PHYSICS

BOOKS - MODERN PUBLICATION

Radioactivity

Example

1. After a series of alpha and beta decays,plutonium $\left({}_{}(94)Pu^{239} \right)$ becomes lead -$\left({}_{}(82)Pb^{207} \right)$. How many alpha and beta particles are emitted in the complete decay scheme?

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2. The helf life period o a radioactive substace is 30 days.What is the time taken for $3/4th$ of its original mass to disintegrate?

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3. A radioactive substance decays to $1/32$ th initial activity in 25 days.Calculate its half life.

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4. Half life of a certain radioactive material is 130 days. After what lapse of time, the undecayed fraction of the

material will be 25% ?

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5. After a certain lapse of time,the fraction of radioactive polonium undecayed is foud to be 12.5% of the initial quanitity.What is the duration of this time lapse,if the half life of polonium is 138 days?

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6. Tha half-life of U^{238} against alpha decays is $1.42 \times 10^{17} s$ .How many disintengrations per second occur in 1 g of U^{238}?Given,Avogadro umber $= 6.02 \times 10^{23} mol^{-1}$.

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7. A radioactive material is reduced to $\frac{1}{16}$ of its original amount in 4 days. How much material should one begin with so that $4 \times 10^{-3} kg$ of the material is left after 6 days.

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8. If the activity of a radiacctive element drops to $\frac{1}{16} th$ of its inital value in 40 years. Find its half-life period.

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9. In an experiment,the activity of 1.2 milligram(mg) of radioactive potassium chloride (chlroide of isotopeK_40) was found to be $170s^{-1}$.Taking molar mass of $K-40Cl$ to be 0.075 kg mole ^(-1),find the number of K-40 atoms in the sample and hence find the half-life of K-40 .Given ,Avogadro number =6.0 x 10^(23) mole^(-1).

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10. Biologically useful technetium nuclei(with atomic weight 99) have half life of 6 hours.a solution conatning 10^{-12} gram of this is injected into the bladder of a patient .Find its activity at the beginning and after one hour.

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11. Prove rthat the instantaneous rate of change of the activity of a radioactive substance is inversely propoertional to the square of its half-life.

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12. The nucleus of an atom of $._{92}Y^{235}$ initially at rest decays by emitting an alpha particle. The binding energy per nucleon of parent and dougther nuclei are 7.8MeV and 7.835MeV respectively and that of alpha particles is $7.07MeV/\text{nucleon}$. Assuming the dougther nucleus to be formed in the unexcited state and neglecting its share of energy in the reaction, calculate speed of emitted alpha particle. Take mass of alpha particle to be $6.68 \times 10^{-27}kg$.

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13. How many alpha and eta - particles are emitted ,when uranium nucleus $\left({}_{}(92)U^{238} \right)$ decays to lead $\left({}_{}(82)Pb^{206} \right)$?

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14. There is a stream of neutrons with a kenetic energy of 0.0327 eV.If the half life of neutrons is 700 s,what fraction of neutrons will decays before they trael a distance of 10 m?

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15. Some amount of a radioactive substance (half-life=10days) is spread inside a oun and consequently ,the level of radiation becomes 50 times the permissible level for normal occupancy of the room.After how many days,the room will be safe for occupataion?

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16. The nucleus of an atom of $._{92}Y^{235}$initially at rest decays by emitting an alpha particle. The binding energy per nucleon of parent and dougther nuclei are 7.8MeV and 7.835MeV respectively and that of alpha particles is $7.07MeV/\text{nucleon}$. Assuming the dougther nucleus to be formed in the unexcited state and neglecting its share of

energy in the reaction, calculate speed of emitted alpha particle. Take mass of alpha particle to be $6.68 \times 10^{-27} kg$.

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17. A count rate meter is used to measure the activity of a given sample.At one instant .the meter shown 4,750 counts $\min^{-1}$. Five minutes later,it shown 2,700 counts $\min^{-1}$. Find the decay constant

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18. A count rate meter is used to measure the activity of a given sample.At one instant .the meter shown 4,750

counts $\min^{-1}$. Five minutes later,it shown 2,700 counts $\min^{-1}$. Find the decay constant

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19. A radioactive element decays by β-emission. A detector records n beta particles in 2 s and in next 2 s, it records 0.75 n beta particles .Find mean life correct to nearest whole number. Give that $\log_e 2 = 0.6931$ and $\log_e 3 = 1.0986$.

