**Quiz 6**

# 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. Name two cations that today’s lab is investigating (2 points). \_\_\_

Answers will vary and depend on the qualitative experiment being performed.

1. The Ksp for magnesium hydroxide is 2.06 × 10-13 at 25 °C. Suppose the 75.0 mL of a sodium hydroxide solution with a pOH of 2.58 is mixed with 125.0 mL of a 0.018 M magnesium chloride (18 points).
	1. What is the diluted concentration of hydroxide ions?

$$\left[OH^{-}\right]=10^{-pOH}=10^{-2.58}=2.630267992×10^{-3} M $$

$$[OH^{-}]\_{o}=\frac{\left(75.0 mL\right)\left(2.630267992×10^{-3} M \right)}{\left(75.0 mL+125.0 mL\right)}=9.86350497×10^{-4} M≈9.9×10^{-4} M$$

* 1. What is the diluted concentration of magnesium ions?

$[Mg^{2+}]\_{o}=\frac{\left(125.0 mL\right)\left(0.018 M \right)}{\left(75.0 mL+125.0 mL\right)}=0.01125 M≈0.011 M$

* 1. Will a precipitate form? If so, calculate the equilibrium concentrations of magnesium and hydroxide ions.

$$Q\_{sp}=\left[Mg^{2+}\right]\left[OH^{-}\right]^{2}=(0.01125 M)(9.86350497×10^{-4} M)^{2}=1.094498216×10^{-8}$$

Ksp < Qsp, therefore a precipitate will form.

First Stoichiometry:

|  |  |  |  |
| --- | --- | --- | --- |
|  | Mg2+ (aq) + | OH- (aq) → | Mg(OH)2 (s) |
| I | 0.011 M | 0.00099 M | 0 M |
| C | -x | -2x | +x |
| E | 0.011 M – x =0.011 M – 0.00049 M =0.01051 M ≈ 0.011 M | 0.00099 M – 2x =0 M | x = 0.00049 M |

 The limiting reagent is OH-, therefore

$$0.00099 M-2x=0$$

$$x=0.00049 M$$

Second Equilibrium:

|  |  |  |  |
| --- | --- | --- | --- |
|  | Mg(OH)2 (s)  $\genfrac{}{}{0pt}{}{H\_{2}O}{⇌}$ | Mg2+ (aq) +  | 2 OH- (aq) |
| I |  | 0.011 M | 0 M |
| C |  | +x | +2x |
| E |  | 0.011 M + x =0.011 M + 2.2 × 10-6 M ≈0.011 M | 2x =2(2.2 × 10-6 M) =4.4 × 10-6 M |

$$K\_{sp}=2.06×10^{-13}=\left[Mg^{2+}\right]\left[OH^{-}\right]$$

$$K\_{sp}=2.06×10^{-13}=(0.011 M+x)(2x)^{2}$$

$$2.06×10^{-13}=(0.011 M)(2x)^{2}$$

$$x=2.2×10^{-6} M $$

Check x is small approximation: $\frac{2.2×10^{-6} M}{0.011 M }×100=0.02\%<5\%$

Check Ksp value: $K\_{sp}=2.06×10^{-13}=(0.011 M)(4.4×10^{-6} M)^{2}$

$ K\_{sp}=2.06×10^{-13}=2.1×10^{-13}$ , close enough when round off error is considered.