

Neutralization Exam Review

The products of a neutralization reaction are a salt and

water

. Neutralization reactions are always

exothermic

, which means they release heat. The instrument

used for measurement in a titration is a buret/burette. Titrations are

used for calculating the unknown concentration of an acid or a base. A(n)

indicator

may be added to the titration to indicate the end point

of the reaction, or the point where there is a color change. The indicator

bromothymol blue

would turn green in a neutral solution, blue in a

base

and yellow in an acid.

Buffers resist shifts in the pH of a solution. The buffer systems

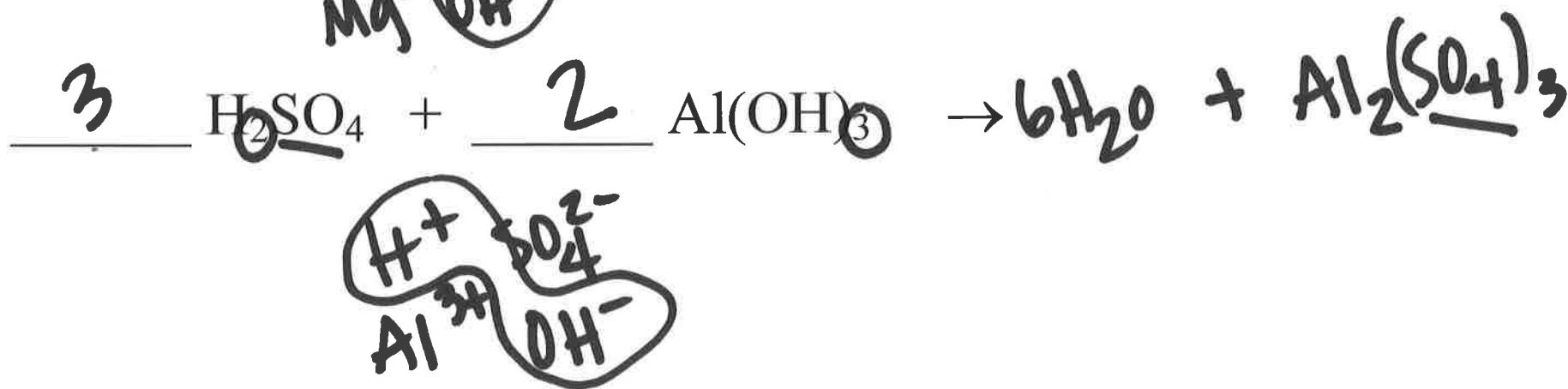
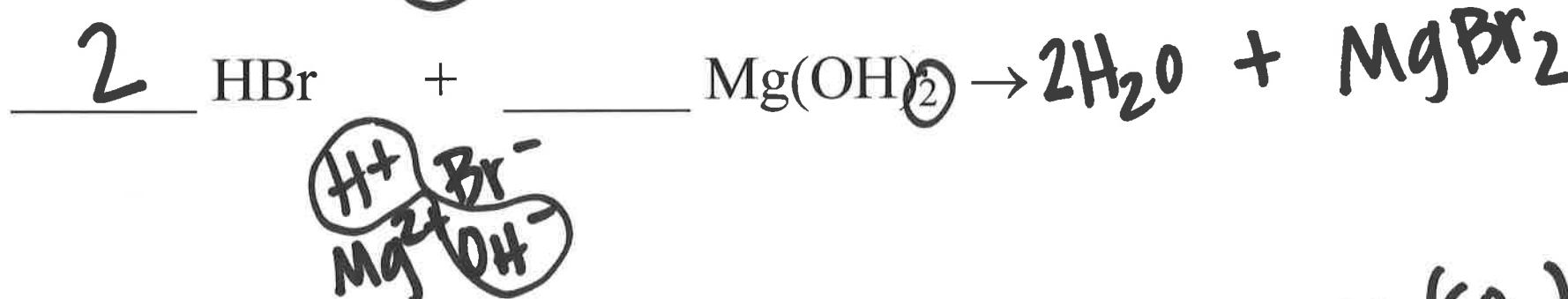
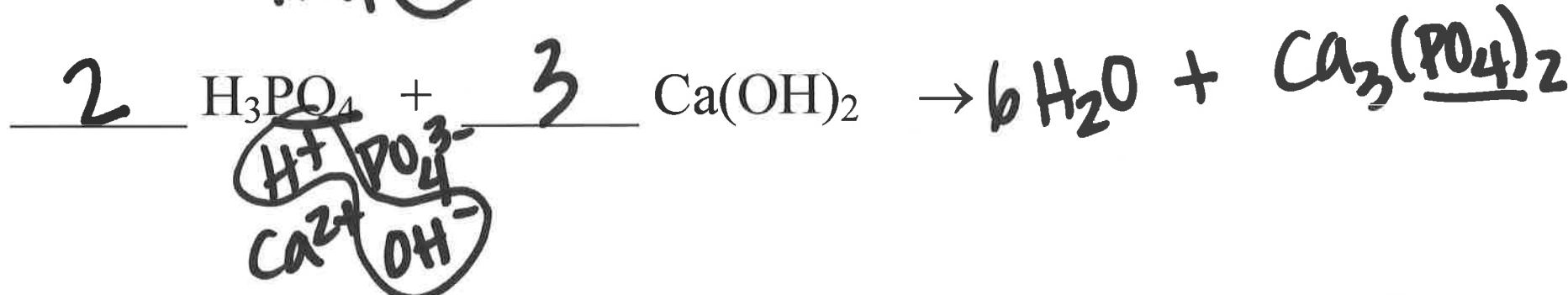
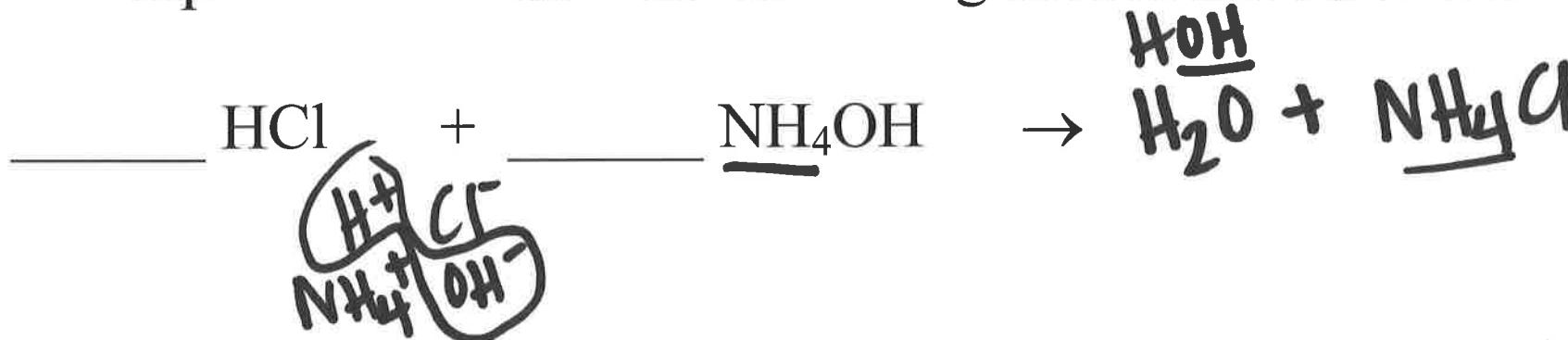
in the blood are $\text{NaHCO}_3/\text{H}_2\text{CO}_3$

