“Making solutions with multiple components”

Part II: Making solutions from concentrated stock solutions
Often, solutions containing multiple components are prepared from concentrated stock solutions.

Stock solutions vary in their concentrations, and in the units used to express their concentrations, but are all used in the same way...
Suppose I need to make 5 L of 0.05 M NaCl from a 5 M NaCl stock solution...

I will need to add some volume of 5 M NaCl...

To prepare solutions for use in the lab, stock solutions are DILUTED to the correct working concentration...

Let's figure out what volume of NaCl stock we need...

and enough water to make 5 L total solution
What volume of NaCl stock do I add?

Use $C_1V_1 = C_2V_2$

$C_1 = 5 \text{ M}$

$C_2 = 0.05 \text{ M}$

$V_1 = ?$

$V_2 = 5 \text{ L} = 5000 \text{ mL}$

$V_1 = (0.05 \text{ M})(5000 \text{ mL}) \div 5 \text{ M}$

$V_1 = 50 \text{ mL}$

I will need to add 50 mL of 5 M NaCl...

and enough water to make 5 L total solution

Let's make the solution...
I will need to add 50 mL of 5 M NaCl to make 5 L total solution.
Now let’s make a solution containing two solutes from concentrated stock solutions...
Here is a simple solution containing multiple components:

**CG**
50 mM calcium chloride
15% glycerol

This is *ONE* solution with *multiple components* that we will make from the following stock solutions:
Making 500 mL of CG from concentrated stock solutions…

I will need to add some volume of 1 M CaCl$_2$…

and some volume of 60% glycerol

and enough water to make 500 mL total solution

Let’s do the math…
What volume of 1 M CaCl\(_2\) do I need?

Use \(C_1V_1 = C_2V_2\)
- \(C_1 = 1\text{ M} = 1000\text{ mM}\)
- \(C_2 = 50\text{ mM}\)
- \(V_1 = ?\)
- \(V_2 = 500\text{ mL}\)

\[V_1 = \frac{(50\text{ mM})(500\text{ mL})}{1000\text{ mM}}\]
- \(V_1 = 25\text{ mL}\)

I will need to add 25 mL of 1 M CaCl\(_2\)...

and some volume of 60% glycerol

and enough water to make 500 mL total solution

Let’s continue...
I will need to add 25 mL of 1 M CaCl$_2$...

Use $C_1V_1 = C_2V_2$

$C_1 = 60\%$

$C_2 = 15\%$

$V_1 = ?$

$V_2 = 500\ mL$

$V_1 = \frac{(15\%)(500\ mL)}{60\%}$

$V_1 = 125\ mL$

Let’s finish…

and enough water to make 500 mL total solution

and 125 mL of 60% glycerol

H$_2$O

125 mL
Let’s make our solution…

I will need to add 25 mL of 1 M CaCl₂…

and 125 mL of 60% glycerol

…to enough water to make 500 mL total solution

Done!