Chemistry 3A

Introductory General Chemistry

Experiment 9a

Solutions & Dilutions

Mitch Halloran

Fresno City College

Introduction

- Making concentrated ("stock") **solutions** and then diluting them to make less concentrated solutions—**dilutions**—is one of the most common and important things done in the chemistry laboratory
- Being able to make calculations related to preparing solutions and making dilutions of the solutions is the most important thing

Background

- Did you know the amount of salt dissolved in natural waters can have concentrations that qualify them as fresh, brackish, briny or the "normal saline" level in blood?
- Brines are
  - solutions that vary from saturated to a bit less than saturated
  - Used to preserve food by pickling it

Two solutions of sodium chloride (NaCl) will be prepared

- Solution 1
  - This is a "stock concentrated" solution in which solid NaCl is weighed out and dissolved
  - These solutions are usually stored long-term
- Solution 2
  - This a "working" solution made as a dilution from the stock solution
  - These solutions are made for temporary use and discarded
  - These solutions should be made at the right concentration and volume with attention to minimizing waste

Concepts

$$\text{Molarity } (M) = \frac{\text{moles (mol) solute}}{\text{liters (L) solution}}$$

$$\text{Mass Percent } \left(\frac{m}{m}\%\right) = \frac{\text{mass (g) solute}}{\text{100 g solution}} = \frac{\text{mass solute}}{\text{mass solution}} \times 100\%$$

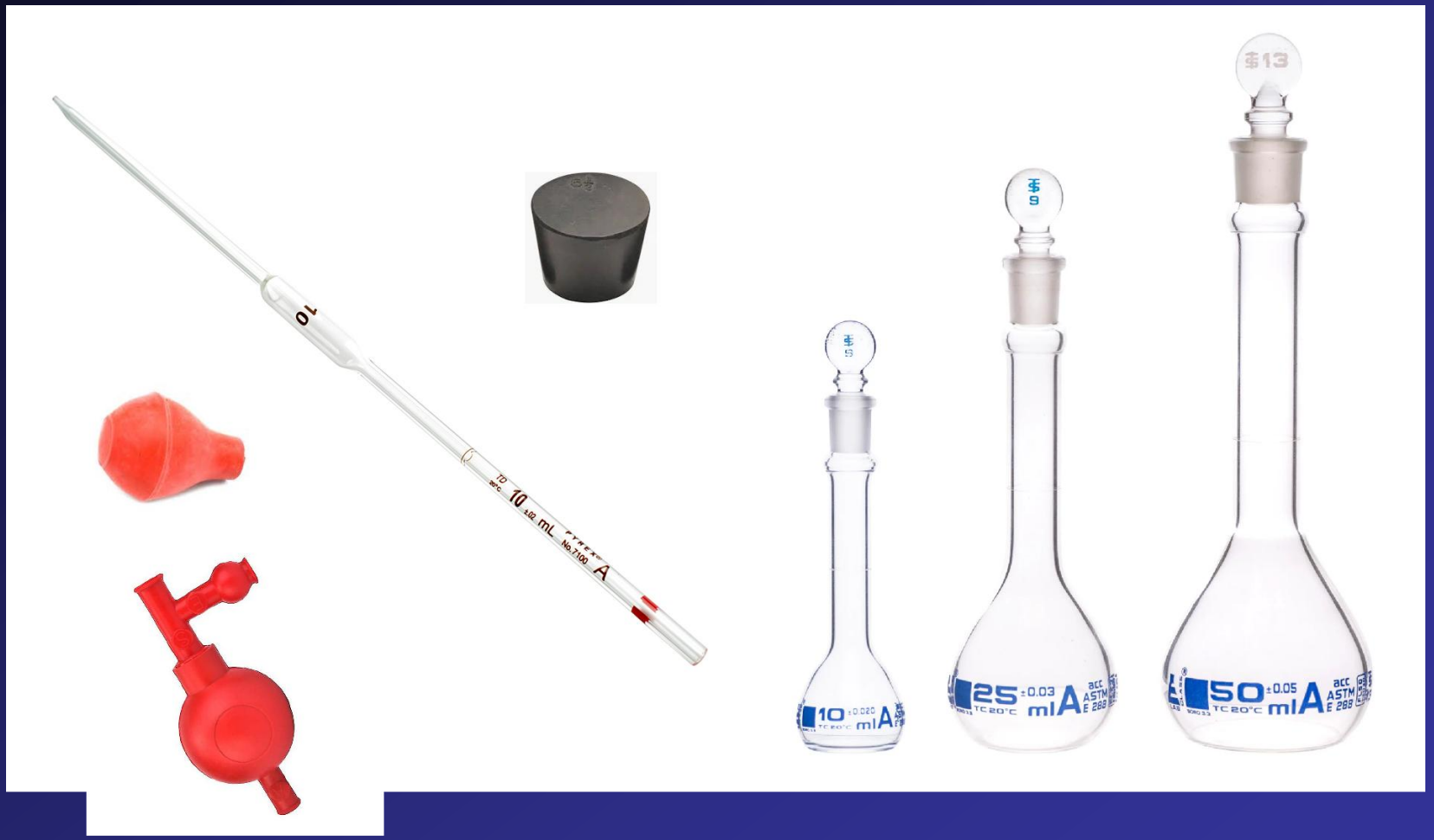
$$\text{Molality } (m) = \frac{\text{mol solute}}{\text{kg solvent}}$$

