Radioactive decay problems and solutions

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In order to continue to use our website, we ask you to confirm your identity as a person. Thank you so much for your cooperation. The problem #1: the semi-imem of unin-71 is 2.4 minutes. If the beginning was 100.0 grams, how many grams would be left in 7.2 minutes? Solution: 7.2 / 2.4 - 3 semi-illium (1/2)3 - 0.125 (the amount left after 3 semi-finals) 100.0 g x 0.125 and 12.5 g remaining problem #2: Pd-100 has a half-term of 3.6 days. If there were 6.02 x 1023 atoms in the beginning, how many atoms would be present in 20.0 days? Solution: 20.0 / 3.6 th 5.56 semi-finals (1/2)5.56 and 0.0213 (decimal fraction, (6.02 x 1023) (0.0213) 1.28 x 1022 atoms remain a problem #3: Os-182 has a half-powder period of 21.5 hours. How many grams of a 10.0 gram sample would break up after exactly three half billions? Solution: (1/2)3 - 0.125 (the amount left after 3 semi-family) 10.0 g x 0.125 g. In addition, please note that the amount that has broken up has been put in place, not the amount that has been overworked. The problem #4: After 24.0 days, 2.00 milligrams of the original sample of 128.0 milligrams remain. What is the time of the semi-mymies sample? Solution: Decimal fraction remaining: 2.00 mg / 128.0 mg and 0.015625 2) How many semi-familys must be easpsed to get to 0.015625 remaining? (1/2)n 0.015625 n magazine 0.5 - magazine 0.015625 n - magazine 0.5 / magazine 0.015625 n No 6 3) Define the period Half-seila: 24 days / 6 periods of semi-seine and 4.00 days Video: An alternative solution to the aforementioned problem #5: the radioactive isotope disintegrated to 17/32 of its original mass after 60 minutes. Find half of this radioisotop's life. Solution: 17/32 y 0.53125 (this is the decimal amount that remains) (1/2)n 0.53125 n magazine 0.5 - magazine 0.53125 n 0.91254 (this is how many half-seed periods have passed) The problem of #6 / 0.91254 y 65.75 min 66 min (up to two sig figs) Problem #6: How long will it take for a 40.0 gram sample of I-131 (half life 8,040 days) to decay to 1/100 of its original mass? Solution: (1/2)n 0.01 n magazine 0.5 - magazine 0.01 n - 6.64 6.64 x 8.040 days - 53.4 days Problem #7: Fermium-253 has a half-seed term of 0.334 seconds. It is believed that the radioactive sample completely decomposes after 10 periods of half-mile. How long will it take for this specimen to be considered extinct? Solution: 0.334 x 10 and 3.34 seconds Problem #8: At a time of zero time, there are 10.0 grams of W-187. If the half-life is 23.9 hours, how long will be present at the end of one day? Two days? Seven days? Solution: 24.0 hr / 23.9 hr/half-life - 1.0042 semi-family one day and one semi-family term; (1/2)1.0042 - 0.4985465 remaining 4.98 g Two days and two half-days; (1/2)2.0084 - 0.2485486 remaining - 2.48 g Seven days and 7 half-billion; (1/2)7.0294 - 0.0076549 remaining 0.0765 G Problem #9: 100.0 grams of isotope with a semi-seven service life of 36.0 hours is present at zero time. How long will it take to get 5.00 grams Solution: 5.00 / 100.0 y 0.05 (remaining decimal fraction) (1/2)n 0.05 n magazine 0.5 4.0 The semi-family period of 36.0 hours x 4.32 and 155.6 hours Problem #10: How long will it take for an H-3 sample to lose 75% of its radioactivity? The lifespan of tritium is 12.26 years. Solution: If you lose 75%, then 25% remains. Use 0.25, not 25%. (1/2)n 0.25 No 2 (remember (1/2)2 - 1/4 and 1/4 - 0.25) 12.26 x 2 x 24.52 Years Comment: A more general explanation follows: (1/2)n 0.25 n journal 0.5 - journal 0.25 n - journal 0.25 / journal 0.5 n No. 2 In nature there are a large number of atomic nuclei that can spontaneously emit elementary particles or nuclear fragments. This phenomenon is called