**Quiz 4**

# 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. What are the reagents for today’s experiment (3 points)? \_\_\_\_depends on experiment
2. A common laboratory method for preparing a precipitate is to mix solutions containing the component ions Does a precipitate form when 0.100 L of 0.30 M Ca(NO3)2 is mixed with 0.200 L of 0.060 M NaF? The Ksp of the precipitate is 3.2 × 10-11. Show work to justify your answer (6 points).

CaF2 (s) $⇌$ Ca2+ (aq) + 2 F­- (aq) Ksp = [Ca2+][F-]2

$$Q\_{sp}=\left[Ca^{2+}\right]\left[F^{-}\right]^{2}$$

$$Q\_{sp}=\left(\frac{0.30 M×0.100 L}{0.100 L+0.200 L}\right)\left(\frac{0.060 M×0.200 L}{0.100 L+0.200 L}\right)^{2}$$

$$Q\_{sp}=(0.10 M)(0.040 M)^{2}=1.6 ×10^{-4}$$

Qsp > Ksp, therefore a precipitate will form.

1. Consider the titration of 25.00 mL of 0.100 M formic acid, HCOOH, Ka = 1.8 x 10-4, with 0.150 M sodium hydroxide (15 points).
	1. What are the major species before titration in each solution? \_\_HCOOH, Na+, OH-
	2. What are the major species at the half-equivalence point? \_HCOOH, HCOO-, Na+
	3. What are the major species at the equivalence point? \_\_HCOO-, Na+
	4. What are the major species at the three halves-equivalence point? \_\_HCOO-, Na+, OH-
	5. If it takes 16.7 mL of sodium hydroxide to reach the equivalence point, what is the pH? Hint use an ICE table.

At equilibrium all of the acid has been converted into conjugate base. Calculate the diluted concentration of the formate ion to use in your ICE table:

$25.00 mL×\frac{0.100 mmol HCOOH}{1 mL}×\frac{1 mmol HCOO^{-}}{1 mmol HCOOH }×\frac{1}{(25.00 mL+16.7 mL)}=0.0600 M HCOO^{-}$

HCOO- (aq) + H2O (l) → HCOOH (aq) + OH- (aq)

I 0.0600 M n/a 0 M ~0 M

C -x n/a +x +x

E 0.0600 M – x n/a x x

 0.0600 M – 1.8 x 10-6 M 1.8 x 10-6 M 1.8 x 10-6 M

$$K\_{b}=\frac{K\_{w}}{K\_{a}}=\frac{\left[HCOOH\right]\left[OH^{-}\right]}{\left[HCOO^{-}\right]}$$

$$K\_{b}=\frac{10^{-14} M^{2}}{1.8×10^{-4} M}=\frac{\left(x\right)(x)}{0.0600 M-x}$$

$$x=1.8×10^{-6}$$

pOH = - log[OH-] = - log(1.8 x 10-6) = 5.74 so, pH = 14 – pOH = 14 - 5.74 = 8.26