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CASE

Activity 1.2.4 Making Molar Solutions

Purpose

Chemists and biotechnicians work with moles, molarity, and molar solutions. Not the burrowing-creature or tooth-extraction kind. For the purposes of this course, a mole is the quantity of a substance equaling the atomic mass of the substance. The atomic mass of an element can be learned from a periodic table of elements.

To determine the molar mass of compounds, substances made up of two or more elements, simply add the atomic mass of each element in the compound. For example, sodium (Na) has an atomic mass of 22.99 and chloride (Cl) has an atomic mass of 35.45. Therefore, one mole of salt (NaCl) has a mass of 58.44 grams.

To make a molar solution, dissolve 1 mole of a compound in solvent, often water, to make a total of 1 liter in volume. Thus, a 1 molar solution has 1 mole of solute per liter of solution. Molarity is expressed using the symbol M, which stands for moles per liter. **NOTE:** Mole is the specific number of molecules while molarity is the concentration.

Materials

Per pair of students:

- 2 250ml reagent bottles
- 2 plastic weigh boats
- 2 100ml volumetric flasks
- Plastic funnel
- Distilled H_2O bottle
- Laboratory tape
- Permanent marker

Per class:

- 5 electronic balances
- NaCl source
- $CaCl_2$ source

Per student:

- Periodic table
- Calculator
- PPE
- Pen
- *Agriscience Notebook*
- *Laboratory Notebook*

Procedure

You and your partner will determine the molar mass of several compounds and mix a molar solution. Be sure to record all of your work in your *Laboratory Notebook* accurately.

Part One – Determining the Mass of a Mole

Using your periodic table, determine the molar mass of each substance required to make the following solutions. Remember, a one molar solution equals one mole of solute in one liter of solution.

Table 1. *Molar Mass*

Solution	Mass of 1 mole of substance	Mass of substance needed for solution
1 L of 1 M NaCl	58.44 g	58.44 g
1 L of 0.5 M $CaCl_2$	110.98 g	55.49 g
2 L of 0.25 M NaCl	58.44 g	29.22 g
500ml of 2 M NaOH	39.98 g	39.98 g
100ml of 0.1 M $CaCl_2$	110.98 g	1.11 g

Part Two – Mixing Molar Solutions

1. Clean glassware and other vessels appropriately.
2. Prepare to make two solutions based on the information below by calculating the amount required.
    - 100ml of 1 M NaCl
    - 100ml of 0.5 M $CaCl_2$
3. Use the laboratory tape and permanent marker to label the reagent bottles with the following information.
    - Solution name and concentration
    - Date of preparation
    - Name(s) of preparer(s)
4. Use a weigh boat to measure out the correct quantity of NaCl as determined by your calculations. Be sure to account for the mass of the weigh boat.
5. Place the funnel into the top of a 100ml volumetric flask.
6. Carefully transfer the NaCl from the weigh boat into the volumetric flask.
7. Rinse any remaining powder from the weigh boat into the funnel using distilled water (dH_2O).
8. Add 50ml of dH_2O to the flask and swirl gently until the NaCl is dissolved.
9. When the NaCl is dissolved, slowly add dH_2O to bring the volume up to 100ml. The meniscus should just touch the 100ml mark on the flask.
10. Transfer your solution to the reagent bottle using a funnel to avoid spills.
11. Store at room temperature as instructed by your teacher.
12. Mix the 0.5 M $CaCl_2$ solution using the procedures above.

Conclusion

1. What is the difference between a mole and molarity?

    A mole is a specific number of molecules, molarity is the concentration.

2. How does mixing a molar solution differ from mixing a percent solution?

    Percent solutions are liquid only and molar solutions are solids and liquids mixed.