radioactive decay. This effect was studied at the turn of the century by Antoine Becquerel, Marie and Pierre Curie, Frederick Soddy, Ernest Rutherford and other scientists. As a result of experiments F. Soddy and E. Rutherford brought out the law on radioactive decay, which is given by a differential equation: Frak-dde - lambda N where the amount of radioactive material, (lambda) is a positive constant depending on the radioactive substance. The minus sign on the right side means that the amount of radioactive material (left (t right) decreases over time (Figure No (1)). This equation is easy to solve, and the solution is in the form: Nya left (tright) - N_0 lambda t.N_0 Next, we introduce two useful parameters that will result from this law. The period of the life or the period of the semi-seed (T) of the radioactive material is the time when it decomposes to half the original cost of the material. So at the moment (T:) (left) (T (right) N_0 {2} (N_0) - Lambda TK{1}{2}. Farrow Right - Lambda T and Frak{1}{2} - in 2,; Right Case T (frak{1} Lambda in 2.{1} TK) and average life expectancy (Tau) are related to each other according to the formula: T Tau in 2 approximately 0.693 tau These (2)) parameters vary greatly for different substances. For example, the term of a half-seed polonium -- (212) is less than a microsecond, but the half-seed of thorium-z (232) is more than 1 billion years old. A wide range of isotopes with different half-seed periods was ejected from nuclear reactors and cooling pools in Chernobyl and Fukushima (Figure 2). Figure 2. Solve the problem Click or click the problem button to see the solution. Find a mass of radioactive isotope if half of life has occurred. Initial mass of material ((80), text (text) The initial mass of iodine isotope was (200), textg.)) Identify the mass of iodine after 1 (30)) days if half the life of the isotope is (8) days. Radioactive isotope Indium-W (111) is often used for diagnostics and imaging in nuclear medicine. Its semi-seven is (2.8) days. What was the initial mass of the isotope before the collapse, if the mass for weeks was (5), text?) Find a half-network period of a radioactive element if its activity decreases within a month by 10%) Find the mass of a radioactive isotope if (3) half of life occurred. The original mass of the material was a (80, text) solution. The mass of radioactive material is reduced by half after each semi-drying. Thus, after half of life (3) will be half the material :(, will be ((large fra{1}{2}ormalsize) 3 (largefrac{1}{8}{1}{8}ormalsize) of the original amount. The initial mass of the iodine isotope was (200,)) to determine the mass of iodine after (30) days if half the life of the isotope is (8) days. Solution. According to the law on radioactive decay, the mass of the isotope depends on the time as follows: N_0 Nya left (right) - lambda t. Here the constant of decay (lambda) is equal to lambde and frac in 2.T.; «kern-0.3pt»T (8); Calculate the mass of iodine isotope within 30 days: Big frak (30) (right) - big coat 30302 {8}ormalsize frak 30 kdota 0.693 {8}ormalsize (approximately 200) - 2.6 approximately 200 times 0.074 (14.9); PROBLEM (PageIndex{1})) Write the following isotopes in nuclide notation (e.g. (se-{14}_6C)) oxygen-14 copper-70 tantalum-175 franci-217 Respond to {14}_8O Answer b (se-{70}_29Cu) Answer with (se){175}_73Ta) Answer d (se){217}_87Fr) Click here for the video solution PROBLEM (PageIndex{2})) For the following isotopes that have missing information, Fill in the missing information to fill in the notation {36}_P ({34}{14}X {56} {121} {57})) Answer question a ({34}{14}Si) Answer b (se {36}-{15}P) Answer c (Sea {57}{25}Mn) Answer d ((SE{121}) {56}Ba) PROBLEM (PageIndex{3}) including a charge, if applicable, for