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20. A small quantity of solution containing Na^{24} radio nuclide (half-life=15 h) of activity 1.0 microcurie is injected

into the blood of a person. A sample of the blood of volume 1cm^3 taken after 5h shows an activity of 296 disintegrations per minute. Determine the total volume of the blood in the body of the person. Assume that the radioactive solution mixes uniformly in the blood of person.

$(1curie = 3.7 \times 10^{10}$disintegrations per second)

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21. A radioactive nucleus X decays to a nucleus Y with a decay constant $\lambda_X = 0.1s^{-1}$, Y further decays to a stable nucleus Z with a decay constant

$\lambda_Y = 1/30s^{-1}$. Initially, there are only X nuclei and their number is $N_0 = 10^{20}$. Set up the rate equations for the

populations of X, Y and Z. The population of Y nucleus as a function of time is given by $N_Y(t) = \{N_0\lambda_X/(\lambda_X - \lambda_Y)\}[\exp(-\lambda_Y t) - \exp(-\lambda_X t)]$. Find the time at which N_Y is maximum and determine the population X and Z at that instant.

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22. Radioactive element A are being produced at a constant rate α. The element has a decay constant λ. At time t=0, there are N_0 nuclei of the element.

Calculate the number of nuclei A at time t.

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23. A nucleus at rest undergoes a decay emitting an alpha -particle of de-broglie wavelength lambda = $5.76 \times 10^{-15} m$. The mass of daughter nucleus is 223.40 amu and that of alpha-particle is 4.002 a.m.u.detrmine the total kinetic energy in the final state.Hence,obtain teh mass of the parent nucleus in a.m.u.

Given that $1 a.\, m.\, u. \, = 931.470 MeV$.

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24. In the chemical analysis of a rock the mass ratio of two radioactive isotopes is found to be 100:1. The mean lives of the two isotopes are 4×10^9years and2×10^9 years, respectively. If it is assumed that at the time of formation

the atoms of both the isotopes were in equal propotional, calculate the age of the rock. Ratio of the atomic weights of the two isotopes is 1.02:1.

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25. What do you mean by radioactive substance?

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26. What is radioactivity ? Explain laws of radioactivity.

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27. Name two radioactive elements, which are not found in observable quantity in nature, why is it so?

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28. What are α-particles?

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29. What is β-particle?

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30. What are γ-rays?

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31. Among α (alpha), β (beta) and γ (gamma) radiations, which one is not affected by a magnetic field ?

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32. Which has greater ionising power : alpha particle or beta particle ?

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33. Why do alpha particles have a hight ionising power?

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34. Arrange radioactive radiations in the increasing order of their penetrating powers

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35. Arrange radioactive radiations in the increasing order of their penetrating powers

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36. "All radioactive substances seem to be identical".Comment.

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37. Define decay constant.

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38. Why is it not possible to define total life of radioactive substance?

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39. Define half life of a radioactive substance.

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40. The half life of $_6C^{14}$ is 5,700 years .what does it mean?

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41. Give the relation between half life and disintegration constant of a radioactive material.

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42. Plutonium decays with a half-life of 24,000 years.If plutonium is stored for 72,000 yuears,what fraction of it remains ?

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43. A radioisotope of silver has half-life of 20 minutes.What fraction of the original mass would remain after one hour?

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44. A certain radioactive substance has a half period of 30 days. What is disintegration constant?

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45. Define half life of a radioactive substance.

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46. Radioactive element A are being produced at a constant rate α. The element has a decay constant λ. At time t=0, there are N_0 nuclei of the element.

If $\alpha = 2N_0\lambda$, calculate the number of nuclei of A after one half life of A and also limiting value of N as $t \to \infty$.

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47. A radioactive uclide has a decay costant equal to λ.Give the formula for the

mean life of this nuclide.

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48. What is meany by average life of a radioactive element? Derive an expression for it. What is the relation between average life and half life?

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49. define activity of a radioactive material and write its Si units.

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50. Does the activity of a radioactive element depend on external physical conditions?

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51. Write down the values of one millicurie in terms of rutherford.

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52. A radioactive substnce havig N nuclei has activity R.Write down an expressin for its half-life in terms of R and N.

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53. Plot a graph showing variation of activity of a given radioactive sample with time.

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54. What is alpha decay, beta decay and gamma decay?

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55. Give the mass number and atomic number of elements on the righthand side of the decay process ${}_{86}^{220}Ru \to P \oplus He.$

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56. Define beta (β) decay.

