Notes 8-8 Obj. 2

Exponential Decay

<u>Ex. 4:</u> Cesium-137 has a half-life of 30 years. Suppose a lab stored 30mCi sample in 1973. How much of the sample will be left in 2003? In 2063?

1973 → 2003 15mCi

(30yrs) ∴ 30mCi ÷ 2 = $\boxed{\text{15mCi}}$

one half-life

1973 → 2063 (90 years or 3 half-lifes)

$\underbrace{30\text{mCi} \div 2 = 15 \div 2 = 7.5 \div 2}$ = $\boxed{\text{3.75 mCi}}$

one half life, two half-lifes, three half lifes

** You could use an exponential decay equation to help you in Ex. 4. $y = 30 \cdot (.5)^{x \div 30}$

y = how much Cesium-137 you have left after half-lives

x = years

a = how much Cesium-137 you started with

b = $\frac{1}{2}$ or .5 for half-life

- exponent is years ÷ half life

Let's try it:

$$y = 30 \cdot \left(\tfrac{1}{2}\right)^{30 \div 30} = 30 \cdot \left(\tfrac{1}{2}\right)^{1} = 30 \cdot \tfrac{1}{2} = \boxed{15 \text{ mCi}}$$

$$y = 30 \cdot \left(\tfrac{1}{2}\right)^{90 \div 30} = 30 \cdot \left(\tfrac{1}{2}\right)^{3} = 30 \cdot \frac{1^3}{2^3} = 30 \cdot \frac{1}{8} = \boxed{3.75 \text{ mCi}}$$

Ex. 5: In 1990, the population of Washington, D.C., was about 604, 000 people. Since then the population has decreased about 1.8% per year. Suppose the trend in population change continued. What would you predict the population of Washington, D.C. would have been in 2010?

$y = a \cdot b^x$

$y = 604{,}000 \cdot (.982)^{20}$ from 1990 to 2010 = 20 years

100% − 1.8% = 98.2% = .982

$y = 604{,}000 \cdot .695392105 \approx \boxed{420{,}017 \text{ people}}$

* round to ones place since we are talking about people & we can't have a fraction of a person