Success Center
Directed Learning Activity (DLA)

Word Problems:
Mixtures

M104.1
Directed Learning Activity – Word Problems: Mixtures

Description: In this Directed Learning Activity (DLA), you will learn about word problems related to mixtures.

Prior Knowledge: In order to complete this DLA, you will need to know how to convert a percentage to a decimal – for example, 3% = 0.03 – and how to solve a linear equation containing decimals:

\[
\begin{align*}
\text{Solve for } x: & \quad 0.04x + 650 - 0.065x = 562.50 \\
& \quad -0.025x + 650 = 562.50 \\
& \quad -0.025x = -87.5 \\
& \quad x = 3,500
\end{align*}
\]

Materials: A scientific calculator may be needed.

Directions: Please read the examples and answer the questions that follow carefully – and in order. Please do not skip ahead. If you have a question, please ask for help.

After reading the examples, spend some time thinking about what is being presented. After you feel you understand the examples, try to answer the practice questions. Please fill in the gray-shaded regions with the correct answers.

When you are finished, review the DLA with a tutor. Don’t worry, you are not being graded. This is a learning activity, and you are not expected to know everything.

Part One: Understanding Percentages and Costs

We need a formula for percentages and a formula for costs before we can attempt mixture problems.

**Percentages**

A bottle of juice contains 60% grape juice. If the bottle contains 1000 ml, then how much of the bottle is grape juice?

Amount of grape juice = \((\text{Percentage of grape juice})(\text{Total amount contained in the bottle})\)

Amount of grape juice = \((0.60)(1000) = 600 \text{ ml of grape juice}\)

The formula for percentages is \[\text{Amount} = (\text{Percentage of the volume}) \times (\text{Amount})\]

**Costs**

You must also understand how to calculate the total cost of multiple items.

A store owner purchases 400 shirts at a cost of $5 per shirt. What is the store owner’s total cost?

Total cost = \((\text{Number of items})(\text{Cost per item})\)

Total cost = \((400)(5) = $2,000\)

The formula for cost is \[\text{Total Cost} = (\text{Number of items}) \times (\text{Cost per item})\]
Try to answer these questions.

1) **Jim has 40 liters of a 3% alcohol solution. How many liters of the solution is alcohol?**

2) **Thomas has 15 gallons of a 30% Kool-Aid solution. How many gallons of the solution is Kool-Aid?**

3) **George purchased 15 iguanas at a cost of $400 per iguana. What was his total cost?**

4) **Kim purchased 17 apple pies at a cost of $2 per apple pie. What was his total cost?**

Answers: 1) 1.2 liters  2) 4.5 gallons  3) $6,000  4) $34

**Part Two: Understanding Mixture Problems**

*If we mix two or more items, then we are making a mixture.*

**Problem 1:** Michelle’s Tonics mixed 40 liters of a 15% alcohol solution with 10 liters of a 20% alcohol solution to create a 16% alcohol solution.

(a) How many liters of solution will the mixture contain?

Hint: Michelle mixed 40 liters with 10 liters to get ______ liters

(b) How many liters of alcohol are in the 40 liters of 15% solution?

\[ \text{Amount} = (\text{Percentage of the volume}) \times (\text{Amount}) = \text{______} \text{ liters} \]

(c) How many liters of alcohol are in the 10 liters of 20% solution?

\[ \text{Amount} = (\text{Percentage of the volume}) \times (\text{Amount}) = \text{______} \text{ liters} \]

(d) How many liters of alcohol are in the final mixture?

Hint: Answer from b + answer from c = ________ liters
A picture of Problem 1 would look something like this:

Problem 2: Anna’s Ultimate Ice Cream Topping is created by mixing 2 gallons of a 80% chocolate syrup with 3 gallons of 40% chocolate syrup.

(a) How many gallons of syrup will the mixture contain? __________________

(b) How many gallons of syrup are in the 2 gallons of 80% solution?

\[ \text{Amount} = \underline{\quad} \text{Gallons} \]

(c) How many gallons of syrup are in the 3 gallons of 40% Chocolate syrup solution?

\[ \text{Amount} = \underline{\quad} \text{Gallons} \]

(d) How many gallons of syrup are in the final mixture? __________________

(e) Place the numbers from the questions and the answers you received on the picture

(f) What is the percentage of syrup in the final mixture?

\[ \% \text{ of syrup} = \frac{\text{Amount of syrup}}{\text{Amount of solution}} \cdot 100 = \underline{\quad} \]
Problem 3: Yvette’s Reload and Conquer Trail Mix is made by mixing 15 pounds of nuts that have a cost of $3.50 per pound with 10 pounds of raisins that have a cost of $2.25 per pound.

