CHEMISTRY SOLUTION MOLARITY PRACTICE (M) II

First let's look at some solution molarity equations:

Remember from Practice I we discussed this example:

Suppose you had 29.22 grams of NaCl and you dissolved it in exactly enough water to make 2.00 L of solution. What would be the molarity of the solution?

The solution to this problem involved two steps:

Step One: convert grams to moles.

Step Two: divide moles by liters to get molarity.

Let's merge these ideas into the formation of a single equation containg four variables as follows:

Equation #1: $$moles = \frac{grams}{molar\ \ mass}$$

Equation #2: $$molarity = \frac{moles}{volume(L)}$$

Substituting for moles in Eq.#2, what a mole is equal to from Eq.#1 gives the following:

Equation #3: $$molarity = \frac{grams}{(molar\ \ mass)(volume)}$$

Multiplying both sides of the Eq.#3 by

$(molar\ \ mass)(volume)$ gives

Equation#4:

$$(molarity)(molar\ \ mass)(volume) = grams$$

Using some symbols in Eq. #4 gives this equation:

Equation #5: (M)(GMM)(V) = grams

M = (**molarity**) in moles/Liter
GMM = (**molecular mass**) in grams/mol
V = (**volume**) in Liters of solution
grams = (**mass of solute**) in grams

Examples:

1) When 2.00 grams of $KMnO_4$(molec. wt = 158.0 g/mol) is dissolved into 100.0 mL of solution, what molarity results?

We are looking for M, molarity. We will solve Eq.#5 for M to give the following:

$$M = \frac{grams}{(GMM)(V)}$$

grams = 2.00 g
GMM = 158 g/mol
V = 100 mL = 0.100 L

Therefore: $$M = \frac{2.00g}{(158g/mol)(0.100L)}$$

M = 0.127 M

2) How many grams of $KMnO_4$are needed to make 500.0 mL of a 0.200 M solution?

grams = (M)(GMM)(V)

M = 0.200 mol/L
GMM = 158 g/mol
V = 500.0 mL = 0.500 L

grams = (0.200 mol/L)(158 g/mol)(0.500 L)

grams = 15.8 g $KMnO_4$

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PRACTICE PROBLEMS

$$Molarity = \frac{moles\ of\ solute}{liters\ of\ solution}$$

$$grams = (M)(GMM)(V)$$

Solve those problems assigned by your teacher from below on a separate paper.

1. Sea water contains roughly 28.0 g of NaCl per liter. What is the molarity of sodium chloride in sea water?

2. What is the molarity of 245.0 g of H_2SO_4 dissolved in 1.00 L of solution?

3. What is the molarity of 5.30 g of Na_2CO_3dissolved in 400.0 mL solution?

4. What is the molarity of 5.00 g of NaOH in 750.0 mL of solution?

5. How many moles of $Na_2CO_3$are there in 10.0 L of 2.0 M soluton?

6. How many moles of Na_2CO_3 are in 10.0 mL of a 2.0 M solution?

7. How many moles of NaCl are contained in 100.0 mL of a 0.20 M solution?

8. What weight (in grams) of NaCl would be contained in problem 7?

9. What weight (in grams) of H_2SO_4 would be needed to make 750.0 mL of 2.00 M solution?

10. What volume (in mL) of 18.0 M H_2SO_4i s needed to contain 2.45 g H_2SO_4?

11. What volume (in mL) of 12.0 M HCl is needed to contain 3.00 moles of HCl?

12. How many grams of $Ca(OH)_2$are needed to make 100.0 mL of 0.250 M solution?

13. What is the molarity of a solution made by dissolving 20.0 g of H_3PO_4i n 50.0 mL of solution?

14. What weight (in grams) of KCl is there in 2.50 liters of 0.50 M KCl solution?

15. What is the molarity of a solution containing 12.0 g of NaOH in 250.0 mL of solution?

16. Determine the molarity of these solutions:

a) 4.67 moles of Li_2SO_3 dissolved to make 2.04 liters of solution.

b) 0.629 moles of Al_2O_3t o make 1.500 liters of solution.

c) 4.783 grams of Na_2CO_3 to make 10.00 liters of solution.

d) 0.897 grams of $(NH_4)_2CO_3$ to make 250 mL of solution.

e) 0.0348 grams of $PbCl_2$ to form 45.0 mL of solution.

17. Determine the number of moles of solute to prepare these solutions:

a) 2.35 liters of a 2.00 M $Cu(NO_3)_2$ solution.
b) 16.00 mL of a 0.415-molar $Pb(NO_3)_2$ solution.
c) 3.00 L of a 0.500 M $MgCO_3$ solution.
d) 6.20 L of a 3.76-molar Na_2O solution.

18. Determine the grams of solute to prepare these solutions:

a) 0.289 liters of a 0.00300 M $Cu(NO_3)2$ solution.
b) 16.00 milliliters of a 5.90-molar $Pb(NO_3)_2$ solution.
c) 508 mL of a 2.75-molar NaF solution.
d) 6.20 L of a 3.76-molar Na_2O solution.
e) 0.500 L of a 1.00 M KCl solution.
f) 4.35 L of a 3.50 M $CaCl_2$ solution.

19. Determine the final volume of these solutions:

a) 4.67 moles of Li_2SO_3 dissolved to make a 3.89 M solution.
b) 4.907 moles of Al_2O_3 to make a 0.500 M solution.
c) 0.783 grams of Na_2CO_3 to make a 0.348 M solution.
d) 8.97 grams of $(NH_4)_2CO_3$ to make a 0.250-molar solution.
e) 48.00 grams of $PbCl_2$to form a 5.0-molar solution.

20. 10.0 g of acetic acid (CH_3COOH) is dissolved in 500.0 mL of solution. What molarity results?

21. How many mL of solution will result when 15.0 g of H_2SO_4i s dissolved to make a 0.200 M solution?