and $\text{HPO}_4^{2-}/\text{HPO}_4^{2-}$

ionic compound

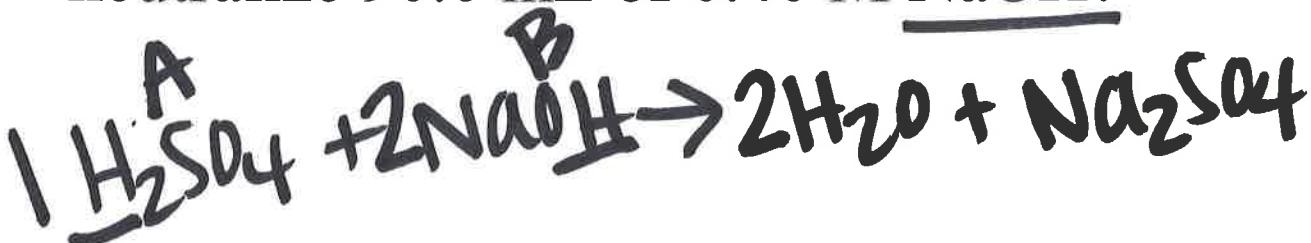
*the positive ion always goes in FRONT!

1. Complete and balance the following neutralization reactions:



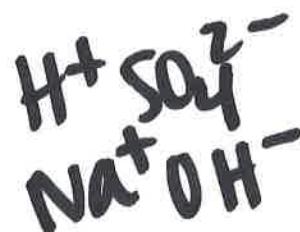
USING EQUATION

2. How many milliliters of 0.600 M H_2SO_4 are required to neutralize 90.0 mL of 0.40 M NaOH ?



$$\frac{M_A V_A}{mols_A} = \frac{M_B V_B}{mols_B}$$

$$\begin{aligned}
 M_A &= 0.600 \text{ M} & M_B &= 0.40 \text{ M} \\
 V_A &= x \text{ mL} & V_B &= 90.0 \text{ mL} \\
 mols_A &= 1 & mols_B &= 2
 \end{aligned}$$



use
coefficients
from
balanced
eqn.

$$\begin{aligned}
 \frac{(0.600 \text{ M})(x \text{ mL})}{1} &= \frac{(0.40 \text{ M})(90.0 \text{ mL})}{2} \\
 1.2x &= \frac{36}{1.2} \\
 x &= V_A = 30.0 \text{ mL H}_2\text{SO}_4
 \end{aligned}$$

USING EQUATION

3. Calculate the molarity of 16.0 mL of H₂SO₄ needed to neutralize 400.0 mL of 0.20 M Ba(OH)₂.



$$\frac{M_A V_A}{mol A} = \frac{M_B V_B}{mol B}$$



$$M_A: x M$$

$$V_A: 16.0 \text{ mL}$$

$$mol A: 1$$

$$M_B: 0.20 \text{ M}$$

$$V_B: 400.0 \text{ mL}$$

$$mol B: 1$$

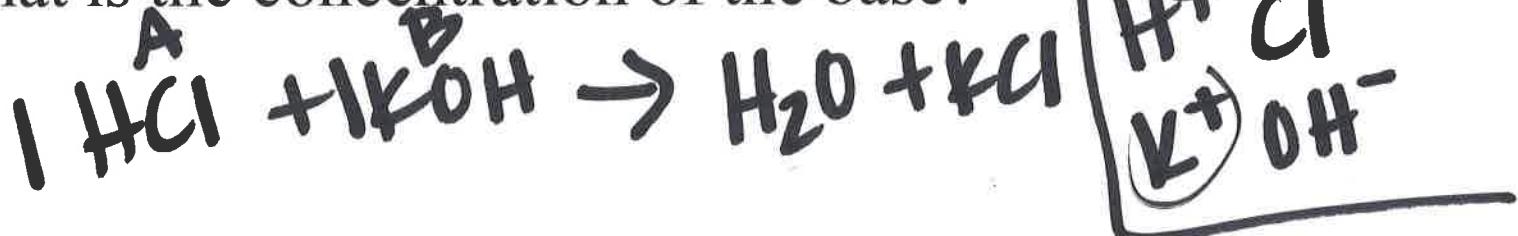
$$\frac{(x M)(16.0 \text{ mL})}{16} = \frac{(0.20 \text{ M})(400.0 \text{ mL})}{X}$$

$$16.0x = \frac{80}{16} = \frac{X}{MA = 5.0 \text{ M}}$$

H₂SO₄

WING EQUATION

4. If 30.0 mL of 0.250 M HCl are neutralized by titrating 35.0 mL of KOH, what is the concentration of the base?



$$M_A: 0.250 \text{ M}$$

$$V_A: 30.0 \text{ mL}$$

$$\text{mol A: } 1$$

$$M_B: x \text{ M}$$

$$V_B: 35.0 \text{ mL}$$

$$\text{mol B: } 1$$

$$\frac{(0.250 \text{ M})(30.0 \text{ mL})}{x} = \frac{(x \text{ M})(35.0 \text{ mL})}{x}$$

