

LESSON

22

Mixture Problems— The Seesaw Method

LEARNING OBJECTIVES

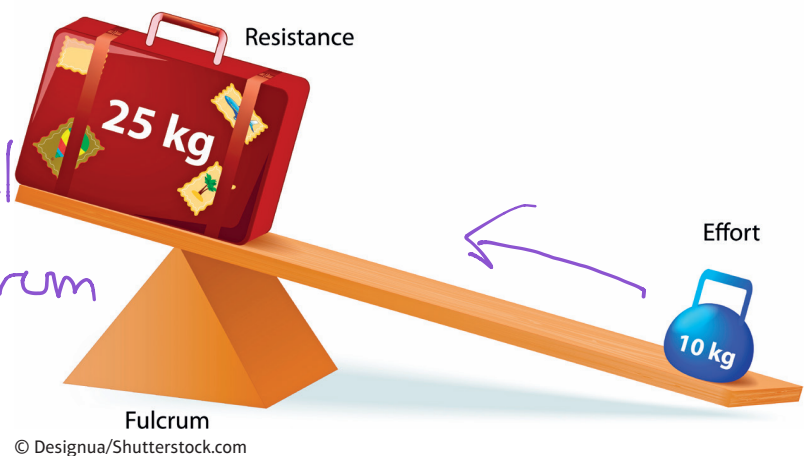
- Today I am: watching a TED-Ed video about how a seesaw works when you have a large monster on one side and a small boy on the other side.
- So that I can: connect the physics of seesaws to mixture problems in math.
- I'll know I have it when I can: determine the cost of a cinnamon mixture that contains Indonesian cinnamon at \$19 per pound and Thai cinnamon at \$11 per pound.

Opening Discussion

1. Where should the 10 kg dumbbell be moved so that the lever is balanced?

move the dumbbell
closer to the fulcrum

LEVER (simple machines)



The science behind the lever is fairly simple as you'll see in the YouTube video, *The mighty mathematics of the lever* on TED-Ed at <https://www.youtube.com/watch?v=YIYEiOPgG1g>

$$\begin{array}{|c|} \hline \text{Weight of the} \\ \text{suitcase} \\ \hline \end{array} \times \begin{array}{|c|} \hline \text{Distance to} \\ \text{the fulcrum} \\ \hline \end{array} = \begin{array}{|c|} \hline \text{Weight of the} \\ \text{dumbbell} \\ \hline \end{array} \times \begin{array}{|c|} \hline \text{Distance to} \\ \text{the fulcrum} \\ \hline \end{array}$$

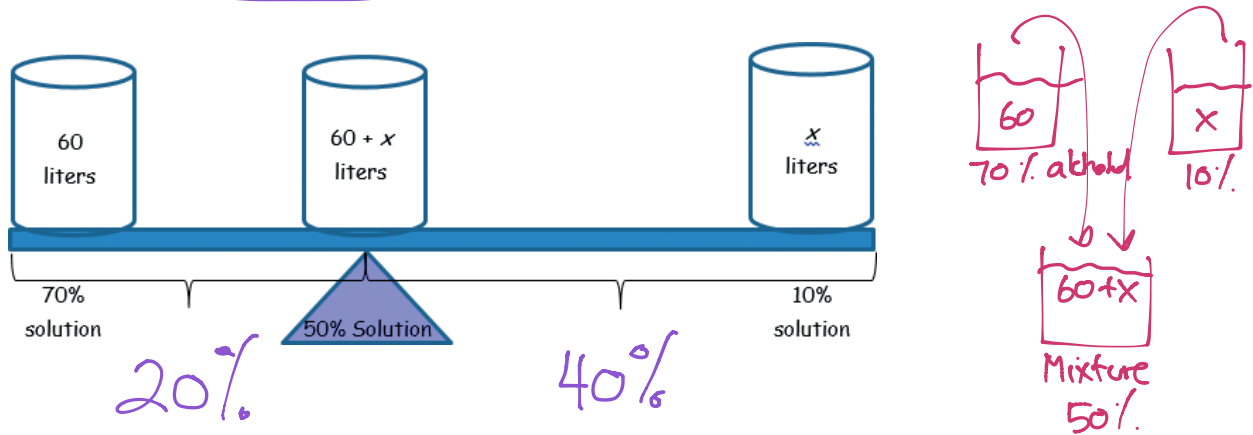
$$\text{Amount \#1} \times \text{Diff in \%}$$

Mixture Problems

This same idea works in mixture problems such as the one below.

In mixture problems, you are trying to determine how much of some substance to add to another to get a specified mixture or percentage. Sometimes a picture can help you write the equations.

Example: How much of a 10% alcohol solution must be mixed with 60 liters of a 70% alcohol solution to create a 50% alcohol solution? \rightarrow mixture



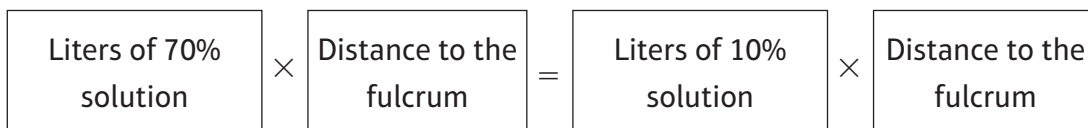
2. Would you expect the added liters of 10% solution to be greater or less than the 60 liter of the 70% solution? Explain your reasoning.