$$\text{Mass Volume Percent } \left(\frac{m}{V}\%\right) = \frac{\text{mass (g) solute}}{\text{100 mL solution}} = \frac{\text{mass (g) solute}}{\text{mL solution}} \times 100\%$$

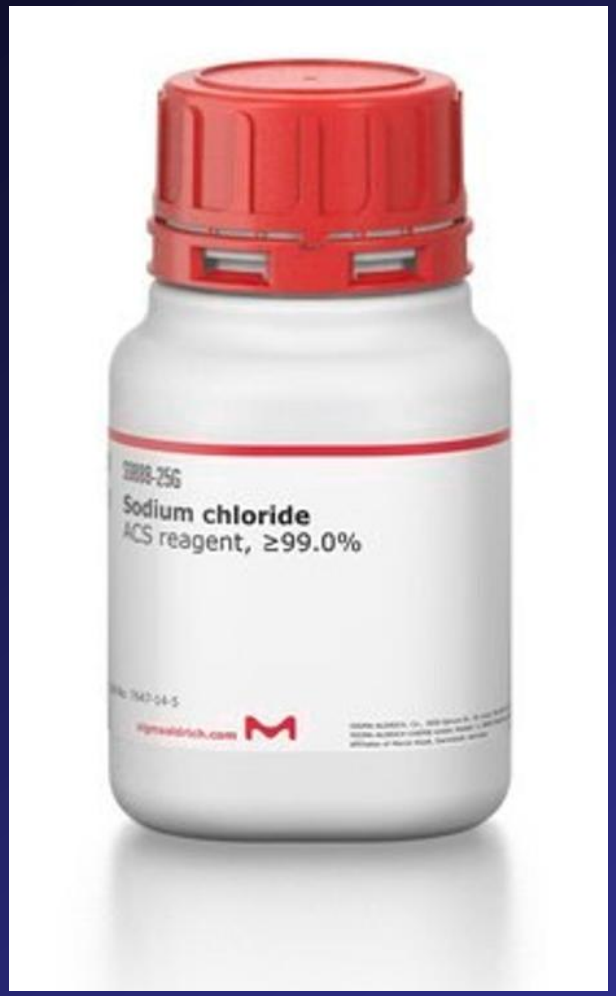
$$\text{Volume Percent } \left(\frac{V}{V}\%\right) = \frac{\text{volume (mL) solute}}{\text{100 mL solution}} = \frac{\text{volume solute}}{\text{volume solution}} \times 100\%$$