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57. Write a general equation that represents beta emission.

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58. Write nuclear reaction equations for- $\beta - decayof_{15}^{32}P$

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59. What is the difference between an electron and a β-particle?

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60. What is the difference between an electron and a β-particle?

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61. Why do all electrons emitted during beta decay not have the same energy? give reasons.

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62. Plot the distribution of kinetic energy of $\beta - particles$ and state why energy spectrum is continuous?

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63. Why do all electrons emitted during beta decay not have the same energy? give reasons.

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64. Write the basic nuclear processes of neutron undergiong β-decay .Why is the detection of neutrinos found very difficult?

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65. What is alpha decay, beta decay and gamma decay?

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66. Why does a nucleus emit a γ-ray photon?

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67. What is a radioisotope?

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68. Why all the three types of rays i.e. α, β and γ come out from a radioactive sample though a single radioactive sample obeys a particular decay mode?

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69. What is the main differnce between X-rays and $\gamma - rays$?

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70. What is radioactivity ? State laws of radioactive decay and deduce an expression for decay law.Show decay is exponential innature.

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71. What are the characteristics of radio-activity?

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72. Natural radioactive nuclei are nuclei of high mass number.Why?

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73. Heavy stable nuclie have more neutrons than protons. This is because of the fact that

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74. All the radioactive series terminate at lead as their final product.Explain,why.

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75. define activity of a radioactive material and write its Si units.

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76. Two radioactive nuclei X and Y initially contain an equal number of atoms.Their half life is 1 hour and 2 hours respectively.Calculate ratio of their rates of disintegration after two hours.

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77. Two different radioactive elements with half-lives T_1 and T_2 and N_1 andN_2 (undecayed) atoms respectively

present at a given instant. Determine the ratio of their activities at this instant.

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78. What fraction of tritium will remain after 25 years? given hlf life of tritium is 12.5 years.

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79. Define the term half life period and decay constant of a radioactive substance. Write their SI unit. Establish a relation between them.

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80. Distinguish between half and average life of a radioactive substance.

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81. Distinguish between half and average life of a radioactive substance.

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82. define activity of a radioactive material and write its Si units.

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83. Define two units of radioactivity .How are they related?

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84. In a radioactive decay,the nucleus emits an α-particle followed by two β-particles.Show that the final nucleus is an isotope of the original line.

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85. Write symbolically the process expressing the β^+ decay of $_{}(11)Na^{22}$Also write the basic nuclear process underlying this decay.

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86. Is the nucleus formed in the decay of the nucleus $_{}(11)Na^{22}$ an isotope or isobar?

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87. The sequence of stepwise decay of a radioactive nucleus is:

$$D \xrightarrow{\alpha} D_1 \xrightarrow{\beta} D_2$$

If the atomic number and mass number of D_2 and 71 and 176 respectively, what are their corresponding values for D?

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88. The sequence of stepwise decay of a radioactive nucleus is:

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If the atomic number and mass number of D_2 and 71 and 176 respectively, what are their corresponding values for D?

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89. The radioactive isotope D decays according to the sequences

$$D \xrightarrow{\beta-} D_1 \xrightarrow{\alpha - particli} D_2$$

If the mass number and atomic number of D_2 are 176 and 71 respectively, what is

atomic number of D?

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90. The radioactive isotope D decays according to the sequences

$D \xrightarrow{\beta-} D_1 \xrightarrow{\alpha-particli} D_2$

If the mass number and atomic number of D_2 are 176 and 71 respectively, what is

the mass number?

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91. The radioactive isotope D decays according to the sequences

$D \xrightarrow{\beta-} D_1 \xrightarrow{\alpha-particli} D_2$

If the mass number and atomic number of D_2 are 176 and 71 respectively, what is

the mass number?

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92. A radioactive nucleus undergoes a series of decays according to the sequence,

$$A \xrightarrow{\beta} A_1 \xrightarrow{\alpha} A_2 \xrightarrow{\alpha} A_3$$

If the mass number and atomic number of A_3 are 172 and 69 respectively,what is the mass number and atomic number of A?

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93. A radioactive nucleus A undergoes a series of decays according to the following scheme:

$$A \xrightarrow{\alpha} A_1 \xrightarrow{\beta} A_2 \xrightarrow{\alpha} A_3 \xrightarrow{\gamma} A_4$$

The mass number and atomic number of A are 180 and 72 respectively. What are these number for A_4.