atoms with the following characteristics: 25 protons, 20 neutrons, 24 electrons 45 protons, 24 neutrons, 43 electrons 53 protons, 89 neutrons, 54 electrons 97 protons, 146 neutrons, 97 electrons Answer to question a ({45}-{25}N'1)) Answer b (sea {69} {45}Rh)) Answer with the answer to the question {142} {53}1) Answer d (se {243} {97}Bk) Click here for the video solution PROBLEM (PageIndex{4}) Which of the following are in the stability range? chlorine-37 calcium-40 204Bi 56Fe 206Pb 211Pb 222Rn carbon-14 Response (a), (b), (c), (c), and (e) PROBLEM (PageIndex{5}) Which of the following cores are in the stability lane? argon-40 oxygen-16 122Ba 58Ni 205Tl 210Tl 226Ra magnesium-24 Answer (b), (e - very close), and (h) Click here for video solution problems (PageIndex{6}) Write a short description or definition of each of the 1: nucleon α particle β positron particle γ a beam of nucleid mass of atomic number Response to the collective term for protons and neutrons in the nucleus Answer b (α or (((Ce'4_2He)) or ((Ce)) high energy nucleus; helium atom losing two electrons and containing two protons and two neutrons Answer C ((β) or (Se-0'-1'e) or q (Se-0'-1'β)) high-energy electron Answer d antiparticles to electron; it has identical properties to the electron, except that the opposite (positive) charge Response e (γ or q (c 0))) short wavelength, high energy electromagnetic radiation, which demonstrates the wave particle duality Response f core of a specific isotope Answer g the sum of neutron numbers and protons in the nucleus of the atom Answer h number of protons in the nucleus PROBLEM (PageIndex{7})) Complete each of the following equations by adding the missing species: (Sea {27} {13} 4_2He⟶:? (1_0n)) (Se-{239}{94}Pu, ?⟶ {242}-{96}SM, 4_2He⟶ 1_0n {14}_7N) (1_1H)) (Se {235}{92}U⟶:? ({135} 1_0n{55}C) Answer to {27} {13}{13} 4_2He⟶ {30} {15} 1_0n P) Answer b ({239} {94}Pu 4_2He ⟶) ({242}) {96}SM 1_0n) Answer from (Se {14}_7N) 4_2He⟶ ({17}_8O 1_1H) Answer d (Se {235} {92}⟶U⟶ {96}) {37} Rb ({135} {55}Cs) 1_0n Click here for a video solving problem (PageIndex{8}) Complete each of the {14}_7N {14}_6C⟶ 4_2He ⟶ 7_3Li the following equations: B) ({27} {13} (4_2He⟶)? (1_0n)) (Se {250}{96}SM 1_0n ⟶ {38}), {98} ? (Se 7_3Li 1_1H ⟶2'4_2He)) Answer B (Se {14}_6C⟶ {14}_7N 0-1) Answer 1_0n c (Sea {27}{13} 30_15P 4_2He⟶Al) B) Answer d (Se-{250}{96}SM ⟶h148{58}Ce - {98} {38}SR 41_0n) PROBLEM ((PageIndex{9})) Write a balanced equation for each of the 148{58} Nuclear Response: 17O production from 14N α particle bombardment production 14C from 14N neutron bombardment production 233Th from 232Th neutron bombardment production 239U from 238U by (ce'2_1H) bombardment Respond a ('ce'{14}_7N ⟶) {17}_8O (1_1H) Answer b (se {14}_7N 1_0n⟶ {14}_6N 1_1H) Answer with (Se {232}{90}T 1_0n⟶ {233} {90}) Answer d (sea {92} {238}U) 1H⟶ ({239} {92}U) 1_1H Click here for video solution PROBLEM (PageIndex{10}) Technetium-99 is prepared from 98Mo. Molybdenum-98 is combined with a neutron to give molybdenum-99, an unstable isotope that emits a particle β to give an excited form of technetium-99, presented as 99Tc. into a terrestrial state, presented as 99Tc, emitting γ beam. The ground state of 99Tc then emits β particle. Write equations for each of these nuclear reactions. Answer to this question: {98} {42}MO 1_0n (right ({99}{42} {43} {99} {43} {99} {42}MO {99}) right- {0}-gamma {99} {43}Tc) (se {99}{43}Tc rightarrow 0-1'e {99} {44}Ru) Problem (PageIndex{11}) What changes occur in the atomic quantity and mass of the nucleus during each of the following decay scenarios? α particle emits a particle β emits γ the radiation is emitted by a positron emitted by an electron captured by answer C α a particle the same as the nucleus (4_2He), the mass number will