(a) How many pounds will the mixture contain?

(b) What is the cost of the 15 pounds of nuts?

\[ \text{Total Cost} = (\text{Number of items}) \times (\text{Cost per item}) = \]

(c) What is the cost of the 10 pounds of nuts?

\[ \text{Total Cost} = (\text{Number of items}) \times (\text{Cost per item}) = \]

(d) What is the total cost of the mixture of nuts and raisins?

\[ \text{Total cost} = \]

(e) Incorporating the numbers from the questions and the answers into our picture would look like this:

(f) What is the cost per pound of the final mixture?

\[ \text{Cost per pound} = \frac{\text{Total cost}}{\text{Number of pounds}} = \]

The amounts from the nuts and raisins add up to the mixture amount.

The total costs of the nuts and raisins add up to the mixture’s total cost.

\[ \text{Cost per pound} = \frac{\text{Total cost}}{\text{Number of pounds}} = \] per pound.
Part Three: Solving Mixture Problems With Unknowns

Problem 4: Chad’s Healthy Bread is a mixture of wheat flour and flax seed. He has created a final mixture of wheat and flax with a weight of 20 lbs. The cost per lb. of wheat flour is $2 and the cost per lb. of flax seed is $5. The cost of the final mixture is $2.55 per lb.

(a) If Chad used 15 lbs. of wheat flour, then how much flax seed must he have used to obtain the 20 lb. mixture?

(b) If Chad used 3 lbs. of flax seed, then how much wheat flour must he have used to obtain the 20 lb. mixture?

(c) If Chad used \( x \) lbs. of wheat flour, then the amount of flax seed he must have used to obtain the 20 lb. mixture is: \( 20 - x \)

(d) If Chad used \( x \) lbs. of flax seed, then how much wheat flour must he have used to obtain the 20 lb. mixture? Your answer should be in terms of \( x \).

(e) What is the total cost for \( x \) lbs. of flax seed? Your answer should be in terms of \( x \).

\[ \text{Total Cost} = (\text{Number of items}) \times (\text{Cost per item}) = \]

(f) If Chad used \( x \) lbs. of flax seed, then what is the total cost for the wheat flour? Your answer should be in terms of \( x \).

\[ \text{Total Cost} = (\text{Number of items}) \times (\text{Cost per item}) = (20 - x) \times (\text{ }) = \]

(g) What is the total cost of the mixture of wheat flour and flax seed?

\[ \text{Total Cost} = (\text{Number of items}) \times (\text{Cost per item}) = \]

(e) Placing the numbers from our problem and \( e, f, \) and \( g \) into our picture would look like this:

(f) How many lbs. of flax must Chad use to obtain the final 20 lb. mixture? Comparing the total costs, we would have the following equation: \( 2(20 - x) + 5x = 51 \)

Solve:
Problem 5: Francie’s famous pulled-pork hot dogs are made with pulled pork and hot dogs. Francie combines 20 lbs. of pulled pork that contains 20% fat with hot dogs that contain 80% fat to create delicious pulled-pork hot dogs that contain 60% fat.

(a) How many pounds of fat are in the 20 lbs. of pulled pork?

\[ Amount = (\text{Percentage of the volume})(\text{Amount}) = \underline{4 \text{ lbs. of fat}} \]

(b) If we use \( h \) to represent the number of pounds of hot dogs, then how many pounds of fat are in the hot dogs? Your answer will be in terms of \( h \).

\[ Amount = (\text{Percentage of the volume})(\text{Amount}) = \underline{0.8h \text{ lbs. of fat}} \]

(c) The number of pounds of pulled-pork hot dogs is \( 20 + x \).

Francie mixed 20 lbs. with \( x \) lbs. to get \( (20 + x) \) lbs. of pulled-pork hot dogs.

