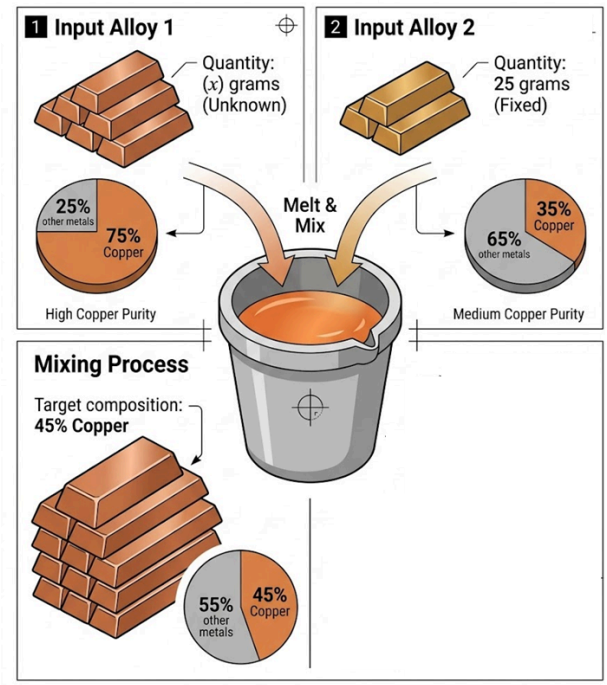
In engineering and chemical processing applications, **mixture problems** model the blending of multiple solutions or alloys of varying concentrations to form a target concentration.

These problems are entirely governed by the fundamental law of the **Conservation of Mass**. Under this law, two balanced equations must hold true simultaneously:

1. **Total Mass Balance:** The mass of substance A plus the mass of substance B must equal the total mass of the final mixture.
2. **Active Ingredient Balance:** The pure amount of the specific component (e.g., pure copper) from each source must sum up to the total pure amount present in the final mixture.

How many grams of an alloy that is 75% copper should be melted with 25 grams of an alloy that is 35% copper to produce an alloy that is 45% copper?



- **Alloy 1:** Concentration = 75%, $Mass = x$
- **Alloy 2:** Concentration = 35%, $Mass = 25\ g$
- **Final Alloy:** Concentration = 45%, $Mass = x + 25$

<u>Step 1:</u> Establish the Active Ingredient Balance Equation

Multiply the mass of each alloy container by its corresponding decimal percentage concentration:

$$Pure\ Copper_1 + Pure\ Copper_2 = Pure\ Copper_{Final}$$

$$0.75(x) + 0.35(25) = 0.45(x + 25)$$

Step 2: **Expand and Simplify**

Perform the static multiplications and distribute the 0.45 into the binomial expression:

$$0.75x + 8.75 = 0.45x + 11.25$$

Step 3: **Solve for variable x**

Group all variable terms on the left side and all constants on the right side:

$$x = \frac{2.50}{0.30} = \frac{25}{3} = 8\frac{1}{3}\ grams$$