**Quiz 11A**

# Directions: Answer each of the following questions. Be sure to use complete sentences where appropriate. For full credit be sure to show all of your work. Where appropriate answers should be boxed for clarity, written to the correct number of significant figures, and, include the proper units.

1. An aqueous solution of iron(III) bromide reacts with an aqueous solution of potassium hydroxide (20 points).
	1. Write the balanced conventional, total ionic, and net ionic equation.

FeBr3 (aq) + 3 KOH (aq) → 3 KBr (aq) + Fe(OH)3 (s)

Fe3+ (aq) + 3 Br- (aq) + 3 K+ (aq) + 3 OH- (aq) → 3 K+ (aq) + 3 Br- (aq) + Fe(OH)3 (s)

Fe3+ (aq) + 3 OH- (aq) → Fe(OH)3 (s)

* 1. How many grams of precipitate are produced when 27.9 mL of 2.12 M iron(III) bromide react with 15.00 mL of 2.50 M potassium hydroxide?

First calculate the moles of each ion that undergoes reaction:

$$27.9 mL FeBr\_{3} soln×\frac{2.12 mmol FeBr\_{3} }{1 mL FeBr\_{3} soln}=59.148 mmol FeBr\_{3}×\frac{1 mmol Fe^{3+}}{1 mmol FeBr\_{3}}=59.148 mmol Fe^{3+}$$

$$15.00 mL KOH soln×\frac{2.50 mmol KOH}{1 mL KOH soln}=37.5 mmol KOH×\frac{1 mmol OH^{-}}{1 mmol KOH}=37.5 mmol OH^{-}$$

Second, using the net ionic equation, complete the ICE table, and determine the limiting reagent by comparing ratios.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Fe3+ (aq) +  | 3 OH- (aq) → | Fe(OH)3 (s) |
| I | **59.1**48 mmol  | **37.5** mmol | 0 mol  |
| C | -x | -3x | +x |
| E | **59.1**48 mmol –x = **59.1**48 mmol – **12.5** mmol = **46.6**48 mmol  | 37.5 mmol -6x =37.5 mmol – 3(**12.5** mmol) =0 mmol  | x = 12.5 mmol =  |

To determine the limiting reagent compare ratios

$theoretical ratio: \frac{3 mol OH^{-}}{1 mol Fe^{3+}}$ > $actual ratio: \frac{37.5 mmol OH^{-}}{59.148 mmol Fe^{3+}}= \frac{0.63400284 mol OH^{-}}{1 mol Fe^{3+}}$

Therefore, the limiting reagent is hydroxide, OH-. So, now x can be found:

$$37.5 mmol OH^{-}-3x=0 mol $$

$$37.5 mmol OH^{-}=3x $$

$$12.5 mmol OH^{-}=x$$

Lastly, calculate the grams of iron(III) hydoxide produced:

$$12.5 mmol Fe(OH)\_{3}×\frac{1 mol }{1000 mmol}×\frac{106.866 g Fe(OH)\_{3} }{1 mol Fe(OH)\_{3}}=1.335825 g Fe(OH)\_{3}=1.34 g Fe(OH)\_{3}$$

* 1. What is the molarity of the ions that are left?

First calculate the millimoles of each ion remaining

$$27.9 mL FeBr\_{3} soln×\frac{2.12 mmol FeBr\_{3} }{1 mL FeBr\_{3} soln}=59.148 mmol FeBr\_{3}×\frac{3 mmol Br^{-}}{1 mmol FeBr\_{3}}=177.444 mmol Br^{-}$$

$$15.00 mL KOH soln×\frac{2.50 mmol KOH}{1 mL KOH soln}=37.5 mmol KOH×\frac{1 mmol K^{+}}{1 mmol KOH}=37.5 mmol K^{+}$$

The total volume of the resulting solution is VT = 27.9 mL + 15.00 mL = 42.9 mL

Then calculate the molarity of the ions remaining in the solution

$$M\_{Br^{-}}=\frac{177.444 mmol Br^{-}}{42.9 mL}=4.136223776 M Br^{-}≈4.14 M Br^{-} $$

$$M\_{K^{+}}=\frac{37.5 mmol K^{+}}{42.9 mL}=0.874125874 M K^{+}≈0.874 M K^{+} $$

$$M\_{Fe^{3+}}=\frac{46.648 mmol Fe^{3+}}{42.9 mL}=1.087365967 M Fe^{3+}≈1.09 M Fe^{3+}$$