

Don't Panic

By Joan Malvas

“Aaargh! This can't be happening to me!”

Hearing this, Dianne rushed outside and saw her older sister Ana, looking panic-stricken.

“What's wrong? You look so harassed,” asked Dianne.

“I need 20% of lavender oil solution for my group's investigatory project in Chemistry, but what we have here are just 5% and 30% solutions. I have to bring it to Ed's house this afternoon so that we could start with the project. I wouldn't have volunteered to bring it if I had known that we didn't have some here.” Looking more harassed by the minute, Ana finished, “My group mates are going to be mad at me!”

Smiling at Ana's theatrical outburst, Dianne said, “Don't you ever listen to your Chemistry teacher? One of the reasons why you have an investigatory project is for you to be able to apply what you learned.”

Glaring at Dianne, Ana said, “This isn't the time to brag. Are you going to help me or not?”

“Of course, I'll help you,” Dianne answered. “How much lavender oil solution do you need?”

“Three ounces,” replied Ana.

“Okay, let me get this straight. You need three ounces of 20% lavender oil solution, but what we have are 5% and 30% solutions. Hmm, what we can do is mix up some of the 5% and 30% solutions to be able to come up with a 20% solution.”

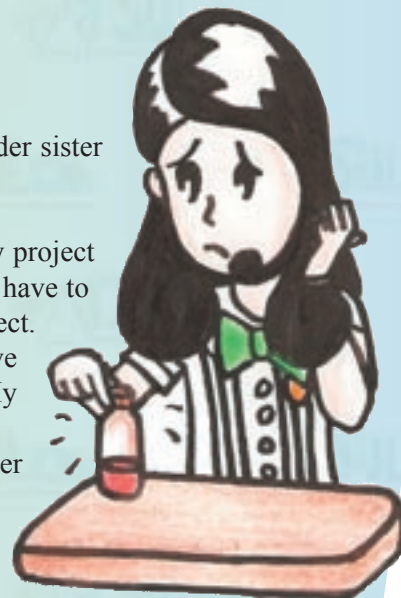
“But how do we know how much of each to mix?” asked Ana.

“Easy,” answered Dianne. “I can just apply what I learned from my math teacher, which is to come up with a system of linear equations which would represent our problem.”

“And how would you do that?” asked Ana impatiently.

“Here, I'll show you,” replied Dianne. “We can just create a table so that we can easily determine the system of linear equations that would help us in answering our problem.

Here is the table that Dianne came up with:



| | Percent Concentration | Number of Ounces | Amount of Lavender Oil |
|--------------------|-----------------------|------------------|------------------------|
| Solution 1 | 5% | x | $0.05x$ |
| Solution 2 | 30% | y | $0.3y$ |
| Resulting Solution | 20% | 3 | $(0.2)(3) = 0.6$ |

“So if we let x be the number of ounces of the 5% lavender oil solution and y be the number of ounces of the 30% lavender oil solution, we will have the following system of linear equations:

$$(1) \quad x + y = 3$$

$$(2) \quad 0.05x + 0.3y = 0.6$$

Solving this system, we get

$$x + y = 3$$

$$5x + 30y = 60$$

multiply (2) by 100

$$-5x - 5y = -15$$

multiply (1) by -5 to eliminate x

$$\underline{5x + 30y = 60}$$

$$25y = 45$$

$$y = \frac{9}{5} \text{ or } 1 \frac{4}{5}$$

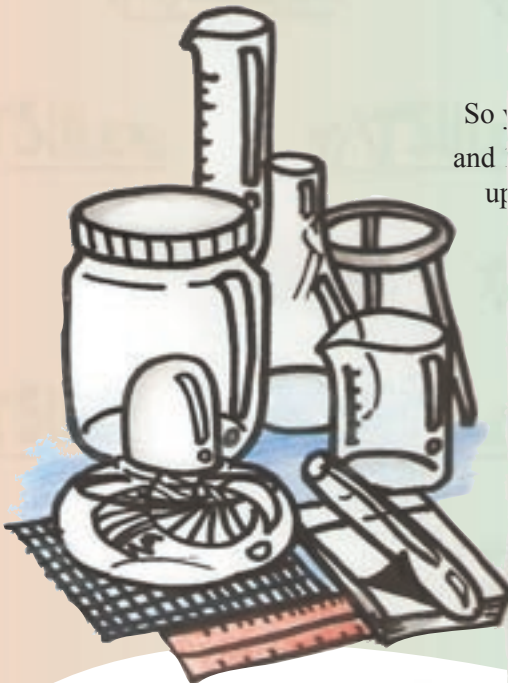
ounces of the 30% lavender oil solution

$$x = 3 - y = 1 \frac{1}{5}$$

ounces of the 5% lavender oil solution

So you would need $1 \frac{4}{5}$ ounces of the 30% lavender oil solution and $1 \frac{1}{5}$ ounces of the 5% lavender oil solution to be able to come up with three ounces of the 20% lavender oil solution,” said Dianne triumphantly.

“Wow!” said Ana, looking relieved, “I never thought that systems of linear equations would someday become handy. Thanks, Sis. You’re the best. I’ll start measuring the amounts that I’ll be needing.”



WORKSHEET

For each of the following mixture problems,

- Complete the given table;
- Set up a system of linear equations; and
- Solve what is asked for.

- A chemist wants to test a 25% gasohol mixture (combination of gasoline and ethanol). He doesn't have any on hand, so he'll have to make the mixture himself by adding a 30% gasohol mixture to 10 gallons of an 18% mixture. How many gallons of the 30% mixture should he add, and how many gallons is the resulting mixture?

| | Percent Concentration | Number of Gallons | Amount of Gasohol |
|-------------------|-----------------------|-------------------|-------------------|
| Mixture 1 | 30% | | |
| Mixture 2 | 18% | | |
| Resulting Mixture | 25% | | |

- Hero wants to dilute a 25% fertilizer solution with water until it is only 5% strong. He needs 10 gallons of the 5% solution. How much water and how much 25% solution should he add to make 10 gallons of the weaker mixture?

| | Percent Concentration | Number of Gallons | Amount of Solution |
|---------------------|-----------------------|-------------------|--------------------|
| Fertilizer Solution | | | |
| Water | | | |
| Resulting Mixture | | | |

WORKSHEET

3. In a Chemistry class, 6 liters of a 12% alcohol solution must be mixed with a 20% solution to get a 14% solution. How many liters of the 20% solution are needed?

| | Percent Concentration | Number of Liters | Amount of Solution |
|--------------------|-----------------------|------------------|--------------------|
| Solution 1 | 12% | | |
| Solution 2 | 20% | | |
| Resulting Solution | 14% | | |

Now, look for your answers in the table below. The letters that correspond to your answers will answer this question:

What do you call a metal that is a mixture of two or more metals?

All you have to do is rearrange the letters to get the answer.

| | | | | | | | |
|----|---|----|----|---|----|----|---|
| 14 | 8 | 10 | 24 | 2 | 10 | 16 | 2 |
| O | A | S | Y | L | S | E | L |

ANSWERS:

1.

| | Percent Concentration | Number of Gallons | Amount of Gasohol |
|-------------------|-----------------------|-------------------|-------------------|
| Mixture 1 | 30% | x | $0.3x$ |
| Mixture 2 | 18% | 10 | 1.8 |
| Resulting Mixture | 25% | y | $0.25y$ |

System:

$$\begin{aligned}x + 10 &= y \\0.3x + 1.8 &= 0.25y\end{aligned}$$

Answer: He should add 14 gallons of the 30% mixture in order to get 24 gallons of the resulting mixture.

2.

| | Percent Concentration | Number of Gallons | Amount of Solution |
|---------------------|-----------------------|-------------------|--------------------|
| Fertilizer Solution | 25% | x | $0.25x$ |
| Water | 0% | y | 0 |
| Resulting Mixture | 5% | 10 | 0.5 |

System:

$$\begin{aligned}x + y &= 10 \\0.25x &= 0.5\end{aligned}$$

Answer: He should add 2 gallons of the 25% solution and 8 gallons of water.

3.

| | Percent Concentration | Number of Liters | Amount of Solution |
|--------------------|-----------------------|------------------|--------------------|
| Solution 1 | 12% | 6 | 0.72 |
| Solution 2 | 20% | x | $0.2x$ |
| Resulting Solution | 14% | y | $0.14y$ |

System:

$$\begin{aligned}6 + x &= y \\0.72 + 0.2x &= 0.14y\end{aligned}$$

Answer 2 liters of the 20% solution are needed.

ANSWER: ALLOY