Objective 3 - Solving Real-World Problems

Note: There are no textbook or videos directly to this section. If you want to review a certain type of model, you will need to go back to that Module.

We have spent a lot of time building models. Once we have a model, solving a real-world problem is just a matter of plugging in some values into your model.

Question 1 *Chemists commonly create a solution by mixing two products of differing concentrations together. Find the amount of* 5% *acid solution and* 30% *acid solution needed to create a* 12 *liter* 25% *solution.*

5% *acid solution:* $\boxed{\frac{12}{5}}$ *liters*

30% *acid solution:* $\boxed{\frac{48}{5}}$ *liters*

Question 2 *There is initially* 649 *grams of element* X*. The half-life of element* X *is* 4410 *years. How much element* X *will be left after* 4486 *years?*

$\boxed{\frac{649}{2}\left(\frac{1}{2}\right)^{\frac{38}{2205}}}$ *grams*

Question 3 *A company sells doughnuts. They incur a fixed cost of* \$17000 *for rent, insurance, and other expenses. It costs* \$0.05 *to produce each doughnut. The company sells each doughnut for* \$0.15*. How many doughnuts would they need to sell to break even?*

$\boxed{170000}$ *doughnuts*

Question 4 *Kepler's Third Law: The square of the time,* T*, required for a planet to orbit the Sun is directly proportional to the cube of the mean distance,* a*, that the planet is from the Sun. Assume that Neptune's mean distance from the Sun is* 4 *AUs and it takes Neptune about* 386.73 *months to orbit the Sun.*

Learning outcomes:
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If it takes Saturn about 251.19 *months to orbit the Sun, what is Saturn's mean distance from the Sun?*

$\boxed{3}$

Question 5 *The half-life of carbon-14 is 5,730 years. A bone fragment is found that contains* 15% *of its original carbon-14. To the nearest year, how old is the bone?*

$\boxed{15683}$ *years old*

Question 6 *Two UFPD are patrolling the campus on foot. To cover more ground, they split up and begin walking in different directions. Office A is walking at* 3 *mph directly south while Office B is walking at* 6 *mph directly west. How long would they need to walk before they are* 3 *miles away from each other?*

$\boxed{12\sqrt{5}}$ *minutes*

Question 7 *A population of bacteria* `doubles` *every hour. If the culture started with* 600*, how long would it take before the population is over* 7 *million?*

$\boxed{\dfrac{\log\left(\frac{280000}{3}\right) - 3\log(2)}{\log(2)}}$ *hours*