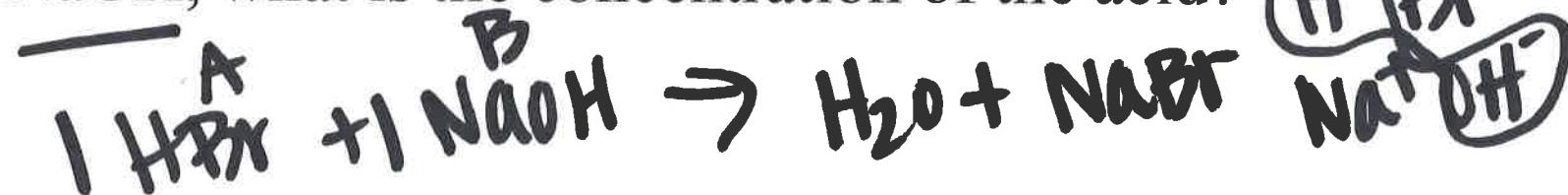
$$x$$

$$\frac{7.5}{35} = 35x$$

$$x = \frac{M_B}{M_A} = \frac{0.214 \text{ M}}{0.250 \text{ M}}$$

USING EQUATION

5. A 50.0 mL sample of HBr is titrated to an endpoint with 20.0 mL of 1.50 M NaOH, what is the concentration of the acid?



$$M_A : x \text{ M}$$

$$V_A : 50.0 \text{ mL}$$

$$\text{mol}_A : 1$$

$$M_B : 1.50 \text{ M}$$

$$V_B : 20.0 \text{ mL}$$

$$\text{mol}_B : 1$$

$$\frac{M_A V_A}{\text{mol}_A} = \frac{M_B V_B}{\text{mol}_B}$$

$$\frac{(x \text{ M})(50.0 \text{ mL})}{x} = \frac{(1.50 \text{ M})(20.0 \text{ mL})}{x}$$

