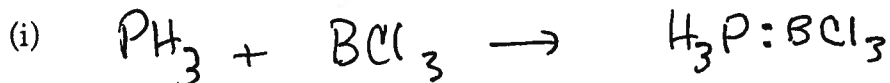


AP Chemistry
Reaction Practice
Day 7

Name Key 2011
Date _____ Period _____

For each of the following three reactions, in part (i) write a BALANCED equation and in part (ii) answer the question about the reaction. In part (i), coefficients should be in terms of lowest whole numbers. Assume that solutions are aqueous unless otherwise indicated. Represent substances in solutions as ions if the substances are extensively ionized. Omit formulas for any ions or molecules that are unchanged by the reaction.

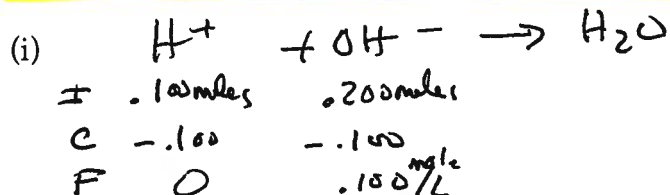
1. Phosphine (phosphorus trihydride) gas is bubbled into liquid boron trichloride.



(ii) Name the Lewis Acid in this reaction. Explain how to identify this reactant as a Lewis acid?

BCl_3 is the Lewis Acid because it accepts e^- from PH_3 which is the Lewis Base

2. 500.0 mL of 0.20 M barium hydroxide is reacted with 500.0 mL of 0.20 M nitric acid



(ii) What would be the pH of the resulting solution? Explain your answer.

$\text{pOH} = -\log(.100\text{M}) = 1$ so the $\text{pH} = 13$

3. Equal volumes of equimolar solutions of phosphoric acid and sodium hydroxide are mixed.



(ii) Will the resulting solution be acidic, basic or neutral? Explain your answer.

The resulting solution will be basic. You began w/ a strong base & a weak acid.

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2008 SCORING GUIDELINES (Form B)

Question 1

Answer the following questions regarding the decomposition of arsenic pentafluoride, $\text{AsF}_5(g)$.

(a) A 55.8 g sample of $\text{AsF}_5(g)$ is introduced into an evacuated 10.5 L container at 105°C .

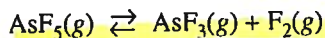
(i) What is the initial molar concentration of $\text{AsF}_5(g)$ in the container?

$\text{mol AsF}_5 = 55.8 \text{ g AsF}_5 \times \frac{1 \text{ mol AsF}_5}{169.9 \text{ g AsF}_5} = 0.328 \text{ mol}$ $[\text{AsF}_5]_i = \frac{0.328 \text{ mol AsF}_5}{10.5 \text{ L}} = 0.0313 \text{ M}$	<p>One point is earned for the correct molar mass.</p> <p>One point is earned for the correct concentration.</p>
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(ii) What is the initial pressure, in atmospheres, of the $\text{AsF}_5(g)$ in the container?

$PV = nRT$ $P = \frac{0.328 \text{ mol} \times 0.0821 \text{ L atm mol}^{-1} \text{ K}^{-1} \times 378 \text{ K}}{10.5 \text{ L}} = 0.969 \text{ atm}$	<p>One point is earned for the correct substitution.</p> <p>One point is earned for the correct pressure.</p>
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At 105°C , $\text{AsF}_5(g)$ decomposes into $\text{AsF}_3(g)$ and $\text{F}_2(g)$ according to the following chemical equation.



(b) In terms of molar concentrations, write the equilibrium-constant expression for the decomposition of $\text{AsF}_5(g)$.

$K = \frac{[\text{AsF}_3][\text{F}_2]}{[\text{AsF}_5]}$	<p>One point is earned for the correct equation.</p>
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(c) When equilibrium is established, 27.7 percent of the original number of moles of $\text{AsF}_5(g)$ has decomposed.

(i) Calculate the molar concentration of $\text{AsF}_5(g)$ at equilibrium.

$100.0\% - 27.7\% = 72.3\%$ $[\text{AsF}_5] = 0.723 \times 0.0313 \text{ M} = 0.0226 \text{ M}$	<p>One point is earned for the correct concentration.</p>
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Question 1 (continued)

(ii) Using molar concentrations, calculate the value of the equilibrium constant, K_{eq} , at 105°C.

$[\text{AsF}_3] = [\text{F}_2] = 0.277 \times [\text{AsF}_5]_i$ $= 0.277 \times 0.0313 \text{ M} = 0.00867 \text{ M}$ $K_{eq} = \frac{[\text{AsF}_3][\text{F}_2]}{[\text{AsF}_5]} = \frac{[0.00867][0.00867]}{[0.0226]} = 0.00333$	<p>One point is earned for setting $[\text{AsF}_3] = [\text{F}_2]$.</p> <p><u>Note:</u> the point is not earned if the student indicates that $[\text{AsF}_3] = [\text{F}_2] = [\text{AsF}_5]$.</p> <p>One point is earned for the correct calculation of $[\text{AsF}_3]$ and $[\text{F}_2]$.</p> <p>One point is earned for the correct calculation of K_{eq}.</p>
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(d) Calculate the mole fraction of $\text{F}_2(\text{g})$ in the container at equilibrium.

$\text{mol AsF}_5 = 0.0226 \text{ M} \times 10.5 \text{ L} = 0.237 \text{ mol}$ $\text{mol F}_2 = \text{mol AsF}_3 = 0.00867 \text{ M} \times 10.5 \text{ L} = 0.0910 \text{ mol}$ $\text{mol fraction F}_2 = \frac{\text{mol F}_2}{\text{mol F}_2 + \text{mol AsF}_3 + \text{mol AsF}_5}$ $= \frac{0.0910}{0.0910 + 0.0910 + 0.237} = 0.217$ <p>OR</p> $\text{mol fraction F}_2 = \frac{0.00864}{0.00864 + 0.00864 + 0.0226} = 0.217$	<p>One point is earned for the correct calculation of the mole fraction of $\text{F}_2(\text{g})$.</p>
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