Chemistry
Mr. MacGillivray
Solution Stoichiometry Worksheet

1. PROBLEM: What volume of 0.250 M phosphoric acid (H_3PO_4) is required to neutralize 35.2 ml of 0.338 M calcium hydroxide, $Ca(OH)_2$?

___$Ca(OH)_2$ (aq) + ___H_3PO_4 (aq) → ___$Ca_3(PO_4)_2$ (s) + ___HOH (l)

$Ca(OH)_2$		H_3PO_4
	V	
	M	
	n	

a. Balance the equation above.

b. Fill in the blanks to set up your knowns and unknowns.

c. Find the number of moles of calcium hydroxide. Use M=n/V. Show calculations. Units have to cancel, so use liters! Fill in the answer in the "mol" ("n") box under $Ca(OH)_2$.

d. Convert from mol of calcium hydroxide to moles of phosphoric acid. Show your calculations. Fill in the answer above in the "mol" box under phosphoric acid.

e. Use M=n/V to find the number of liters of H_3PO_4. Convert to ml and fill in the answer ☺!

2. Repeat the above procedure for the following problem: How many ml of a 0.312 M solution of $Pb(NO_3)_2$ are needed to react completely with 75.0 ml of 0.500 M NaI?

___$Pb(NO_3)_2$ + ___ NaI → ___ PbI_2 + ___ $NaNO_3$

ANSWERS

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1. PROBLEM: What volume of 0.250 M phosphoric acid (H_3PO_4) is required to neutralize 35.2 ml of 0.338 M calcium hydroxide, $Ca(OH)_2$?

$3\ Ca(OH)_2\ (aq) + 2\ H_3PO_4\ (aq) \rightarrow Ca_3(PO_4)_2\ (s) + 6\ HOH\ (l)$

35.2 ml	**V**	**31.7 ml**
0.338 M	**M**	**0.250 M**
0.0119 moles	**n**	**0.00793 moles**

a. Balance the equation above.

b. Fill in the blanks to set up your knowns and unknowns.

c. Find the number of moles of calcium hydroxide. Use M=n/V. Show calculations. Units have to cancel, so use liters! Fill in the answer in the "mol" ("n") box under $Ca(OH)_2$.

$$M = \frac{n}{V} \qquad n = (0.338\ \frac{\text{moles}}{\text{L}})(0.0352\ \text{L}) = 0.0118976\ \text{moles}\ Ca(OH)_2$$

d. Convert from mol of calcium hydroxide to moles of phosphoric acid. Show your calculations. Fill in the answer above in the "mol" box under phosphoric acid.

$$0.0119\ \text{moles}\ Ca(OH)_2\ \ \mathbf{X}\ \ \frac{2\ \text{moles}\ H_3PO_4}{3\ \text{moles}\ Ca(OH)2} = 0.00793\ \text{moles}\ H_3PO_4$$

e. Use M=n/V to find the number of liters of H_3PO_4. Convert to ml and fill in the answer ☺!

$$M = \frac{n}{V} \qquad V = \frac{n}{M} \qquad V = \frac{0.00793\ \text{mol}}{0.250\ \frac{\text{mol}}{\text{L}}} \qquad V = 0.0317\ \text{liters} \qquad \boxed{V = 31.7\ \text{ml}}$$

ANSWERS

2. Repeat the above procedure for the following problem: How many ml of a 0.312 M solution of $Pb(NO_3)_2$ are needed to react completely with 75.0 ml of 0.500 M NaI?

$$Pb(NO_3)_2 + 2\,NaI \rightarrow PbI_2 + 2\,NaNO_3$$

$Pb(NO_3)_2$		NaI
60.1 ml	V	75.0 ml
0.312 M	M	0.500 M
0.0188 moles	n	0.0375 moles

$$M = \frac{n}{V} \qquad n = (0.500\ \frac{\text{moles}}{\text{L}})(0.0750\ \text{L}) = 0.0375 \text{ moles NaI}$$

$$0.0375 \text{ mol NaI} \times \frac{1 \text{ mol } Pb(NO_3)_2}{2 \text{ mol NaI}} = 0.01875 \text{ mol } Pb(NO_3)_2$$

$$M = \frac{n}{V} \qquad V = \frac{n}{M} \qquad V = \frac{0.01875 \text{ mol}}{0.312\ \frac{\text{mol}}{\text{L}}}$$

$V = 0.0601$ liters $\boxed{V = 60.1 \text{ ml}}$