$$50x = \frac{30}{50} \quad x = \boxed{\frac{M_A}{M_B}}$$

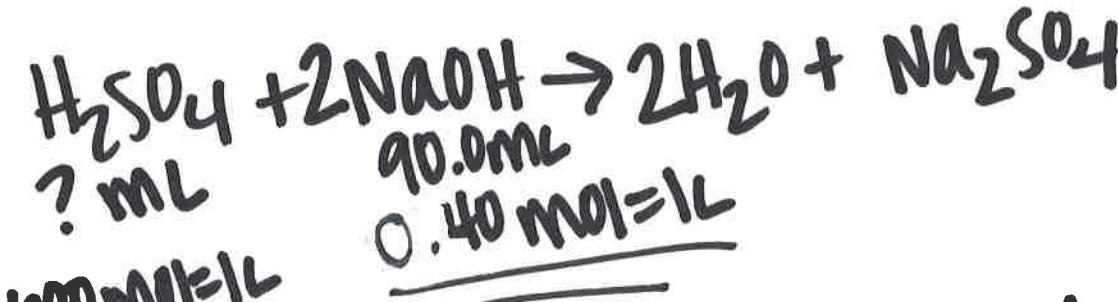
D. 0.600 M HBr

~ STOICHIOMETRY ~

2. How many milliliters of 0.600 M H_2SO_4 are required to neutralize 90.0 mL of 0.40 M NaOH?



$$x \text{ M} \Rightarrow x \text{ mol/L}$$

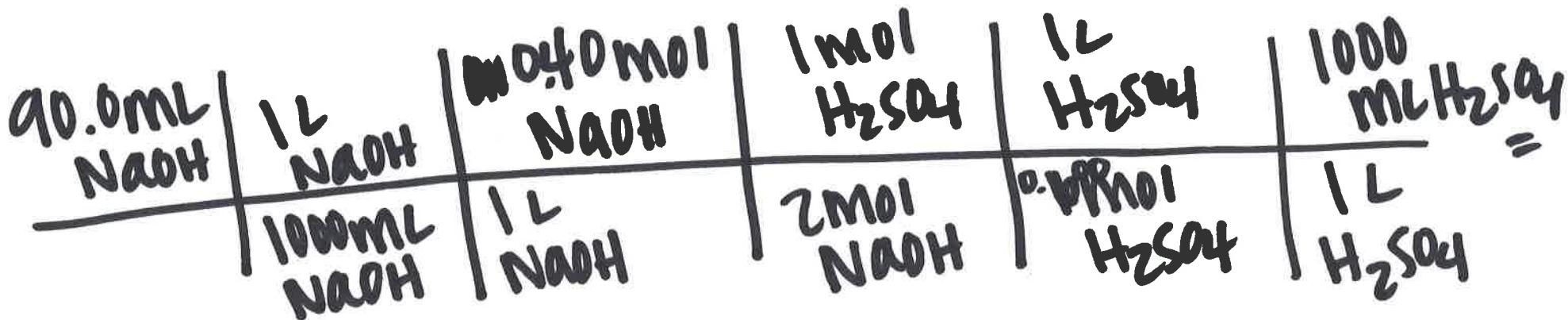


$$\cancel{0.600 \text{ M}} = \cancel{1 \text{ L}}$$

$$1 \text{ mol H}_2\text{SO}_4 = 2 \text{ mol NaOH}$$

$$g: 90.0 \text{ mL } \cancel{\text{NaOH}}$$

$$w: ? \text{ mL } \cancel{\text{H}_2\text{SO}_4}$$

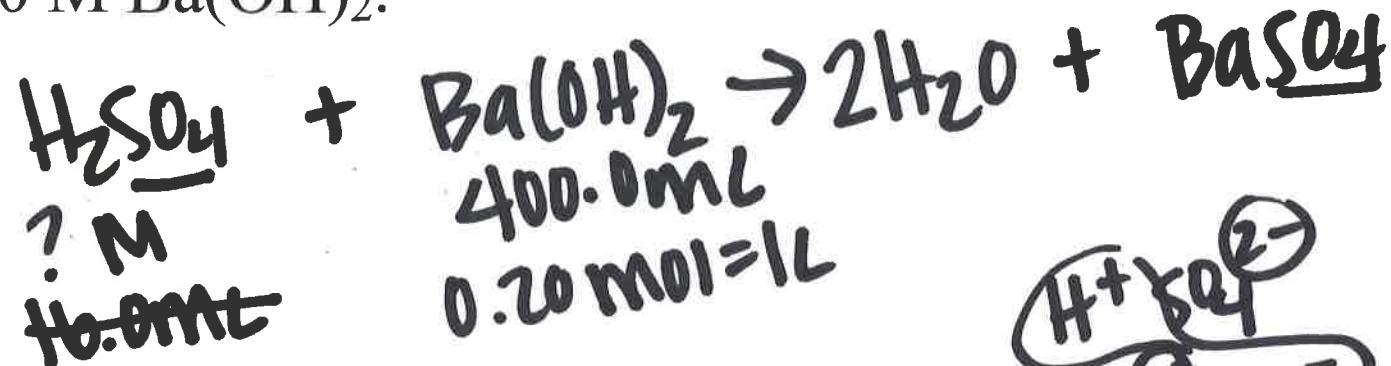


$$\frac{3600 \text{ mL}}{1200} = \boxed{30. \text{ mL}} \quad \boxed{\text{H}_2\text{SO}_4}$$