(d) How many pounds of fat are in the \( (20 + x) \) lbs. of pulled-pork hot dogs?

\[ Amount = (\text{Percentage of the volume})(\text{Amount}) = \underline{0.6(20 + x) \text{ lbs. of fat}} \]

(e) Placing the numbers from the questions and answers into our picture would look like this:

(f) How many lbs. of hot dogs must Francie use to obtain the final fat percentage of 60% for her pulled-pork hot dogs?

Comparing the lbs. of fat, we would have the following equation: 
\[ 4 + 0.8x = 0.6(20 + x) \]

Solve: 
\[ x = \underline{10 \text{ lbs.}} \]
Part Four: Forming Equations

Problem 6: Blaire’s Rapid Grow Chicken Feed is made from a corn-based chicken feed. How many pounds of chicken feed that is 50% corn must be mixed with 400 lbs. of feed that is 80% corn to make a chicken feed mixture that is 75% corn?

We start the problem by using the picture we now know how to create to form an equation.

1) Fill in the percentages
2) Fill in the given amount and needed variable.
3) Multiply the percentage by the amount.
4) Create an equation by comparing the new amounts of corn created.

When we compare the lbs. of corn, we get the following equation:

\[
0.5x + 320 = 0.75(x + 400) \\
0.5x + 320 = 0.75x + 300 \\
20 = 0.25x \\
80 = x
\]

Now we can check our answer. We replace the \( x \) with 80.

<table>
<thead>
<tr>
<th>Chicken feed #1 50%</th>
<th>Chicken feed #2 80%</th>
<th>Chicken feed mixture 75%</th>
</tr>
</thead>
<tbody>
<tr>
<td>( x ) lbs.</td>
<td>400 lbs.</td>
<td>( (x+400) ) lbs.</td>
</tr>
<tr>
<td>0.5x lbs. of corn</td>
<td>320 lbs. of corn</td>
<td>0.75(( x+400) ) lbs. of corn</td>
</tr>
</tbody>
</table>

Our answer checks out because

\[
80 \text{ lbs. of chicken feed} + 400 \text{ lbs. of chicken feed} = 480 \text{ lbs. of chicken feed, and} \\
40 \text{ lbs. of corn} + 320 \text{ lbs. of corn} = 360 \text{ lbs. of corn}.
\]

Therefore, 80 lbs. is our answer, but we should write our answer as a complete sentence.

Answer: Blaire should mix 80 lbs. of 50% corn chicken feed with 400 lbs. of 80% corn chicken feed to make 480 lbs. of 75% corn chicken feed.
Here are some mixture problems for you to try.

Problem 7: How many liters of a 14% alcohol solution must be mixed with 20 L of a 50% alcohol solution to get a 30% alcohol solution?

Problem 8: Manuel’s Ultra-Color Hair Dye is made by blending 7% hydrogen peroxide solution and 4% hydrogen peroxide solution. How many milliliters of each are used to make a 300-milliliter solution that is 5% hydrogen peroxide?
Problem 9: Some of the world’s best and most expensive coffee is Hawaii’s Kona coffee. Bryan’s Bean Town Roasters mixes a $2 per lb. breakfast blend coffee with a $5 per lb. Kona coffee to make a Kona coffee blend. How many lbs. of the breakfast blend coffee and how many lbs. of the Kona coffee does Bryan need in order to make to make 150 lbs. of a Kona coffee blend with a cost of $4 per lb.?

Part Five: Reflection

a) Name one thing that you understand better about mixture problems as a result of completing this activity.

b) Name one thing that you still do not understand about mixture problems.

c) Can you think of a way to apply what you have learned about mixture problems in your real life?

d) Do you feel more or less confident about mixture problems?

STOP. Please review your work with a tutor at this time.
Tutor Feedback:

_______ The student completed the entire activity.

_______ The student attempted to answer every question.

_______ The student demonstrated an understanding of the processes involved in the solving of mixture problems during the discussion of his/her work.

Additional Comments:

_________________________________________________________________________________
_________________________________________________________________________________
_________________________________________________________________________________
_________________________________________________________________________________
_________________________________________________________________________________

PRINT INSTRUCTOR/TUTOR NAME   _________________________

DATE

INSTRUCTOR/TUTOR SIGNATURE

STUDENT – DO NOT FORGET TO TURN THIS SHEET IN AT THE FRONT DESK!

You may not get credit for completing this DLA if you fail to leave this sheet with the front desk receptionist.