Workshop 1: Solutions & Pipettes

**Labels**

Labels are made with Sharpie on lab tape. If there are too many reagents to fit, make sure they’re all listed in your lab notebook.

**Notebook Entry**

<table>
<thead>
<tr>
<th>Prep: 500mmol NaCl Solution</th>
<th>2019.09.04</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amt Unit Reagent Manufacturer Lot #</td>
<td></td>
</tr>
<tr>
<td>29 g NaCl Fisher ABC123</td>
<td></td>
</tr>
<tr>
<td>1 L deionized H₂O -</td>
<td></td>
</tr>
</tbody>
</table>

Makes 1L 500mmol NaCl Solution

This is a very brief example – sometimes you may have many rows in the table, one for each reagent you use to make a solution.
Containers

PCR tubes
(0.2ml, 0.5ml)

Eppendorf Tubes
Various sizes & shapes
(Usually between 1-5ml)

Centrifuge tubes
(15ml, 50ml)

Glass Bottles
Various sizes
(Usually 100ml – 2L)

Beakers
Various sizes

Round Bottomed Flasks
Various sizes

Erlenmeyer Flasks
Various sizes

Test Tubes
Equipment

- Vortex
- Centrifuge
- Scales
- Magnetic Mixer
- Micropipettes
- Pipettes (Glass or Plastic)
- Pipette Gun
- Manual Pipette Fillers
- Trash
**Solutions**

*Calculating Molar Masses & Molarity*

(1 mole is \(6.022 \times 10^{23}\) molecules, but we don’t need to worry about that right now)

The molar mass gives you the grams per mole of a substance. Molarity gives you the moles per liter of a solution.

We can use the periodic table to find the molar masses of sodium and chlorine: 22.990 and 35.453.

Add to get the molar mass of NaCl:

\[23 + 35 = 58\] grams/mole

If we add 58 grams of salt to 1 liter of water, this solution is referred to as “1 molar” which can be abbreviated as 1M.

There are many ways to make a 1M solution of NaCl:

1. Add 58g NaCl to 1L water (1000ml)
2. Add 29g NaCl to 0.5L water (500ml)
3. Add 5.8g NaCl to 0.1L water (100ml)
4. Add 2.9g NaCl to 0.05L water (50ml)

The typical unit for a solution less than one molar is millimoles, abbreviated mmol or mM. We could get a 500mM solution of NaCl in many different ways:

1. Add 58g of NaCl to 2L water (2000ml)
2. Add 29g of NaCl to 1L water (1000ml)
3. Add 5.8g of NaCl to 0.2L water (200ml)
4. Add 2.9g of NaCl to 0.1L water (100ml)

As you can see, you can make the amount of solution you need by calculating the mass of NaCl to use.
Solutions

Serial Dilutions

Sometimes you will have a stock solution that is far more concentrated than what you need to work with.

Serial dilutions require some patience and a bit of math but they can make your life much, much easier.

We will be using tenfold dilutions at each step.

If you take 1ml of concentrated solution you would have to add it to 10 liters of water to get a 1:10,000 dilution directly. A five tube dilution can get you there with only 36ml of water.

Serial dilution steps:
1. Organize test tubes in a rack and label them: O for Original, 1:10, 1:100, 1:1k, 1:10k.
2. Add 1.5ml of food coloring to the Original tube.
3. Add 9ml water to each of the other four tubes.
4. Take 1ml food coloring from Original and add it to 1:10 tube. Mix with pipette or swirl.
5. Take 1ml from 1:10 tube and add to 1:100 tube. Mix or swirl.
6. Take 1ml from 1:100 tube and add to 1:1k tube. Mix or swirl.
7. Take 1ml from 1:1k tube and add to 1:10k tube. Mix or swirl.
8. You now have a solution diluted to 1:10,000.

In the future if your original solution has already been diluted, you can take that into account and calculate the final concentration. If the original solution had been half food coloring and half water, the original tube would be referred to as a 1:2 dilution and the other tubes would be 1:20, 1:200, 1:2k, and 1:20k dilutions.