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94. The sequence of stepwise decays of radioactive nucleus is

$$D \xrightarrow{\alpha} D_1 \xrightarrow{\beta} D_2 \xrightarrow{\alpha} D_3 \xrightarrow{\alpha} D_4.$$

If the nucleon number and atomic number for D_2 are respectively 176 and 71 ,what ar the corresponding values for D anD_4 nuclei .Justify your answer.

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95. How many α- and β- particles are emitted, when $_{}(92)U^{238}$ decays to $_{}(90)Th^{230}$?

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96. How many α- and β- particles are emitted, when $_{}(90)Th^{232}$ decays to $_{}(89)Ac^{228}$?

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97. How many α- and β- particles are emitted, when $_{}(90)Th^{232}$ decays to $_{}(82)Pb^{208}$?

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98. An isotope $_{}(92)U^{238}$ decays successively to form $_{}(90)Th^{234}$, $_{91}Pa^{234}$, $_{92}U^{234}$, $_{90}Th^{230}$ and $_{}(88)Ra^{226}$ .What are the radiation emitted in these five steps?

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99. The α particle faces a coulomb barrier .A neutron being uncharged faces no such barrier .Why does the nucleus $_{}(92)U^{238}$ not decay spontaneously by emitting a neutron?

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100. If the α-decay of U^{238} is energetically allowed (i.e. the decay products have a total mass less than the mass of U^(238)`) from decaying all at once? Why is its half life so large?

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101. What are α-particles?

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102. Does the ratio of neutrons to protons in a nucleus increase, decrease or remain the same after the emission

of

$\alpha - particles.$

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103. The question given below consist of an assertion (A) and a reason (R). Use the following key to choose the appropriate answer to these questions from the codes (a), (b), (c) and (d) given below:

(a) Both A and R are true and R is the correct explanation of A.

(b) Both A and R are true but R is NOT the correct explanation of A.

(c) A is true but R is false.

(d) A is false and R is also false.

Assertion: Nucleus of the atom does not contain electrons, yet it emits β-particles in the form of electrons.

Reason: In the nucleus, protons and neutrons exchange mesons frequently.

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104. A nucleus contains no electrons, but can eject them. Why?

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105. The neutron to proton ratio increases during β-decay. (True /false)

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106. What is the basic mechanism for the emission of β^- or β^+ particles in a nucleide? Give an example by writing explicity a decay process for β^- emission. Is (a) the energy of the emitted β-particles continuous or discrete,

the daughter nucleus obtained through β-decay, an isotope or an isobar of the parent nucleus?

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107. What is the basic mechanism for the emission of β^- or β^+ particles in a nucleide? Give an example by writing explicity a decay process for β^- emission. Is (a) the energy of the emitted β-particles continuous or discrete,

the daughter nucleus obtained through β-decay, an isotope or an isobar of the parent nucleus?

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108. A sample of a radioactive isotope contains N nuclei at time t.At time $(t + \triangle t)$,it contains $(N - \triangle N)$ nuclei of the isotope.

For the period $\triangle t$,state in terms of N, $\triangle N$ and $\triangle t$, the mean activity of the sample

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109. A sample of a radioactive isotope contains N nuclei at time t.At time $(t + \triangle t)$,it contains $(N - \triangle N)$ nuclei

of the isotope.

For the period $\triangle t$,state in terms of N, $\triangle N$ and $\triangle t$, the probability of decay of a nucleus.

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110. A cobalt-60 source having a half-life of 5.27 years is calibrated and found to have an activity of 3.50×10^5 Bq.The uncertainty in the calibration is $\pm 2\%$ .Calculate the length of time.in days, after the calibration has been made, for the stated activity of $3.50 \times 10^5 Bq$ to have a maximum possible error of 10%.

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111. The half - life period of radioactive element A is the same as the mean life time of another radioactive element B. Initially both of them have same number of atoms. The radioactive element B decays faster than A. Explain, why.

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112. Radon is a radioactive gas with half-life 56 s.For health reasons,the maximum permissible level of radon in air in a building is set a t 1 radon atom for every $.15 \times 10^{21}$ molecules of air 1 mol of air in the building is contained in 0.024 m^3.Calculate ,for this building

the maximum permissible number of radon atom in $1.0m^3$ of air

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113. Radon is a radioactive gas with half-life 56 s.For health reasons,the maximum permissible level of radon in air in a building is set a t 1 radon atom for every $.15 \times 10^{21}$ molecules of air 1 mol of air in the building is contained in 0.024 m^3.Calculate ,for this building

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molecules of air 1 mol of air in the building is contained in 0.024 m^3.Calculate ,for this building

the number of molecules for air in $1.0m^3$.