* Mistake on video... fixed on this key! *

5 TOUCH

3. Calculate the molarity of 16.0 mL of H_2SO_4 needed to neutralize 400.0 mL of 0.20 M $\text{Ba}(\text{OH})_2$.



g: 400.0mL Ba(OH)₂

w: ? mol H₂SO₄

$$1\text{ mol H}_2\text{S}\text{O}_4 = 1\text{ mol Ba(OH)}_2$$

400.0mL
 Ba(OH)_2

1 L
Baloh)₂

1000 ml
BalOH

0.20 mol
 Ba(OH)_2

12
 Ba(OH)_2

$$\text{1 mol H}_2\text{SO}_4 =$$

Imol
Balotti

$$\frac{80}{1000} = 0.08 \text{ mol}$$

Molarity Hz Say

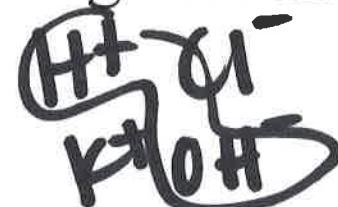
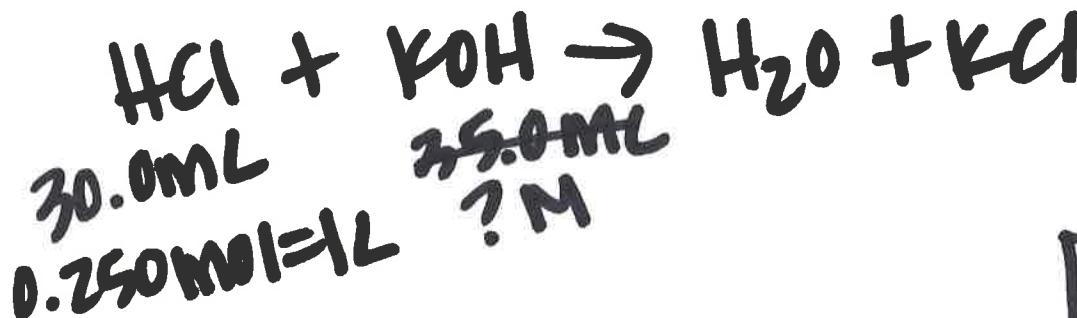
$$M = \frac{m_0 l}{L} = \frac{0.08 \text{ md}}{0.0160 \text{ L}}$$

