CHEMISTRY
The Complete Course

Lesson Nineteen

Additional Molarity Problems

KA8519

Worksheet

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9. 1.1 g

10. $FeS + 2HI \rightarrow H_2S + FeI_2$ (6.4 L)(1 mol/22.4 L)(2 mol HI/1 mol H_2S)(1 L/10.0 mol) = 0.057 L or 57 ml.

ANSWERS

1. (0.05 L)(6.0 mol/1 L) = 0.30 mol HCl in a total of 100 ml of solution. [HCl] = 0.3 mol/0.1 L = 3.0 M.

2. (0.5 L)(1 M) = 0.5 mole NaOH needed. (0.5 mol)(1 L/3.25 mol) = 0.154 L or 154 ml.

3. Measure out 154 ml of 3.25 M NaOH in a graduated cylinder and pour into a 500 mL volumetric flask. Add enough water to bring the volume of solution to the etched line on the flask, giving a total of 500 ml of solution.

4. How many moles are provided by each solution? (0.150 L)(1.5 M) = 0.225 mol and (0.3 L)(2.25 M) = 0.675 mol. The total is 0.9 mole in 450 ml of solution so, 0.9/0.450 = 2.0 M.

5. $2Cr + 6HCl \rightarrow 2CrCl_3 + 3H_2$ This is a g → mol → mol → vol stoichiometry problem: (67 g)(1 mol/158 g)(6 mol HCl/2 mol $CrCl_3$)(1 L/2.5 mol) = 0.51 L or 510 ml.

6. 0.015 mol of HCl and 0.038 mol of Cr are combined. Which is limiting? 0.015/6 = 0.0025 and 0.038/2 = 0.0128 so HCl is limiting. (0.015 mol HCl)(2 mol $CrCl_3$/6 mol HCl)(158 g/mol) = 0.79 g $CrCl_3$ formed.

7. a) 1.25 M b) 1.68 M c) 1×10^{-6} M

8. 2.8 M

I. VIDEOTAPE FOLLOW-UP QUESTIONS

I. In this lecture we take what we learned about molarity in the last lecture and apply this knowledge to a few additional types of problems.
   A. This is a very challenging task, since no sample problems of the type presented have been "modeled" or solved in previous lectures.
   B. Solving any of these problems correctly can be taken as an indication of mastery of both the specific concepts previously covered as well as the general approach to thinking about problems offered throughout this series of lectures.
   C. It is assumed that most students will not be highly successful at the tasks presented in this particular lecture, since they are of unusual difficulty.
   D. If difficulty is encountered in solving the problems presented, that is to be expected.
   E. Whether any or all of the problems are solved correctly or not, each solution should be watched carefully.
   F. Some of the problems solved are some times given specific names, such as "dilution" problems.
      1. In some cases special "formulas" are presented for solving the specific problems.
      2. Since there actually is nothing different about these problems, no special formulas or approaches are required.

II. The remainder of the tape consists of several problems being presented and solved.

II. SUPPLEMENTARY EXERCISES

1. What is the concentration of a solution prepared by diluting 50 ml of 6.0 M HCl with 50 ml of water?

2. What volume of 3.25 M NaOH is needed to prepare 500 ml of a 1.0 M solution?

3. Describe the preparation of the solution in question 2.

4. What is the concentration of the NaOH solution prepared by adding 150 mL of 1.50 M NaOH to 300 ml of 2.25 M NaOH?

5. How many mL of 2.5 M HCl are needed to produce 67 g of $CrCl_3$? $Cr + HCl \rightarrow CrCl_3 + H_2$ (not balanced)

6. If 10 ml of 1.5 M HCl is combined with 2.0 g of Cr, how much $CrCl_3$ is produced? (use the reaction above)

7. What is the concentration of the sulfate ion, SO_4^{2-}, in the following aqueous solutions:
   a) 1.25 M Li_2SO_4 b) 0.56 M $Cr_2(SO_4)_3$
   c) 1×10^{-6} M $CaSO_4$

8. What is the concentration of the potassium ion in 1.4 M K_2CO_3?

9. What is the mass of the K+ in 1 L of a 1.4 M solution of K_2CO_3?

10. What volume of 10.0 M HI is needed to produce 6.4 L of H_2S gas at STP? $FeS + HI \rightarrow H_2S + FeI_2$ (not balanced)