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115. Barium-141 has a half-life of 18 minutes.The half-life of Krypton-92 is 3.0 s .In the fission reaction of a mass of Uranium - 235 , equual numbers of barium and krypton nuclei are produced .Estimate the time tken after the fission of the sample of uranium for the ratio $\frac{\text{number of Barium}-141\text{nuclei}}{\text{number of Krypton}-92\text{nuclei}}$. to be approximately equal to 8.

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116. The isotope Phosphorus-33 undergoes β- decay to form Sulphur-33, which is stable.The half - life of Phosphorus-33 is 24.8 days.

Show that the decay constant of Phosphorus -33 is $3.23 \times 10^{-7} s^{-1}$.

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117. The isotope Phosphorus-33 undergoes β- decay to form Sulphur-33,which is stable.The half - life of Phosphorus-33 is 24.8 days.

A pure sample of Phosphorus - 33 has an initial activity of 3.7×10^{6}Bq. Calculate the initial number of Phosphorus - 33 nuclei in the sample,

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118. The isotope Phosphorus-33$\left({}_{}(15)P^{33} \right)$ undergoes β-decay to form $\text{Sulphur} - 33\left({}_{}(16)S^{33} \right)$,which is stable.The half - life of Phosphorus-33 is 24.8 days.

A pure sample of Phosphorus - 33 has an initial activity of 3.7×10^{6}Bq.Calculate

the number of Phophorus - 33 nuclei remaining in the sample after 30 days.

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119. Uranium - 234 is radioactive and emits α-particles at what appears to be a constant rate.A sample of uranium - 234 of mass $2.64\mu G$ is found to hae an activity of 604 Bq.

Calculate for the sample of Uranium -234

the number of nclei,

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120. Uranium - 234 is radioactive and emits α-particles at what appears to be a constant rate.A sample of uranium - 234 of mass $2.64\mu G$ is found to hae an activity of 604 Bq.

Calculate for the sample of Uranium -234

the decay constant

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121. Uranium - 234 is radioactive and emits α-particles at what appears to be a constant rate.A sample of uranium -

234 of mass $2.64\mu G$ is found to hae an activity of 604 Bq.

Calculate for the sample of Uranium -234

the half-life in years.

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122. Strontium-90 decays with the emission of a $\beta-$ particle to form Ytrium-90 .The reaction is represented by the equation

$_(38)Sr^{90} \rightarrow_{39} Y^{90} +_{-1} e^0 + 0.55MeV$ the decay constant is $0.025year^{-1}$.

Suggest,with a reason,which nucleus $_(38)Sr^{90}$ or $_(39)Y^{90}$,has the greater binding energy.

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123. Strontium-90 decays with the emission of a $\beta -$ particle to form Ytrium-90 .The reaction is represented by the equation

$_(38)Sr^{90} \rightarrow_{39} Y^{90} +_{-1} e^{0} + 0.55MeV$ the decay constant is $0.025year^{-1}$.

At the time of purchase of a Stronituim-90 source the activity is $3.7 \times 10^{6} Bq$.

Calculate ,for this sample of strontium,the initial number of atoms.

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Calculate ,for this sample of strontium,the initial number of atoms.

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125. The isotopes Radium-224$\left({}_{}(88)Ra^{224} \right)$ and Radium-226$\left({}_{}(88)Ra^{226} \right)$ both undergo spontaneous α-particle decay.The enrgy of the α-particles emitted froim radium -224 is 5.68 MeV and from Radium-226,4.78 MeV

Suggest with a reason ,which of the two isotopes has the larger decay constant.

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126. The isotopes Radium-$224\left({}_{(88)}Ra^{224} \right)$ and Radium-$226\left({}_{(88)}Ra^{226} \right)$ both undergo spontaneous α-particle decay.

Radium-224 has a half - life of 3.6 days.

Calculate the decay constant of Radium-224.

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127. The isotopes Radium-$224\left({}_{(88)}Ra^{224} \right)$ and Radium-$226\left({}_{(88)}Ra^{226} \right)$ both undergo spontaneous α-particle decay.The enrgy of the α-particles emitted froim radium -224 is 5.68 MeV and from Radium-226,4.78 MeV

Suggest with a reason ,which of the two isotopes has the larger decay constant.

