Chapter 22 review nuclear chemistry section 22-2 answers

Nuclear reaction, Section 22.2 Radioactive decay or emissions reaction: Unstable atoms try to change the number of protons or zeros. They can do this with a high-energy nuclear reaction. Nuclear reactions actually change the identity of atoms by changing the number of protons (chemical reactions cannot do this). Table 22.1 and Example 22.1, Issue 22.1-2 Beta Release (occurs when there are too many protons in an atom or there are not enough protons). In the nucleus, the loins are divided into electrons and protons (10n g 11p + 0-1e) and the electrons are beta particles because they are derived from the nucleus. Electron/beta particles can't live in the nucleus, so they're ejected! Example: 3215P g 0-1e + 3216S net effect is mass dynamics, protons are neutrals down one. Example: 4220Ca g 0-1e + 4221Sc alpha release (occurs when the nucleus is too large and generally a larger element than Bi) nucleus emits alpha particles, or 2 protons and 2 heavy particles. Example: 23892U g 42He + 23490Th net effect is mass down 4 and proton down 2. Example: 21084Po g 42He + 20682Pb posyron emission (too many protons or not enough protons) protons in the nucleus emit protons such as proton positrons and metons (11p g 01e + 10n) beta particles. Example: 116C g 01e + 115B net effect is the same mass, proton down is one neutral. Example: 3317Cl g 01e + 3316S gamma emission (meta-serance symbolized by the occurrence = m when the nucleus becomes very energetic and unstable) For example, the 11m5B g 115B + 00g effect is to release energy in the form of gamma lines, mass equality, protons. Electron capture (occurs when there are too many protons or not enough neutrals) protons in the nucleus are neutral (11p + 0-1e g 10n) for example, 20884Po + 0-1e g 20883Bi net effect is the same mass, protons one by one. Electron capture and positron emission have the same result. Example: 116C + 0-1e g 115B balanced nuclear reaction mass number must be the same on both sides of the arrow (charge or proton #) arrow example on both sides: 116C + 0-1e g 115B (11 for both total masses), 5 bilateral charge) Radioactive decay rate, extra-band section 22.3 atoms of stability are voluntarily called radioactivity. A person can't stop or slow down these natural decay reactions. They are always present, and always will be. Multi-step processes because they can often be product atoms or radioactive. They can take several reactions and billions of years for atoms made to finally reach a stable copper and small type. Parents are reaction atoms, daughters are product atoms. Velocity constants are called decay constants. All radioactive decay reactions are in the first order! So remember these equations: t1/2 - 0.693 /k and ln ([A]t / [A]o) = -kt e.g. Protactinium-234, Pa has a half-life of 1.17 minutes. How many samples remain after 5.75 minutes? Answer: First, find corruption or velocity constants. k = 0.693 / t1 /2, k = 0.693 / 1.17 minutes = 5.923 x 10-1 minutes -1. Now use the first order consolidated rates law. ln (At / 100%) = -5.923 x 10-1 minutes-1 (5.75 minutes). Resolved in = 3.32%. Now remember that the half-life is the time it takes for one-half of the radioactive sample to decay. Table 22.2 If I have 100 grams, 1/2 50 grams after life, after the second there is 1/2 life 25 grams, and after the third 1/2 life is 12.5 grams and so on. Example: The half-life of a 90Sr is 29 years. How many of the 500.0 gram samples remain after 87 years? Answer: 87 years has 3 and a half lives, so one 1/2 life after 250 grams, another after 1/2 life has 125 grams, the third has 62.5 grams after 1/2 life. t1/2 cannot be changed. There's nothing we can do (temperature changes, pressure changes) that affect the half-life. We can't slow down or speed up radioactive decay. Here are a few more half life values: 14C is 5730 years, 40K is 1280 million years, 205Rn is 1.8 minutes, 222Rn is 3.82 days, and 238U is 4500 million years. Radioactive dating 14C is used to date everything that is exactly alive (corpses, plants, trees) up to 60,000 years old. When something dies, new carbon is not incorporated into the body. Time is 12C, but 14C decays. Therefore, the ratio of carbon-12 to carbon-14 is no longer constant and does not change over time. So we can use this ratio to tell us the age after death. 238U is used to date rocks up to billions of years. Meteorites go back 4.6 billion years. 40K uses minerals to date. Example 22.2-5, problem 22.3-8 stability, section 22.4 recalled isotopes - the number of protons is the same, but the number of the two atoms different. Most elements have two or more isotopes, such as carbon-12 (12C), carbon-13 (13C), carbon-11 (11C) and carbon-14 (14C). Some isotopes are unstable = radioactive. Every element up to bismuth except Tc has one or more stable isotopes, but some of them have unstable isotopes. The elements above Bismuth are all unstable (even some of them think it could take billions of years to rot). There is a graph called a band of stability that plots stable atoms by protons versus protons. 