Less than the 60 liter of 70%

3. How far off is the 70% solution from the 50% needed? How far off is the 10% solution from the 50% needed? Write those amounts on the diagram as the distance from the liters to the fulcrum.

20% , 40%

4. Now you are ready to write the equation using the physics idea of the balance beam. Write your equation and solve. Does your answer make sense?



$$60 \times 20 = X \times 40$$

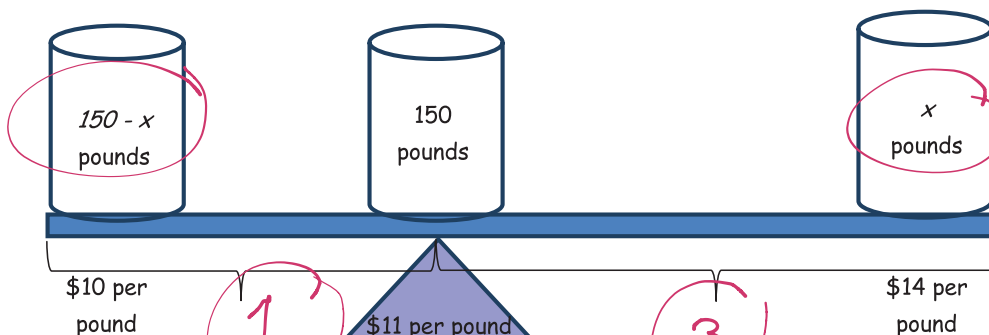
$$1200 = 40X$$

$$30 = X$$

5. A store sells Brazilian coffee for \$10 per lb. and Columbian coffee for \$14 per lb. If the store decides to make a 150-lb. blend of the two and sell it for \$11 per lb., how much of each type of coffee should be used? The information for the seesaw has been set up for you.



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Brazilian (1) Columbian (3)

$$(150 - x) \cdot 1 = 3 \cdot x$$

$$150 - x = 3x$$

$$150 = 4x$$

$$37.5 = x$$

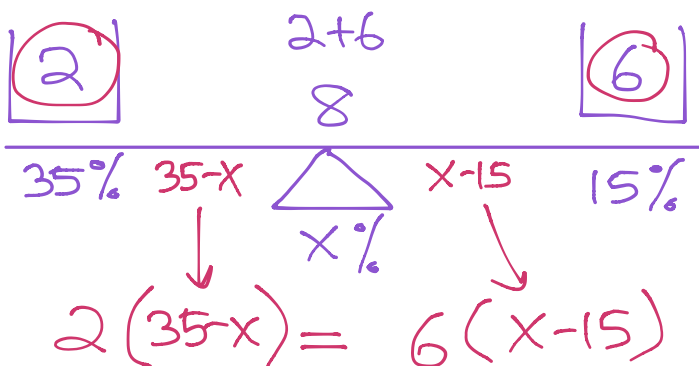
$$150 - 37.5$$

$$112.5$$

Brazilian

On Your Own

6. Two cubic meters of soil containing 35% sand was mixed into six cubic meters of soil containing 15% sand. What is the sand content of the mixture?



$$70 = 8x - 90$$

$$+90 \quad +90$$

$$160 = 8x$$

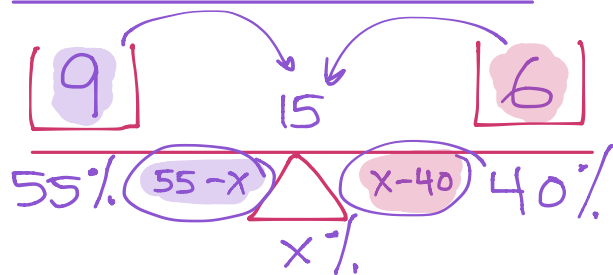
$$70 - 2X = 6X - 90$$

$$\begin{array}{r} +2X \\ +2X \end{array}$$

$$20 = X$$

20% of sand

7. Nine pounds of mixed nuts containing 55% peanuts were mixed with six pounds of another kind of mixed nuts that contain 40% peanuts. What percent of the new mixture is peanuts?