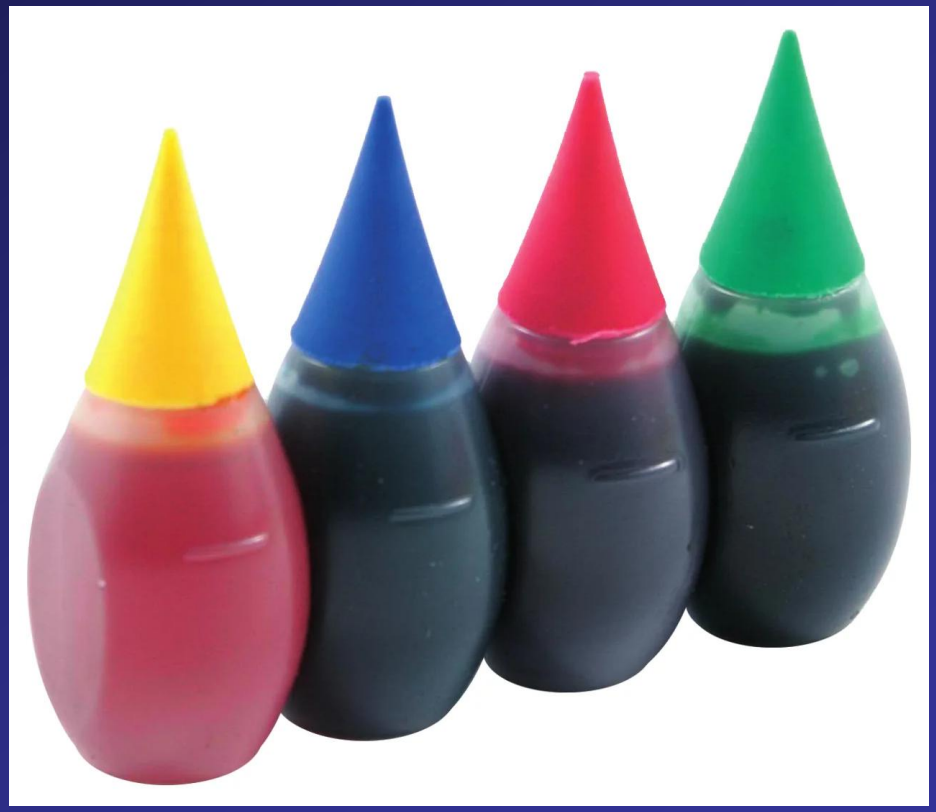
$$\text{Solution Density} = \frac{\text{grams solution}}{\text{milliliters solution}}$$

Equipment You Will Use



Consumables





Procedure

Solution A

1. Use a Sharpie (permanent marker) to write “A” on 50 mL volumetric flask
2. Record mass of the empty flask
3. Measure out 4.5-6.0 g NaCl on glassine paper and deliver to 50 mL flask
4. Record mass of flask containing the NaCl
5. Fill flask with DI water to about halfway, add 1 gtt food coloring, swirl to dissolve most or all of salt
6. Place the stopper, fill to volume mark with DI water. Mix by inversion, inverting about 15 times
7. Fill to mark again noting meniscus. Record mass of solution

Procedure

Solution B

1. Use a Sharpie (permanent marker) to write “B” on 25 mL volumetric flask
2. Record mass of the empty flask
3. With 10 ml pipet, transfer 10.00 mL of “A” into flask for “B”
4. Fill flask with DI water to the line. Place stopper and mix by inversion at least 15 times
5. Fill to mark again noting meniscus. Record mass of solution

Clean Up

- Saline solutions are safely discarded in the sink
- Flush the volumetric pipet with DI water (collect in beaker, then dump beaker wash)
- Rinse the volumetric flasks a couple of time with DI water from its tap. If possible, place flasks upside down on drying racks near sinks
- If you used Sharpie on glass, use a very small amount of acetone to wash it off (paper towel helps)

Example Data Analysis

Make sure that you use the significant digits of for the volumes in the flasks and pipets shown on p 97: 10.00 mL, 25.00 mL, 50.00 mL

DATA

	Solution A
Mass of 50-mL volumetric flask + stopper (empty)	
Mass of 50-mL volumetric flask + stopper + NaCl	
Mass of 50-mL volumetric flask + stopper + "Solution A"	

	Solution B
Mass of 25-mL volumetric flask + stopper (empty)	
Mass of 25-mL volumetric flask + stopper + "Solution B"	
Volume of "Solution A" used to make "Solution B"	

Example Data Analysis

CALCULATIONS

Show your mathematical work, complete with units.

1. Mass of solute in Solution A:

2. Mass of solution for Solution A:

3. Mass of solvent for Solution A:

Example Data Analysis

4. Moles of solute in Solution A:

5. Molarity (M) of Solution A:

6. Mass % (m/m%) of Solution A:

7. Molality (*m*) of Solution A:

8. Mass-Volume % of Solution A:

Example Data Analysis

9. Density of Solution A:

10. Moles of solute in 10.00 mL of Solution A ("Moles of Solute" for Solution B):

11. Mass of solute used to make Solution B:

12. Mass of solution for Solution B:

13. Mass of solvent for Solution B:

Example Data Analysis

14. Molarity (M) of Solution B:

15. Mass % (m/m%) of Solution B:

16. Molality (*m*) of Solution B:

17. Mass-Volume % of Solution B:

18. Density of Solution B:

Example Data Analysis

RESULTS Solute = NaCl, Solvent = H_2O (water)

	Solution A	Solution B
Mass Solute		
Mass Solvent		
Mass Solution		
Moles of Solute		
Molarity (M)		
Mass Percent (m/m %)		
Mass-Volume Percent (m/v %)		
Molality (*m*)		
Density of Solution		