. Atomic weight of Th is 232 and its atomic number is 90. The number of α- and β-particles which be lost so that an isotope of lead (atomic weight 208 and atomic number 82) is produced is

A. $4\alpha + 6\beta$

B. $6\alpha + 4\beta$

C. $8\alpha + 2\beta$

D. $10\alpha + 2\beta$

Answer: B

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70. Out of the four series, which series disintegrates in a least branching manner?

A. $4n + 2$

B. $4n$

C. $4n+3$

D. $4n+1$

Answer: D

Watch Video Solution

71. The atomic mass and atomic number of lead are 208 and 82. The atomic mass and atomic number of bismuth are 209 and 83. The $\text{neutron}/\text{proton}$ ratio in an atom

A. Is higher in lead than in bismuth

B. Is lower in lead than in bismuth

C. Is equal in both lead and bismuth

D. None of these

Answer: D

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72. When n/p ratio of an isotope is greater than the stable isotope of that element, it emits

A. β-particles

B. α-particles

C. Neutron

D. Positron

Answer: A

Watch Video Solution

73. The decay of a radioactive element follows first order kinetic. Thus,

A. Half-life period $= a$ constant $/ K$,

B. The rate of decay is independent of temperature

C. The rate can be altered by changing chemical conditions

D. The element will be completely transformed into new element after expiry of two half-life period

Answer: A

Watch Video Solution

Watch Video Solution

74. Which of the following has magic number of protons and neutrons?

a. $._{82}Pb^{208}$ b. $._{2}He^{3}$ c. $._{50}Sn^{120}$ d. $._{82}Pb^{206}$

A. $._{50}Sn^{123}$

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

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

D. $._{50}Sn^{118}$

Answer: B

Watch Video Solution

75. Which of the following has magic number of neutrons?

A. $\cdot_{13} Al^{27}$

B. $\cdot_{83} Bi^{209}$

C. $\cdot_{92} U^{238}$

D. $\cdot_{26} Fe^{56}$

Answer: B

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76. Which of the following is artificial radioactive series?

A. $4n+1$

B. $4n + 2$

C. $4n$

D. $4n + 3$

Answer: A

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77. All nuclides exhibit radioactivity when the atomic number exceeds

A. 80

B. 83

C. 90

D. 92

Answer: B

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78. After three half lives, the percentage of fraction of amount

A. 6.35

B. 12.5

C. 50

D. 75

Answer: B

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79. Magic number elements are those isotopes of elements

A. In which the number of protons or neutron is 2,8,20,28,50,82, or 125

B. Which are relatively more abundant

C. Which are unusually stable

D. All of equal

Answer: A

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80. The SI unit of radioactivity is

A. Curie

B. Micro-curie

C. Rutherford

D. Becquerel

Answer: A

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Exercises Assertion-Reasoning

1. Assertion (A): Nucleus of the atom does not contain electrons, yet it emits $\beta-$ particles in the form of 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 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.

Answer: C

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2. Assertion $(A): \gamma -$ rays have very high penetrating power.

Reason $(R): \gamma -$ rays are high $-$ energy electromagnetic radiations.

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.

Answer: A

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3. Assertion $(A) : \beta -$ particles have greater penetrating power than $\alpha -$ rays but less than $\gamma -$ rays.

Reason $(R) : \beta -$ particles are lighter than $\alpha -$ particles but heavier than γ.

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.

Answer: A

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

Reason (R): As a radioactive element disintegrates, more of it is formed in nature by itself.

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.

Answer: C

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5. 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.

Answer: B

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6. Assertion (A): In radioactive disintegrations, $._2 H^4$ nuclei can come out of the nucleus but lighter $._2 H^3$ cannot.

Reason (R): The binding energy of $._2 H^3$ is more than that of $._2 H^4$.

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.

Answer: C

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7. Assertion (A): Protons are better projectiles than neutrons.

Reason (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 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 both (A) and (R) are incorrect.

Answer: D

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

Reason (R): Halt $-$ of readioactive isotopes is independent of the initial amount of the isotope.

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 both (A) and (R) are incorrect.

Answer: D

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9. 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.

Answer: A

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

Reason (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 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.

Answer: C

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11. 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.

Answer: B

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

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

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.

Answer: A

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13. 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 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.

Answer: C

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14. 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.

D.

Answer: B

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Exercise Fill In The Blanks

1. The n/p ratio for a stable lighter nuclei is about ....

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2. In $\beta-$ emission, n/p ratio...........................

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3. The half – life of a radioactive isotope is always. ....

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4. The decay constant related to half – life period is ....

Watch Video Solution

5. The rate of disintegration of a radioactive substance is .... to the number of atoms present at that time .

Watch Video Solution

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6. Radioactive substance of 1 curie is the amount that can produce .... disintegrations per second.