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Suggest with a reason ,which of the two isotopes has the larger decay constant.

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129. The isotope Manganese-56 decays and udergoes $\beta -$ particle eission to form the stable isotope Iron-56 .The half life for this decay is 2.6 hours .Initially,at time t=0,a sample of Manganese-56 has a mass of $1.4\mu G$ and there is no iron - 56.

Determine the time at which the ratio is equal to 9.0.

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130. The isotope Manganese-56 decays and udergoes $\beta -$ particle eission to form the stable isotope Iron-56 .The half life for this decay is 2.6 hours .Initially,at time t=0,a sample of Manganese-56 has a mass of $1.4\mu G$ and there is no iron - 56.

For the smple of Manganese-56 ,determine

the initial number of Manganese-56 atoms in the sample an d

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For the smple of Manganese-56 ,determine

the initial activity.

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132. The isotope Manganese-56 decays and udergoes $\beta -$ particle eission to form the stable isotope Iron-56 .The half life for this decay is 2.6 hours .Initially,at time t=0,a sample of Manganese-56 has a mass of $1.4\mu G$ and there is no iron - 56.

Determine the time at which the ratio is equal to 9.0.

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133. Strontium-90 is a radioactive isotope having a half-life of 28 years.Calculate

the decay constant $\lambda\left(\in s^{-1} \right)$ of Strontium-90,

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134. Strontium-90 is a radioactive isotope having a half-life of 28 years.Strontium-90 has a denstiy f 2.5 g cm^{-3}.A smaple of Strontium-90 has an activity of $6.4 \times 10^9 Bq$ .Calculate

the mass of stronitium 90 in the sample

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135. Strontium-90 is a radioactive isotope having a half-life of 28 years.Strontium-90 has a denstiy f 2.5 g cm^{-3}.A smaple of Strontium-90 has an activity of $6.4 \times 10^9 Bq$ .Calculate

the volume of the sample.

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136. Suggest why dust that has been contaminated with Strontium-90 presents a serious health hazard.

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137. A radioactive sample decays by simultaneous emission of two particles having respective half-lives of 1,620 years and 810 years. After what time, one fourth of the sample will be left behind?

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138. Why electron capture is common in case of heavy nuclei?

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Exercise

1. What is meant by radioactive substance?

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2. What is radioactivity ? State laws of radioactive decay and deduce an expression for decay law.Show decay is exponential innature.

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3. State the law of radioactive decay. Show that radioactive decay is exponential in nature.

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4. State the law of radioactive decay, If N_0 is the number of radioactive nuclei in the sample at same initial time, find out the relation to determine the number N present at a subsequent time. Draw a plot of N as a function of time.

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5. Show that decay rate R of a sample of a radio-nuclide is related to the number of radioactive nuclei N at that

instant by the expression $R = \lambda N$.

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6. State the law of radioactive decay and hence derive the relation $N = N_0 e^{-\lambda t}$, where the letters have their usual meanings?

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7. State the law of radioactive decay and hence derive the relation $N = N_0 e^{-\lambda t}$, where the letters have their usual meanings?

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8. Sketch a graph to illustrate radioactive decay.

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9. What is meant by half life of a radioactive substance? Derive expression for them. What is relation between average life and half life?

Watch Video Solution

10. What is radioactivity ? State laws of radioactive decay and deduce an expression for decay law.Show decay is exponential innature.

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11. An isotope $_{}(92)U^{238}$ decays successively to form $_{}(90)Th^{234}$, $_{91}Pa^{234}$, $_{92}U^{234}$, $_{90}Th^{230}$ and $_{}(88)Ra^{226}$ .What are the radiation emitted in these five steps?

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12. Define decay constant of a radioactive sample. Which of the following radiations, $\alpha - rays, \beta - rays, \gamma - rays$ are similar to X-rays?

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13. Define decay constant of a radioactive sample. Which of the following radiations, $\alpha - rays, \beta - rays, \gamma - rays$ are easily absorbed by matter?

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14. Define decay constant of a radioactive sample. Which of the following radiations, $\alpha - rays, \beta - rays, \gamma - rays$ travel with greatest speed?

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15. Define decay constant of a radioactive sample. Which of the following radiations, $\alpha - rays, \beta - rays, \gamma - rays$

are similar in nature to cathode rays?