22.3 Atomic maximum calcium is generally stable when proton = atom. Budgets -16, carbon-12, nitrogen-14. Some notable exceptions hydrogen -1, Atoms above calcium for bismut are stable when there are more protons than there are more. Therefore, if the middle star is not the same as or equal to the proton, it is unstable. The atoms above the bismuth are unstable for anything. They all need to lose protons and protons in order to make them smaller, and they are just too darn fat. In addition, in general, having an even number of even numbers of protons and an even number of protons is the most stable combination while having the odd number of protons and the odd number of protons the combination of the odd number of the sexes is the most stable combination. Nuclear Binding Energy - E is required to break down the nucleus. Very high indeed. Don't worry about counting. The toilet, Section 22.7 occurs naturally in space, but a person has found a way to perform these reactions by hitting particles and atoms in particle accelerators. Example: 105B + 10n g 42a + 73Li . We hit boron with a mesotom and get alpha particles and li. yes: ? + 11p g 42a + 126C where? = 157N. Example 22.9, Issue 22.15-16 Use and Biological Effects, Section 22.8-10 Most of this information comes from medical texts. Used in addition to bombs and forces: dating as mentioned above, medical tests for diagnosis, chemotherapy, and reaction mechanisms to study tag isotopes (e.g. 14CO2 used to learn about photosynthetic reactions - while reacting along the 14C tag) alpha radiation is stopped by the skin, thus generally very harmful outside the body. Beta radiation is stopped by 1 cm of lead, so it can get inside the body and it's worse. Gamma radiation is stopped by 10 cm of lead, so it is considered the worst to be exposed. However, if alpha particles are swallowed or inhaled, they are actually the most dangerous inside the body due to the +2 charge - it is a powerful ion agent. Alpha particles inside the body are more dangerous than gamma or beta particles. Medical terminology and measurement radiation intensity are measured at 3.7 x 1010 counts per second or millisecond cues (mCi) = 3.7 x 107 counts per second or micro-curie (mCi) = 3.7 x 104 counts per second. Strength can also be measured in becquerels (Bq) = 1 count/second when strength is low. Roentgens (R) measures exposure to radiation, measures the energy transmitted by radiation lads (rad = radiation absorption) and measures how much of radiation is actually absorbed by the body. Rems (roentgen equivalent men) measure the effect of radiation of 1 R in humans for different types of radiation. Average exposure to humans - yes this means you! Natural sources: cosmic rays, rocks, natural radiation inside the body, radon = annual artificial source 294 mrem: X rays in medicine, medicine, consumer goods, nuclear power plants = 65 mrem per year (power plants are only 2 mrem) Radon is 200 mrem per year! Radon is a noble gas, but all isotopes Why is this a problem? Radon is inhaled by us, which is gas! Its half-life is 3.8 days. When inhaled, some exhale, but some rot into Po. Pho is a solid alpha emitter. Because Po is solid, it just sits in our lungs emitting the most dangerous alpha particles inside our bodies and doesn't exhale like this. It causes lung cancer. Accumulates underground. Problems in many areas of the basement (Canada, Colorado ...) exposure to levels of 25 rem just stand out from the blood (rems, no mrems) 100 rem cause minor radiation diseases 400 rem is needed to kill the 1,000,000 rem virus needed to kill 600 rem deadly 50,000 rem bacteria causing a 50% chance of death (not hardy?) Small but repeated doses over the years can cause cancer, especially leukemia and sunlight exposure can cause skin cancer diagnosed with medical use - radioactive isotopes are injected intravenously and detectors monitor where they go and accumulate. Certain isotopes are more likely to go to some institutions than others. Gamma emitters (collecting iodine from the thyroid gland) are most commonly used because they can escape the body (they are not charged) and are used in small quantities. 11C - Positron emitter 32P, used for brain scans (PET = positron emission terrain) to track glucose, is used to detect ocular tumor 59Fe, which is used to examine bone marrow 60Co, which is used to treat cancer used to test heart muscle. Brain, liver, Kidneys, Bone Marrow - Gamma The emitter 131I is used to diagnose thyroid problems - beta emitter 24Na is used in saline solutions (NaCl (aq) to be followed in the circulatory system - beta emitter therapy is used to ionize radiation and select cells such as cancer cells Destroying tissues and destroying (e to generate knock radiation radiation cations) destroys the cells used when the cancer spreads (not chrysanthemal) and therefore surgery is rarely used to obtain what is left in cancer cells after surgery, so the cancer moves to another site (transferable state) X-ray Both gamma rays and proton beams are focused on suspected areas to minimize damage to normal cell CT scans (computer-assisted tomosynx) X rays. Detects data collected by a computer that generates images used to generate images used to detect brain tumors used to detect stroke-damaged MRI (magnetic resonance imaging) used in soft tissues containing H atoms (water and fat), The Positron Emitter (11C) positrons collide with electrons around other atoms to generate gamma, as radio waves are used to reverse the spin of H atoms, and pet scans (positron emission terrain) can be known as different environments because different H atomic environments are reversed at different frequencies. Rays detect gamma rays and compile images that show brain changes when we think (brain stimulation) stimuli)

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