

Nuclear Stability

We can establish a pattern of reactions between protons and neutrons in nuclear reactions



The question is why, for example, some nuclei undergo an alpha decay and not a beta decay. This has to do with the **neutrons to protons ratio** (n/p) in the nuclei. When the nuclei of all 1000 known isotopes are plotted based on their number of protons and neutrons, a **band (belt) of stability** is obtained (blue region). The nuclei in this region are stable. The isotopes that fall outside of this region (are off-balance) are radioactive and decay spontaneously. Example B1 is the last element on the band of stability, so all nuclei with 84 or more protons are radioactive. The type of radioactivity depends on the n/p

- The nuclei above the band of stability tend to decrease the n/p ratio.
- The nuclei below the band of stability tend to increase the n/p ratio.



Nuclei with the **magic numbers** of 2, 8, 10, 20, 28, 50, or 82 protons or 2, 8, 20, 28, 50, 82, or 126 neutrons, and in general, with even numbers of protons, neutrons are more stable.

Rates of Radioactive Decay

Radioactive decay obeys first-order kinetics laws. And although the half-life of radioactive elements may vary enormously (10^2 second to billions of years), it is independent of the quantity of the element. This advantage is used in **radiocarbon dating** which is used for **estimating the ages of fossils and artifacts**. The technique is based on the rate of ${}^{14}\text{C}$ decay which spreads from the atmosphere to living organisms.



The half-life of carbon-14 decaying to nitrogen by emission of a β^- particle is 5715 years.



The ${}^{14}\text{C} : {}^{12}\text{C}$ ratio is constant in living organisms. However, when a living organism dies, the ${}^{14}\text{C} : {}^{12}\text{C}$ ratio begins to decrease, and so does the decay rate of ${}^{14}\text{C}$. The relationship of the quantity or rates of decay is given by the first-order rate law:

$$\ln \left(\frac{N}{N_0} \right) = -kt \quad \ln \frac{\text{rate}_t}{\text{rate}_0} = -kt$$

Example: A sample of wood from an Egyptian mummy case gives a count of 9.4 counts/g, this is the current decay rate determined experimentally. How old is the wood if its initial decay rate is 15.3 counts/g?

Solution: We are going to use the integrated rate law of first-order reactions. The rates are given, so we need to determine the rate constant of the decay.

The half-life of first-order reactions is $t_{1/2} = 0.693/k$. Therefore, k is:

$$k = \frac{0.693}{t_{1/2}} = \frac{0.693}{5715 \text{ y}} = 1.210 \times 10^{-4} \text{ y}^{-1}$$

$$\ln \left(\frac{9.4}{15.3} \right) = (1.210 \times 10^{-4}) \times t \quad \Rightarrow \quad t = \frac{\ln \left(\frac{9.4}{15.3} \right)}{(1.210 \times 10^{-4})} = \boxed{4,829 \text{ years}}$$

Energy Changes in Nuclear Reactions

The energies involved with nuclear reactions are extremely large. For example, the energy change in this reaction is $-4.1 \times 10^{12} \text{ J/mol}$



For comparison, the energy change for combustion of 1 mol CH_4 is 890 kJ/mol.

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web sep 1 2022 in this article we ll go over 17 of the best pets for college students we ve taken into consideration budget level of care required and the amount of space needed for each pet some of the best pets for college students include goldfish gerbils turtles chinchillas geckos parakeets cats and more should college students have pets

İstanbul köpek eğitimi eğitim merkezi petokulu - Mar 30 2022

web köpek eğitimleri konusunda hizmet veren pet okulu bünyesinde uzman köpek eğiticiler uzman veteriner ve köpek bakımı yapan pet kuaförleri bulundurulur köpek tuvalet eğitimi temel itaat eğitim İleri itaat eğitimi evde köpek eğitimi tasma eğitimi yavru köpek eğitimi gibi köpek eğitimlerimiz hakkında bilgi almak için iletişime geçmenizi öneriyorum

best pets for college students vet guru - Sep 04 2022

web sep 9 2021 10 best pets for college students so what makes a great pet for a busy college student pets that are small quiet friendly and easy to look after will fit in well with your student lifestyle and campus or off campus living

best low maintenance pets for college students collegiateparent - Mar 10 2023

web the turtle the turtle is a low maintenance pet just right for families including college students turtles don t require much pampering or stimulation unlike dogs they don t need to be walked and unlike cats they don t need to be admired 24 7 however they do require a clean tank so this does mean extra chores

b1 pet sınavı cambridge sınavları İngilizce sınav rehberi ef - Apr 30 2022

web Şu anda b1 preliminary sınavının puanları 120 170 arasında değişmektedir 140 ve üstü bir puan geçti olarak değerlendirilir ve bu puana sahip öğrenciler cefr a göre İngilizce de b1 seviyesine denk gelen pet sınavı sertifikası alır b1 preliminary sınavında 160 veya üstü bir puan alan öğrenciler b2 seviyesine

top 10 best pets for college students youtube - Feb 26 2022

web jan 4 2022 best pets for college students having pets in college may be something you want maybe as a support friend or just for the love of animals in today s video we will be looking at the best college

list of the best pets for college students emotional pet support - Jul 14 2023

web dec 11 2021 8 best pets for college students the guinea pig the hamster the goldfish mice small breed dogs turtles birds large breed dogs having a pet while in college can be highly beneficial to the student pets do not just provide emotional benefits but they can also help relieve stress and create a strong bond with their owners

İstanbul da cambridge english preliminary pet dersi verenler - May 12 2023

web cambridge english preliminary pet okul Öncesi İlköğretim takviye lise takviye Üniversite takviye sınav hazırlık yabancı dil bilgisayar müzik spor sanat dans kişisel gelişim direksiyon Özel eğitim oyun ve hobi

pet walker and care student jobs istanbul erasmusu com - Dec 07 2022

web student jobs in istanbul need to leave the pet because of vacation business or holidays for few days and looking for a clean safety shelter for all pets as hamsters guineapigs birds dogs etc except big dogs and cats because have 2 own dogs or someone to come to your place and check your pet don t hesitate to

should college students have pets ist 110 introduction to - Aug 03 2022

web oct 10 2021 although your post relates directly to college students having a dog i believe pets in general are a great support system for college students with the stress and anxiety that comes from meeting deadlines and social needs having a friend no matter what kind of animal can help

8 benefits of classroom pets with infographic pet keen - Aug 15 2023

web aug 21 2023 having a pet in the classroom will give you the opportunity to teach a variety of lessons based on the animal itself a classroom animal can provide an interactive way to engage the children with their studies and you can use science math and even english assignments based on the pet