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16. The rate constant and half life of a first order reaction are related to each other as:

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17. State the law of radioactive decay. Show that radioactive decay is exponential in nature.

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18. State the law of radioactive decay. Show that radioactive decay is exponential in nature.

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19. Define half life of a radioactive substance.

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20. What is radioactivity ? State laws of radioactive decay and deduce an expression for decay law.Show decay is exponential innature.

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21. Express the relation between the half life period of a reactant and its initial concentration for a reaction of nth order.

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22. State the law of radioactive decay. Show that radioactive decay is exponential in nature.

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23. Define half life of a radioactive substance.

Watch Video Solution

24. Define the term half life period and decay constant of a radioactive substance. Write their SI unit. Establish a relation between them.

Watch Video Solution

25. Define half life of a radioactive substance.

Watch Video Solution

26. What is meany by average life of a radioactive element? Derive an expression for it. What is the relation between average life and half life?

Watch Video Solution

27. Define the term half life period and decay constant of a radioactive substance. Write their SI unit. Establish a relation between them.

Watch Video Solution

28. Define the term half life period and decay constant of a radioactive substance. Write their SI unit. Establish a relation between them.

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29. Derive an expression for the average life of a radionuclide.Give its relationship with the half - life.

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30. What is the mass of an α-particle ?

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31. What is meant by the Alpha decay?

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32. What is β-particle?

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33. What is beta decay? Write a brief account of $\beta - particle$ spectrum?

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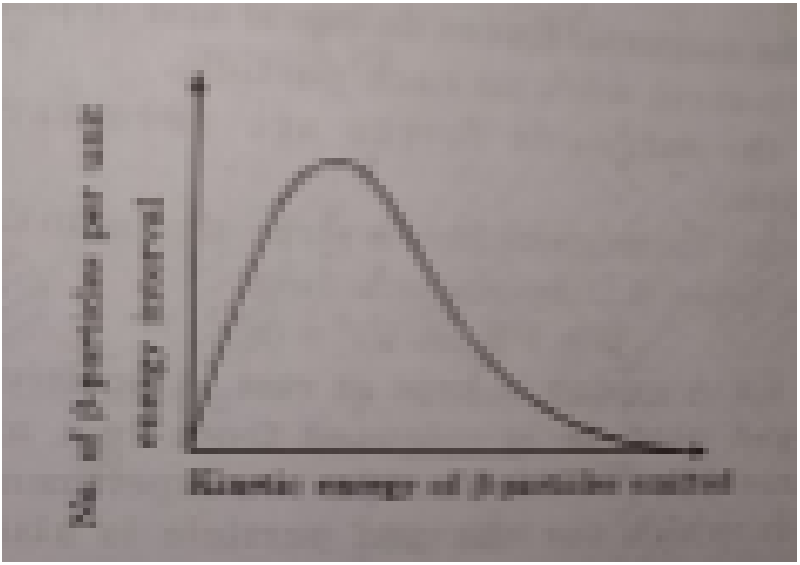
34. Consider the decay of the free neutron at rest:

n = p + e^{-} .

Show that the two-body decay of this type must necessarily give an electron of fixed energy and, therefore, cannot account for the observed continuous energy

distribution in the β decay of a neutron or a nucleus.



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35. Explain,how radioactive nuclei can emit$\beta -$ particles even though nuclei do not contain these particles.Hence explain why the mass number of a radioactive nuclide does not charge during β decay.

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36. Define gamma (γ) decay.

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37. What is alpha decay, beta decay and gamma decay?

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38. Explain radio-carbon dating.

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39. What is natural radioactivity ? What type of radiations are emitted ? Write two properties of each one.

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40. State the law of radioactive decay. Show that radioactive decay is exponential in nature.

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41. State the law of radioactive decay, If N_0 is the number of radioactive nuclei in the sample at same initial time, find out the relation to determine the number N present

at a subsequent time. Draw a plot of N as a function of time.

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42. State the law of radioactive decay, If N_0 is the number of radioactive nuclei in the sample at same initial time, find out the relation to determine the number N present at a subsequent time. Draw a plot of N as a function of time.

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43. Give the relation between half life and disintegration constant of a radioactive material.

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44. What is meant by half life of a radioactive substance? Derive expression for them. What is relation between average life and half life?

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45. A radioactive nucleus is represneted by the symbol $_{}bX^{a}$,How is the new ucleus represented after the emission of

an alpha particle

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46. A radioactive nucleus is represneted by the symbol $_bX^a$,How is the new ucleus represented after the emission of

a beta particle

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47. A radioactive nucleus is represneted by the symbol $_bX^a$,How is the new ucleus represented after the emission of

a gamma ray photon?