View Text Solution

7. The last member of $4n+1$ series is an isotope of ....

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8. The conversion of one element into another by aritificial means is termed ....

View Text Solution

9. In nuclear reactions, total number of .... and .... are conserved.

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10. In exoergic reaction, the total mass of products is .... than the total mass of reactants.

View Text Solution

View Text Solution

11. The disappearance of one atomic mass unit (amu) releases .... MeV energy.

View Text Solution

12. The most effective projectile in the transmutation of heavy element is ....

View Text Solution

13. The hydrogen bomb uses the principle of ....

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14. The atomic bomb uses the principle of ....

Watch Video Solution

15. .... brings fission in U^{235}.

View Text Solution

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

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17. Atoms of the same element possessing identical mass but differing in half $-$ life period are called ....

Watch Video Solution

18. Nuclear fusion takes place at very high temperature and hence it is called ....

Watch Video Solution

19. The splitting of a heavy nuclei with neutron into two smaller nuclei and large amount of energy is known as ....

Watch Video Solution

20. The age of archaeological findings can be determined by . . .. method.

Watch Video Solution

21. The age of the earth has been estimated by . . .. dating technique.

Watch Video Solution

22. .... emitted by $Co - 60$ can burn cancerous cells.

Watch Video Solution

23. In Indai, the first nuclear reactor was established at ....

Watch Video Solution

24. The type of reactions considered to be the principal sources of energy in stars is .... when hydrogen is converted to ....

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25. Write the complete nuclear reactions : ltbr. a.

$._{4}Be^{9}+._{9}He^{4}\rightarrow ._{6}C^{12}+..................$

b. $._{1}H^{3}\rightarrow ._{2}He^{3}+.............$.

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

$d.\ ._{92}U^{235}+._{0}n^{1}\rightarrow ._{38}Sr^{92}+....\ Xe3._{0}n^{1}$

$e.\ ._{3}Li^{7}+._{0}n^{1}\rightarrow 2._{2}He^{4+}.........$

$f.\ ._{92}U^{238}+.......\ .\ \rightarrow ._{92}U^{239}\rightarrow ._{93}Np^{239}+....$

$g.\ ._{7}N^{14}+._{0}n^{1}\rightarrow ._{1}H^{3}+.........$

$h.\ ._{3}Li^{7}+............\ \rightarrow ._{4}Be^{8}+\gamma-$ radiations

$i.\ ._{1}H^{2}+...........\rightarrow ._{2}He^{4}+._{0}n^{1}$

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26. The transuranic element with longes half – life is ....

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27. .... is used for the treatment of leukaemia.

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28. Radioactive disintegration is a .... order reaction.

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29. Pu^{239} is artificial nuclear fuel.It is obtained from fertile material. . . ..

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30. Artificial radioactivity was discovered by . . ..

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Exercise True/False

1. The $\alpha -$ rays have more penetrating power than $\gamma -$ rays.

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2. Radioisotopes of elements have same atomic number.

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3. Smaller the value of half $-$ life period, greater is the number of atoms that are disintegrating.

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4. Radon, actinon, and thoron are isobars.

Watch Video Solution

5. The last member of $4n + 1$ series is an isotope of lead.

Watch Video Solution

6. Gamma rays produce maximum ionization in gases.

Watch Video Solution

7. The radioactive decay follows zero $-$ order kinetics.

Watch Video Solution

8. Pu^{239} is an artificial fissile material.

Watch Video Solution

9. Control rods of calcium or boron are inserted into the nuclear reactor to absorb neutrons.

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10. I^{131} is unsed to study the activity of thyroid gland.

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11. Alpha particles are positively charged.

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12. Tritium is $\beta -$ radioactive in nature.

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13. The atomic reactor when used to generate electricity is termed breeder reactor.

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14. The nuclear activity of a neutral atom and its ion is always the same.

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15. A positron is as heavy as a proton.

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16. The percentage efficiency of nuclear fissiion is higher than nuclear fusion.

Watch Video Solution

17. The ratio of C^{14}/C^{12} in dead tissue is less than that in fresh tissue.

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18. The SI unit of radioactivity is curie.

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19. All radioactive elements which emit $\beta -$ rays have the same half $-$ life periods.

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20. The emission of an $\alpha -$ particle reduces the mass of nuclei by 4 units and increases its atomic number by 2.

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Archives Linked Comprehension

1. Carbon-14 used to determine the age of organic material. The procedure is absed on the formation of C^{14} by neutron capture iin the upper atmosphere.

$\cdot_7 N^{14} + \cdot_0 n^1 \rightarrow \cdot_6 C^{14} + \cdot_1 H^1$

C^{14} is absorbed by living organisms during photosynthesis. The C^{14} content is constant in living organism. Once the plant or animal dies, the uptake of carbon dioxide by it ceases and the level of C^{14} in the dead being falls due to the decay, which C^{14} undergoes.

