KEY

Molarity Practice

Name: _____

Date: _____

1. Calculate the molarity of the following solutions:

   a) 45 g of Na_2SO_4 in 150 mL of solution.

   $(45g)\left(\frac{mol}{142.1g}\right)\left(\frac{1}{0.150L}\right) = \boxed{2.1\ M}$

   b) 24.6 g of $(NH_4)_2CO_3$ in 75 mL of solution.

   $(24.6g)\left(\frac{mol}{96.0g}\right)\left(\frac{1}{0.075L}\right) = \boxed{3.4\ M}$

   c) 73.1 g of $Ca(NO_3)_2$ in 125 mL of solution.

   $(73.1g)\left(\frac{mol}{164.1g}\right)\left(\frac{1}{0.125L}\right) = \boxed{3.6\ M}$

2. What is the concentration of sulphate ions, SO_4^{-2}, in each of the following?

   a) 0.75 M $Al_2(SO_4)_3$

   $Al_2(SO_4)_3 \rightarrow 2Al^{3+} + 3SO_4^{2-}$

   0.75 → $\boxed{2.3\ M}$

   b) 1.35 M Na_2SO_4

   $Na_2SO_4 \rightarrow 2Na^{+} + SO_4^{2-}$

   1.35M → $\boxed{1.4\ M}$

3. What is the molarity of chlorine ions in solution when 47 g of $AlCl_3$ is dissolved in a 210 mL of solution?

   $(47g)\left(\frac{mol}{133.5g}\right)\left(\frac{1}{0.210L}\right) = 1.68\ M$

   $[Cl^-] = 3(1.68M) = \boxed{5.0\ M}$

4. Which of the following solutions has the highest concentration? Prove using calculations.

   A) 12.5 g of $CaCl_2$ in 40 mL of solution

   $(12.5g)\left(\frac{mol}{111.1g}\right)\left(\frac{1}{0.040L}\right) = 2.82M$

   B) 20.9 g of MgI_2 in 35 mL

   $(20.9g)\left(\frac{mol}{278.1g}\right)\left(\frac{1}{0.035L}\right) = 2.2\ M$

5. How many grams of salt (NaCl) need to be dissolved in 300 mL of solution to give you a solution that has a concentration of 1.2 M? (Hint: you need to work backwards on this one. You are given the molarity and the liters, so find the moles and convert to grams.)

   $\left(\frac{1.2mol}{L}\right)(0.300L) = 0.36mol$

   $M = (0.36mol)\left(\frac{58.5g}{mol}\right) = \boxed{21.\ g}$

6. Calculate the number of grams of Na_2SO_4 that would be required to mix 5.0L of a 0.10M solution.

$$\left(\frac{142.09\text{ g}}{1\text{ mol}}\right)\left(\frac{0.10\text{ mol}}{1\text{ L}}\right)(5.0\text{ L}) = \boxed{71\text{ g}}$$

7. Calculate the number of grams of NaOH that would be required to mix 10.0L of a 0.400M solution.

$$\left(\frac{40.0\text{ g}}{1\text{ mol}}\right)\left(\frac{0.400\text{ mol}}{1\text{ L}}\right)(10.0\text{ L}) = \boxed{160\text{ g}}$$

8. Calculate the number of grams of $Ca(NO_3)_2$ that would be required to mix 20.0L of a 0.0100M solution.

$$\left(\frac{164.1\text{ g}}{1\text{ mol}}\right)\left(\frac{0.0100\text{ mol}}{1\text{ L}}\right)(20.0\text{ L}) = \boxed{32.8\text{ g}}$$

9. A calcium chloride solution was prepared by dissolving 54.0g of calcium chloride in sufficient water to make a final solution volume of 2.00L. What is the molarity of the solution?

$$(54.0\text{ g})\left(\frac{1\text{ mol}}{111\text{ g}}\right)\left(\frac{1}{2.00\text{ L}}\right) = \boxed{0.243\text{ M}}$$

10. If 26.0g of NaCl are dissolved to make 250.0mL of solution, what is the resulting molarity?

$$(26.0\text{ g})\left(\frac{1\text{ mol}}{58.5\text{ g}}\right)\left(\frac{1}{0.250\text{ L}}\right) = \boxed{1.78\text{ M}}$$

11. A 2.00g sample of NaOH was dissolved in water to produce a volume of exactly 200.0mL. What is the molarity of the solution?

$$(2.00\text{ g})\left(\frac{1\text{ mol}}{40.0\text{ g}}\right)\left(\frac{1}{0.200\text{ L}}\right) = \boxed{0.250\text{ M}}$$

12. How many millilitres of 0.500M Li_2CO_3 solution are required to supply 0.0100mol Li_2CO_3?

$$(0.0100\text{ mol})\left(\frac{1\text{ L}}{0.500\text{ mol}}\right) = 0.0200\text{ L} = \boxed{20.0\text{ mL}}$$

13. What volume of a 1.80M solution of H_2CO_3 contains 5.00g of H_2CO_3?

$$(5.00\text{ g})\left(\frac{1\text{ mol}}{62.0\text{ g}}\right)\left(\frac{1\text{ L}}{1.80\text{ mol}}\right) = 0.0448\text{ L} = \boxed{44.8\text{ mL}}$$

14. How many millilitres of 0.250M K_2CO_3 solution are required to supply 0.100mol K_2CO_3?

$$(0.100\text{ mol})\left(\frac{1\text{ L}}{0.250\text{ mol}}\right) = 0.400\text{ L} = \boxed{400\text{ mL}}$$

15. What volume of a 1.20M solution of $AgNO_3$ contains 55.0G of $AgNO_3$?

$$(55.0\text{ g})\left(\frac{1\text{ mol}}{169.9\text{ g}}\right)\left(\frac{1\text{ L}}{1.20\text{ mol}}\right) = 0.270\text{ L} = \boxed{270\text{ mL}}$$