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48. What is meant by half life of a radioactive substance? Derive expression for them. What is relation between average life and half life?

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49. Define α- decay and show that kinetic energy of an α-particle is

$$\frac{m_y Q}{m_y + m_\alpha},$$

Where the symbols have their usual meaning.

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50. Tha half-life of U^{238} against alpha decays is $1.42 \times 10^{17} s$.How many disintengrations per second occur in 1 g of U^{238}?Given,Avogadro umber $= 6.02 \times 10^{23} mol^{-1}$.

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51. Tha half-life of U^{238} against alpha decays is $1.42 \times 10^{17} s$.How many disintengrations per second occur in 1 g of U^{238}?Given,Avogadro umber $= 6.02 \times 10^{23} mol^{-1}$.

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52. The atomic weiht of radium is 226 .It is observed that $3.67 \times 10^{10} \alpha$- particles are emitted per second from one gramp of radium.Calculate in years the half-life period of radium.

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53. Tha half-life of U^{238} against alpha decays is $1.42 \times 10^{17} s$.How many disintengrations per second occur in 1 g of U^{238}?Given,Avogadro umber $= 6.02 \times 10^{23} mol^{-1}$.

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54. 4 g of radioactive material of half-life 10 years is kept in a store for 15 years.How much material is disintergrated?

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55. One gram radium is reduced by 2 milligram in 5 years by α-decay. Calculate the half period of radium.

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56. The half-life of a radioactive substance is 1,672 years. If the initial mass of the substance is 1 g, after how many years will only 1 mg of it to be left behind?

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57. The half-life of a radiaoactive substance is 100 years. In how many years its activity will deacy to 10% of its initial value?

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58. The half-life of a radiaoactive substance is 100 years. In how many years its activity will deacy to 10% of its initial value?

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59. A nucleus of UX_1 has a half - life of 24.1 days.How long a sampleUX_1 will take to change 90% of it to UX_2?

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60. Radioactive disintegration is a first order reaction and its rate depends only upon the nature of nucleus and does not depend upon external factors like temperature and pressure. The rate of radioactive disintegration (Activity) is represented as

$-\frac{dN}{dt} = \lambda N$ Where $\lambda =$ decay constant, N= number of nuclei at time t, N_0 =intial no. of nuclei. The above equation after integration can be represented as

$$\lambda = \frac{2.303}{t}\log\left(\frac{N_0}{N}\right)$$

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

a) 1185 years

b) 2370 years

c) 52.5 years

d) none of these

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61. If the activity of a radiacctive element drops to $\frac{1}{16}th$ of its inital value in 40 years. Find its half-life period.

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62. The half-life of a radiaoactive substance is 100 years. In how many years its activity will deacy to 10% of its initial value?

Watch Video Solution

63. The half-life of a radiaoactive substance is 100 years. In how many years its activity will deacy to 10% of its initial value?

Watch Video Solution

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Watch Video Solution

65. The half-life of a radiaoactive substance is 100 years. In how many years its activity will deacy to 10% of its initial value?

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66. One gram of $_{(88)}Ra^{226}$ has activity of one curie .Find its half-life period.

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67. Obtain the amount of $^{60}_{27}Co$ necessary to provide a radioactive source of 8.0 mCi strength. The half-life of $^{60}_{27}Co$ is 5.3 years.

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68. The count rate from a radiuactive sample falls from $4.0 \times 10^6 s^{-1}$ to $1.0 \times 10^6 s^{-1}$ in 20 hours.What will be the count rate 100 hours after the beginning.

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69. A radioactive sample can decay by two different processes .The half-life for the first process is T_1 and that for the second process is T_2. Show that the effective half-

life T of the nucleus is given by

$$\frac{1}{T} = \frac{1}{T_1} + \frac{1}{T_2}.$$

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70. 1 mg of thorium emits 22 $\alpha -$ particles per minute per unit solid angle.Calculate average - life of thorium.Atomic weight of thorium-232.

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71. A point source of γ- radiatonhas a half-life of 30 minutes.The intitial count rate recorded by Geiger counter placed 2 m from the source is $360s^{-1}$.The distnace between the counter and the source is altered.After 1.5

hours,the count rate recorded is $5s^{-1}$.What is th new distnace between the counter and the source?

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