$\cdot_6 C^{14} \rightarrow \cdot_7 N^{14} + \beta^{c-}$

The half $-$ life period of C^{14} is 5770 year. The decay constant (λ) can be calculated by using the following formuls :

$$\lambda = \frac{0.693}{t_{1/2}}$$

The comparison of the β^{c-} activity of the dead matter with that of the carbon still in circulation enables measurement of the period of the isolation of the material from the living cycle. The method, however, ceases to be accurate over periods longer than 30000 years. The proportion of C^{14} to C^{12} in living matter is $1 : 10^{12}$.

Which of the following options is correct ?

A. In living organisms, circulation of $.^{14}C$ from the atmosphere is high, so the carbon content is constant in organism.

B. Carbond dating can be used to find out the age of earth crust and rocks.

C. Radioactive absorption due to cosmic radiation is equal to the rate of radioactive decay. Hence, the carbon content remains constant in living organisms.

D. Carbon dating cannot be used to determine concentration of C^{14} in dead beings.

Answer: C

View Text Solution

2. Carbon-14 used to determine the age of organic material. The procedure is absed on the formation of C^{14} by neutron capture iin the upper atmosphere.

$\cdot_7 N^{14} + \cdot_0 n^1 \rightarrow \cdot_6 C^{14} + \cdot_1 H^1$

C^{14} is absorbed by living organisms during photosynthesis. The C^{14} content is constant in living organism. Once the plant or animal dies, the uptake of carbon dioxide by it ceases and the level of C^{14} in the dead being falls due to the decay, which C^{14} undergoes.

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

A. 6 years

B. 6000 years

C. 60000years

D. It can be used to calculate any age

Answer: B

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3. Carbon-14 used to determine the age of organic material. The procedure is absed on the formation of C^{14} by neutron capture iin the upper atmosphere.

$\cdot_7 N^{14} + \cdot_0 n^1 \rightarrow \cdot_6 C^{14} + \cdot_1 H^1$

C^{14} is absorbed by living organisms during photosynthesis. The C^{14} content is constant in living organism. Once the plant or animal dies, the uptake of carbon dioxide by it ceases and the level of C^{14} in the dead being falls due to the decay, which C^{14} undergoes.

$\cdot_6 C^{14} \rightarrow \cdot_7 N^{14} + \beta^{c-}$

The half $-$ life period of C^{14} is 5770 year. The decay constant (λ) can be calculated by using the following formuls :

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The comparison of the β^{c-} activity of the dead matter with that of the carbon still in circulation enables measurement of the period of the isolation of the material from the living cycle. The method, however, ceases to be accurate over periods longer than 30000 years. The proportion of C^{14} to C^{12} in living matter is $1: 10^{12}$.

A nuclear explosion has taken place leading to an increase in the concentration of C^{14} in nearby areas. C^{14} concentration is C_1 in nearby 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 places , respectively, then

A. The age of the fossil will increase at the place where explosion has taken place and $T_1 - T_2 = \frac{1}{\lambda}\ln\frac{C_1}{C_2}$

B. The age of the fossil will decrease at the place where explosion has taken place and $T_1 - T_2 = \frac{1}{\lambda}\ln\frac{C_1}{C_2}$

C. The age of fossile will be determined to be same.

D. $\frac{T_1}{T_2} = \frac{C_1}{C_2}$

Answer: A

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Archives Multiple Correct

1. The nuclear reaction (s) accompanied with the emission of neutron(s) is / are

A. $._{13} Al^{17} + ._{2} He^{4} \rightarrow ._{15} P^{30}$

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

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

D. $._{96} Am^{241} + ._{2} He^{4} \rightarrow ._{97} Bk^{244} + ._{1} e^{0}$

Answer: A::D

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2. Decrease in atomic number is observed during

A. Alpha emission

B. Beta emission

C. Positron emission

D. Electron emission

Answer: A::C::D

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3. In the nuclear transmutation

$._4Be^9 + X \rightarrow ._4Be^8 + Y$

(X, Y) is $/$are

A. (γ, n)

B. (p, D)

C. (n, D)

D. (γ, p)

Answer: A::B

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Archives Single Correct Anser

1. If uranium (mass number 238 and atomic number 92) emits an $\alpha -$ paticle, the produc has mass number and atomic number

A. 236 and 92

B. 234 and 90

C. 238 and 90

D. 236 and 90

Answer: B

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2. An isotope of $._{32}Ge^{76}$ is