$$49\%$$

$$9(55 - x) = 6(x - 40)$$

$$495 - 9x = 6x - 240$$

$$\begin{array}{r} +9x \\ +9x \end{array}$$

$$495 = 15x - 240$$

$$\begin{array}{r} +240 \\ +240 \end{array}$$

$$735 = 15x$$

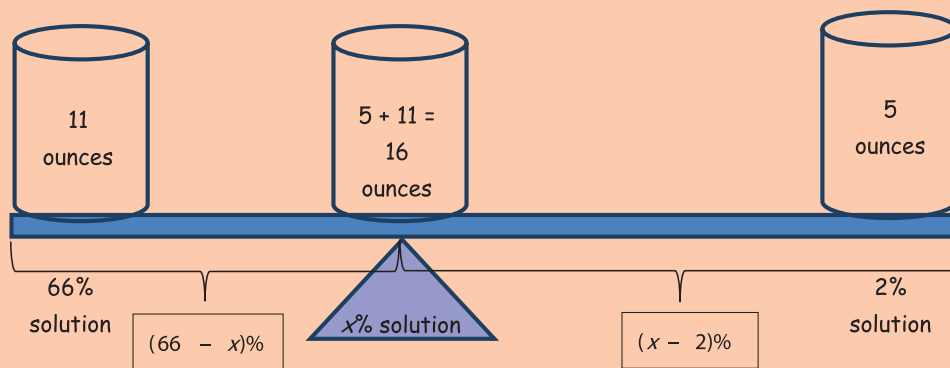
$$\begin{array}{r} \div 15 \\ \div 15 \end{array}$$

$$49 = x$$

Lesson Summary

The Seesaw Method is one way to solve mixture problems.

Example: Five fluid ounces of a 2% alcohol solution was mixed with 11 fluid ounces of a 66% alcohol solution. Find the concentration of the new mixture.



$$11(66 - x) = 5(x - 2)$$

$$726 - 11x = 5x - 10$$

$$736 = 16x$$

$$46 = x$$

The new mixture will have a 46% concentration.

NAME: _____ PERIOD: _____ DATE: _____

Homework Problem Set

1. A chemist has two solutions: a 50% methane solution and an 80% methane solution. He wants 100 mL of a 70% methane solution. How many mL of each solution does he need to mix?

100-x	100	x
80%	70%	50%
10	20	
80-70	70-50	

$$10(100-x) = 20x$$

$$1000 - 10x = 20x$$

$$1000 = 30x$$

$$33\frac{1}{3} = x$$

$$100 - 33\frac{1}{3} = 66\frac{2}{3}$$

2. 16 pounds of cinnamon was made by combining 12 pounds of Indonesian cinnamon with costs \$19/pound with 4 pounds of Thai cinnamon which costs \$11/pound. Find the cost per pound of the new cinnamon mixture.

12	16	4
\$19	x	\$11
(19-x)		(x-11)



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3. Emily mixed together 9 gallons of Brand A fruit drink and 8 gallons of Brand B fruit drink which contains 48% fruit juice. Find the percent of fruit juice in Brand A if the mixture contained 30% fruit juice.



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4. How many mg of a metal containing 45% nickel must be combined with a 6 mg of pure nickel (100%) to form an alloy containing 78% nickel?



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5. Seven kg of soybean oil which costs \$4/kg were combined with 14 kg of canola oil which costs \$1/kg. Find the cost per kg of the mixture.



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6. A sugar solution was made by mixing 8 quarts of a 2% sugar solution and 6 quarts of a 51% sugar solution. Find the concentration of the new mixture.

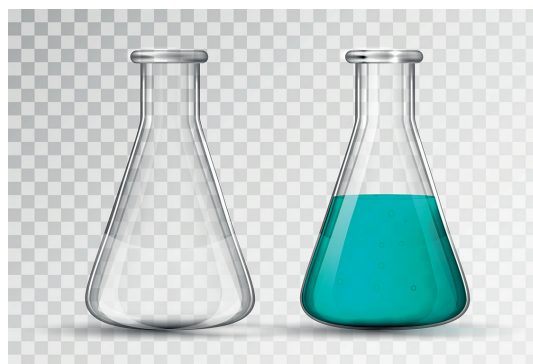
7. How many gallons of a 65% saline solution must be mixed with 8 gallons of pure water (0%) to make a 25% solution?

8. One ounce of walnuts was mixed with 4 ounces of peanuts which cost \$4 per ounce to make mixed nuts which cost \$5 per ounce. What is the price per ounce of walnuts?



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9. Heather wants to make a 36% acid solution. She has already poured 3 fluid ounces of a 72% acid solution into a beaker. How many fluid ounces of a 9% acid solution must she add to this to create the desired mixture?



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10. To build the garden of your dreams, you need 10 ft^3 of soil containing 17% clay. You have two types of soil you can combine to achieve this: soil with 35% clay and soil with 10% clay. How much of each soil should you use?



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11. Bronze which costs $\$9.10/\text{kg}$ is made by combining copper which costs $\$8.90/\text{kg}$ with tin which costs $\$9.50/\text{kg}$. Find the number of kg of copper and tin required to make 15.3 kg of bronze.



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12. Steven added 25 mL of pure water to 125 mL of a 20% salt solution. What is the salt concentration of the new solution?

7 Questions

② on graphing systems
↳ intersection ($y=mx+b$)

$$-2x - y = 4$$

$$\frac{-y}{-1} = \frac{2x}{-1} + \frac{4}{-1}$$

$$y = -2x - 4$$

① Substitution.

① Elimination

③ word problems

↳ ticket sales

↳ Mixture