# 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* 15% *acid solution and* 20% *acid solution needed to create a* 10 *liter* 17% *solution.*

15% *acid solution:* $\boxed{6}$ *liters*

20% *acid solution:* $\boxed{4}$ *liters*

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**Question 2** *There is initially* 714 *grams of element* $X$*. The half-life of element* $X$ *is* 5044 *years. How much element* $X$ *will be left after* 5121 *years?*

$\boxed{357\left(\frac{1}{2}\right)^{\frac{77}{5044}}}$ *grams*

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**Question 3** *A company sells doughnuts. They incur a fixed cost of* \$25000 *for rent, insurance, and other expenses. It costs* \$0.15 *to produce each doughnut. The company sells each doughnut for* \$0.3*. How many doughnuts would they need to sell to break even?*

$\boxed{166667}$ *doughnuts*

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**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* 8 *AUs and it takes Neptune about* 1093.83 *months to orbit the Sun. If it takes Saturn about* 895.29 *months to orbit the Sun, what is Saturn's mean distance from the Sun?*

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Learning outcomes:
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$\boxed{7}$

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**Question 5** *The half-life of carbon-14 is 5,730 years. A bone fragment is found that contains 7% of its original carbon-14. To the nearest year, how old is the bone?*

$\boxed{21983}$ *years old*

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**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 4 mph directly south while Office B is walking at 5 mph directly west. How long would they need to walk before they are 4 miles away from each other?*

$\boxed{\frac{240}{41}\sqrt{41}}$ *minutes*

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**Question 7** *A population of bacteria* `triples` *every hour. If the culture started with 500, how long would it take before the population is over 7 million?*

$\boxed{\frac{\log(14000)}{\log(3)}}$ *hours*

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