decrease by 4 and the atomic number will decrease by 2. Answer b Because β particle is the same as a particle, but the atomic number will increase by 1. Answer C Because γ beam has no mass (this is energy), the mass number and atomic number do not change. The answer d positron is the opposite of the particle β, it is q (0'0'e), the mass number will not change, but the atomic number will decrease by 1 Answer e Electron capture has the same effect on the nucleus as the positron radiation: the atomic number decreases by one, and the mass number does not change. PROBLEM (PageIndex{12}) What is the kernel change that is the result of the following breakup scenarios? radiation β particle capture β the particle of the electron Response to the conversion of the neutron into a proton 1_1p 1_0n ⟶: the positron has the same mass as the electron, and the same magnitude of positive charge as the electron, has a negative 1_0n 1_1p ⟶ charge, when the ratio n:p is too nucleus, the proton is converted into a neutron with the radiation of the positive electron: , the internal atomic electron can be absorbed. In the simplest form, this alters the proton in the neutron: ⟶ 1_0p (Se1_1p) Explain{13} how unstable the heavy nuclides (atomic number of zgt; 83) can decompose to form nucleids of greater stability if (a) they are below the stability range and b) they are above the stability band Answer Nuclei below the stability band will undergo post-terror decay, while those above the band will undergo stability. Heavy nuclei past the stability band will undergo alpha decay problem (PageIndex{14})) Which of the following nuclei are likely to break down into positron radiation? Explain your choice. Chromium-53 manganese-51 iron-59 The manganese-51 response is likely to disintegrate into positron emissions. The ratio n:p for Cr-53 is 1.21 euros{29}{24} (for Mn-51, it is 1.04 {26}{25} (dfrac); for Fe-59, it is 1.27 euros{33}{26} 1.27 euros. may disintegrate as a result of positron emissions. In addition, Ke {53}{24}Cre)) is a stable isotope, and (se {59} {26}Fez) disintegrates by beta radiation. PROBLEM ((PageIndex{15}) The following cores don't lie in the stability lane. (Se {34}{15}P) (Se {239}{92}US) ({38} {20}Cas) (Se)3_1H) (Sea {245} {94})) beta decay, expected to respond b Beyond the stability band, heavy cores undergo alpha-disintegration Response c Below the stability band, positron decay, expected response d Above the band stability, beta decay is expected to respond electronically beyond the stability band , heavy cores undergo alpha-disintegration problems (PageIndex{16}) Write a nuclear reaction for each step in formation ({218} {238} {84} {92}) that continues with a series of decay reactions associated with step-by-step radiation α, β, β, α, α, α, α particles, in this order. The answer to this question ({238}{92}E⟶ {234} {91} {234}⟶ {90}It'4_2He {90} {234}) 1'e) (Se-{234}{91}Pa⟶ {92} {234}-{92} {90} {230}E-0'-1 {234}⟶)) 4_2He T 4_2He) (Se {230}{90}T⟶ {226}{88}⟶ {218}{84} ({222} 4_2He {86}⟶ {88} {226}) Rn (4_2He) ({222} {86}Rn⟶ {218}{84}When - 4_2He) PROBLEM (PageIndex) Write a nuclear reaction to every step in formation () ce'{208}'{82}Pb) from q (se {228}-q 90'Th'), which comes from a number of decay reactions associated with step-by-step radiation α, α, α, α, β, β, α particles, in this order. Answer to this question: ({228}{90}T right 4_2He {224}{88} {86} {220} 4_2He {88}Ra {224})) ({220}{86}T right (4_2He) {216} {84}Po) (se {216}{84} ({212} right 4_2He) {82}Pb {83} {212} {83} {212} {82} {212}) 0'-1'e - {212}-{84}Po) (Se{212}{84}On {82} {208} 4_2He (right) decision Contributors radioactive decay problems and solutions pdf. radioactive decay half life problems and solutions. radioactive decay half life problems and solutions pdf