A. $._{32}Ge^{77}$

B. $._{33}As^{77}$

C. $._{34}Se^{77}$

D. $._{34}Se^{78}$

Answer: A

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3. The radiations from a naturally occuring radioactive substance as seen after deflection by a magnetic field in one direction are

a.Only α-rays b. Only β-rays

c. Both α-and $\beta -$ rays d. Either α-or β-rays

A. Definitely alpha rays

B. Definitely beta rays

C. Both alppha and beta rays

D. Either alpha or beta rays

Answer: D

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4. The half $-$ life periof of a radioactive element is 140 days. After 560 days, one gram of the element will reduce 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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5. $._{13}Al^{27}$ is a stable isotope. $._{13}Al^{29}$ is expected to disintegrate by

A. $alph-$ emission

B. $\beta-$ emission

C. Positron emission

D. Proton emission

Answer: B

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

A. $\beta^{c-} \quad - $ emission

B. $alph -$ emission

C. $\beta^{\oplus} \quad -$ emission

D. K electron capture.

Answer: A

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8. 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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9. Bombardment of aluminium of $\alpha -$ particle leads to its artificial disintegration in two ways (i) and (ii) as shown below. Product $X, Y,$ and Z, respectively, are

$$\cdot_{14} Si^{30} + X \xleftarrow{(i)} \cdot_{13} Al^{27} \xrightarrow{(ii)} \cdot_{15} P^{30} + Y \rightarrow \cdot_{14} Si^{30} + Z$$

A. Proton, neutron, positron

B. Neutron, positron, proton

C. Proton, positron, neutron

D. Positron, proton, neutron

Answer: A

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Archives Assertion-Reasoning

1. Assertion (A) : Nuclide AI_{13}^{30} is less stable than Ca_{20}^{40}

Reason (R) : Nuclide having odd number of proton and neuctrons are generally unstable

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

Answer: B

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2. 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. 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

Answer: A

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Archives Integer-Type

1. 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 ?

$$._{29}Cu^{63} + ._{1}H^{1} \rightarrow 6._{0}n^{1} + ._{2}He^{4}(\alpha) + 2._{1}H^{1} + ._{Z}X^{A}$$

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Archives Fill In The Blanks

1. An element $._{Z}M^{A}$ undergoes an $\alpha-$ emission followed by two successive $\beta-$ emissions. The element formed is ....

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2. Elements of the same mass number but of different atomic number are known as ....

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3. The number of neutrons in the parent nucleus which gives N^{14} on beta emission is

....

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4. $a.\ ._{92}U^{235} + ._{0}n^{1} \rightarrow (52)A^{137} + ._{40}B^{97} + \ldots\ldots\ldots$

$b.\ ._{34}Se^{84} \rightarrow 2._{-1}e^{0} + \ldots\ldots\ldots$

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5. Complete the following :

i.$._{7}N^{14} + ._{2}He^{4} \rightarrow ._{8}O^{17} + \ldots\ldots\ldots$

$ii.\ ._{92}U^{235} + ._{0}n^{1} \rightarrow ._{55}A^{142} + ._{37}B^{92} + \ldots\ldots\ldots$

$iii.\ {}_{29}Cu^{53} \rightarrow {}_{28}Ni^{53} + \ldots\ldots\ldots\ldots\ldots\ldots.$

$iv.\ 2.{}_{1}H^{3} \rightarrow {}_{2}He^{4} + \ldots.$

$v.\ {}_{96}Cm^{246} + {}_{6}C^{12} \rightarrow {}_{102}No^{254} + \ldots\ldots\ldots.$

$vi.\ {}_{94}Pu^{239} + \ldots\ldots \rightarrow {}_{96}Cm^{242} + {}_{0}n^{1}$

$vii.\ {}_{34}Se^{82} \rightarrow \ldots\ldots\ldots\ldots + 2.{}_{-1}e^{0}$

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Archives Subjective

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

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3. 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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4. 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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5. 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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6. Ac^{227} has a half $-$ life of 22.0 years with respect to one leading . To Th^{227} and the other to Fr^{227}. The percentage yields of these two daughter nuclides are 2.0 and 98.0, respectively . What are the decay constants (λ) for each of the separate paths ?

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

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8. (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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9. Calculate the number of α- and β-particles emitted when $._{92}U^{238}$ into radioactive $._{82}Pb^{206}$.

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10. $Cu^{64}(\text{ half life} = 12.8\text{hours})$ decay by $\beta^{c-} -$ emission (38%), $\beta^{\oplus} -$ emission(19%), and electron capture (43%). Write the decay products and calculate partial half lives for each of the decay processes.

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11. Th^{234} disintegrates and emits $6\beta -$ and $7\alpha -$ particles to form a stable product. Find the atomic number and mass number of the stable product and also identify the element.

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12. Calculate the number of α- and β-particles emitted when $._{92}U^{238}$ into radioactive $._{82}Pb^{206}$.

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13. 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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