

What does it mean
for a solution to be
35% alcohol?

Percent Concentrations:

A **solution** is a mixture of a main ingredient like some drug or alcohol (called the **solute**) in some (usually liquid) medium like water (called the **solvent**). We will state the **concentration** as a ratio or percent.

Concentrations will always be stated as the **amount of solute compared to the total amount of solution** (which, as you can imagine, is the solute plus solvent).

A concentration in a ratio of 1:5 means that there is one part solute in five total parts solution. How many parts of this solution would be the solvent?

A 35% alcohol solution means there is 35 parts alcohol out of 100 parts total. How many parts of this solution would be the solvent?

$$\text{percent} = \frac{\text{part}}{\text{whole}}$$

The **units** used for solutions will depend on whether the solute and solvent are liquid or dry. See below for the three possible combinations. As always, include units in answers.

Liquid solute, liquid solvent:

$$\frac{\text{mL of solute}}{\text{mL of solution}}$$

Dry solute, liquid solvent:

$$\frac{\text{g of solute}}{\text{mL of solution}}$$

Dry solute, dry solvent:

$$\frac{\text{g of solute}}{\text{g of solution}}$$

Solute: active
ingredient or drug
Solution: total stuff

Flash Card Facts:
1,000 mL = 1 L
1,000 mg = 1 g

expl 1: You have dissolved 1,500 mg of NaCl in 1 L of solution. Give the concentration in both ratio and percent forms.

Always use
grams and
milliliters.

Preparing Solutions:

We will often use proportions to solve these problems. You should see them as examples of a familiar proportion used before but seen here using different language.

$$\frac{\text{known solute}}{\text{known solution}} = \frac{\text{desired solute}}{\text{desired solution}}$$

On left, use the given concentration.

On right, use the information for the desired solution.

What's on top on left should be on top on right!

Use x for what you do not know.

expl 2: How much (liquid) boric acid is required to make 300 mL of a 5% solution?

expl 3: How many grams of sodium chloride are contained in a 600 mL bottle of 0.45% solution?

You can also think of these as percent problems.

expl 4: If we mix 17 g of a drug to make a 30% solution, how much total solution would we get?

Units, units, units!

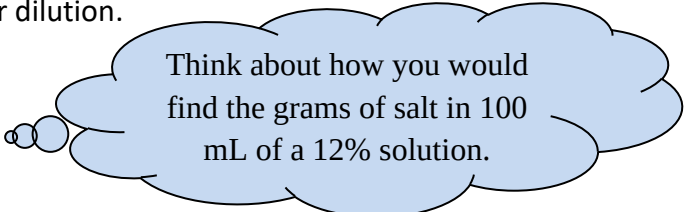
Diluting Solutions:

If we have a 50% solution but want a 15% solution, how would we do that? We would add solvent (often water, saline, alcohol, etc. called a **diluent** or **dilutant**) to dilute this original concentration. This creates a solution that has a weaker concentration.

The key is to see that the amount of the pure active ingredient (solute) has to be the same before and after dilution.

After all, we are *not* adding any more.

Also, the amount of pure solute present is equal to the amount of solution times its concentration.



Think about how you would find the grams of salt in 100 mL of a 12% solution.

Formula for Diluting Solutions:

$$V_1C_1 = V_2C_2$$

Define V_1 to be the amount of solution you *need* and C_1 to be the concentration you *need*.

Define V_2 to be the amount of solution you *have* and C_2 to be the concentration you *have*.

expl 5: Let's say you have as much 50% solution as needed. You require 1,000 mL of 15% solution. How do you do that? Let's do it in steps.

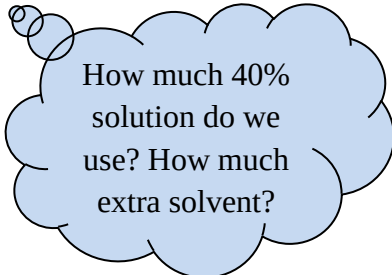
a.) Set up and solve the equation above to find how many milliliters of the 50% solution you should use.

b.) How much additional solvent would need to be added to this amount of 50% solution (found in part a) to make the required amount of 15% solution?

c.) Describe the procedure to create this new 15% solution. Check that your numbers would work out.

expl 6: Ampicillin is packaged to be used as an intramuscular injection. Its label states that there is 1 gram of the drug in 4 mL of solution. If a patient should be dosed with 150 mg, how much should be injected?

expl 7: How much 40% solution is needed to make 50 mL of a solution with a 1:4 ratio?
Describe the procedure.



How much 40% solution do we use? How much extra solvent?