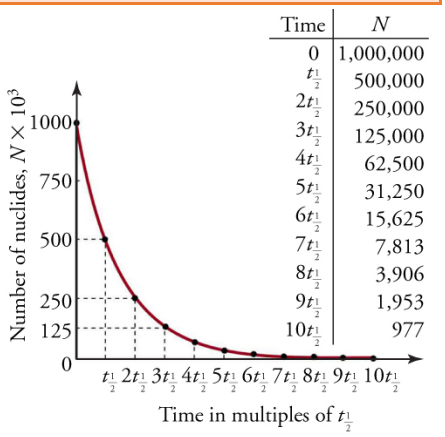
Physics 13-02 Radiometric Dating **Name: _____**

Half-Life



- Measures _____of radioactive decay
- One half-life is time it takes for _____ of the nuclei to _____
- Assumed to be _____for each isotope

$$N = N_0 e^{-\lambda t}$$

- Where N is number of _____at time _____, N_0 is # of nuclei at time _____, λ is the _____constant

$$\lambda = \frac{\ln(2)}{t_{1/2}}$$

Radioactive Dating

- Method used to date _____
- Assumptions
  - Amount of _____material known
  - No radioactive material _____or _____the mineral
  - No new radioactive material _____by other sources such as _____rays or other radioactive reactions
  - Decay rate is _____

Carbon-14 has a half-life of 5730 years. If there was originally 20 grams, but only 15 grams remains. How much time elapsed?

What is the half-life of technetium-99 if 20% decays in about 488000 years?

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Practice Work

1. Radioactivity depends on the nucleus and not the atom or its chemical state. Why, then, is one kilogram of uranium more radioactive than one kilogram of uranium hexafluoride? (OpenStax C31.20)
2. A sample of radioactive material has a decay constant of 0.05 s^{-1}. Why is it wrong to presume that the sample will take just 20 seconds to fully decay? (HSP 22.12)
3. How would some of the daughter products being removed from a mineral change the apparent age with radiometric dating? (RW)
4. How would extra parent isotopes being created affect the apparent age with radiometric dating? (RW)
5. If the decay rate used to be faster than it is today, how would that affect the apparent age with radiometric dating? (RW)
6. Americium-241 is used in smoke detectors and has a half life of 432.2 years. If a new smoke detector has 2.00×10^{-4} g of Americium-241, how much will it still have 100 years later? (RW) $\mathbf{1.71 \times 10^{-4}\ g}$
7. Technetium-99m is used in imaging in medicine and has a half life of 6.02 hours. If 0.100 μg were injected into a person, how much is left after 24 hours? (RW) $\mathbf{6.31 \times 10^{-9}\ g}$
8. Carbon-14 is used in radiocarbon dating and has a half life of 5730 years. What percentage of C-14 should be left after 2000 years? (RW) **78.5%**
9. Potassium-40 is sometimes used to date rocks. It is assumed to have a half-life of 1.25 billion years. What percentage of will be left after 1 million years? (RW) **99.9%**
10. What is the half-life of an unknown isotope if 0.015% of it decays in 2.0 years? (RW) **9240 y**
11. What is the half life of Indium-113m if 28.5% of it remains after 3.0 hours? (RW) **1.66 h**
12. What is the half life of Iodine-131 if 90.2% of it remains after 1.2 days? (RW) **8.06 d**