$$M=5.0 \text{ M}_{\odot} H_2 S^{14}$$

$$\frac{16.0 \text{ mL}}{1000 \text{ mL}} = 0.0160$$

STOICH

4. If 30.0 mL of 0.250 M HCl are neutralized by titrating 35.0 mL of KOH, what is the concentration of the base?



$$1000\text{mL} = 1\text{L}$$

Molarity KOH

$$M = \frac{\text{mol}}{\text{L}}$$

$$= \frac{0.0075\text{ mol}}{0.0350\text{ L}}$$

$$M = 0.214\text{ M}$$

KOH

g: 30.0mL HCl

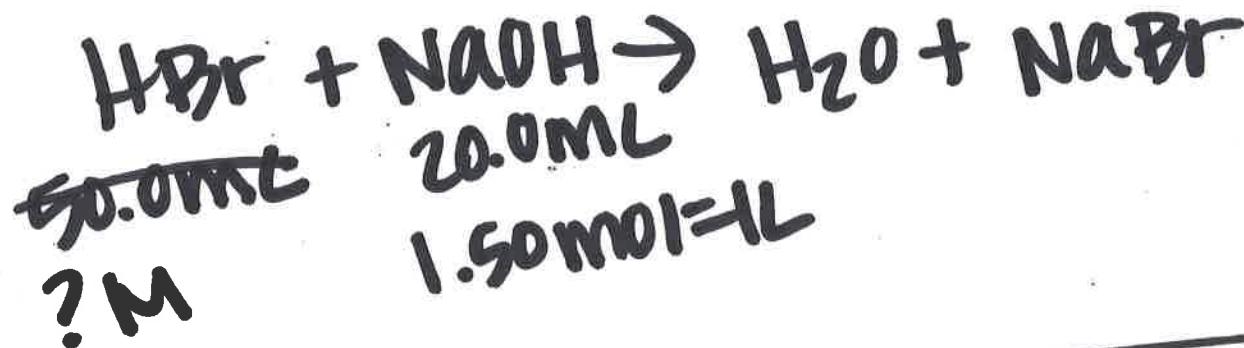
w: ? mol KOH

1 mol HCl = 1 mol KOH

30.0mL	$\frac{1\text{L}}{1000\text{mL}}$ HCl	$\frac{0.250}{1\text{L}}$ mol HCl	$\frac{1\text{mol}}{1\text{mol}}$ KOH = $\frac{7.5}{1000}$ $= 0.0075$ mol KOH
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STOICHIOMETRY

5. A 50.0 mL sample of HBr is titrated to an endpoint with 20.0 mL of 1.50 M NaOH, what is the concentration of the acid?



g: 20.0 mL NaOH

w: ? mol HBr

1 mol NaOH = 1 mol HBr

20.0mL NaOH	1L NaOH	1.50 mol NaOH	1 mol HBr = $\frac{30}{1000}$
1000mL NaOH	1L NaOH	1mol NaOH	0.03 mol HBr

Molarity HBr

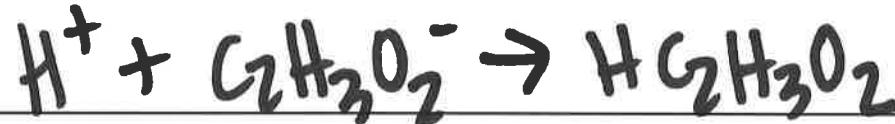
$$M = \frac{\text{mol}}{\text{L}}$$

$$= \frac{0.03 \text{ mol}}{0.0500 \text{ L}}$$

$$M = 0.600 \text{ M HBr}$$

6. Write reactions to show the effect of adding the indicated ion to the acetic acid/acetate ion buffer system. $\text{HC}_2\text{H}_3\text{O}_2 / \text{C}_2\text{H}_3\text{O}_2^-$

a. Addition of H^+ ^{Acid}



b. Addition of OH^- ^{Base}



H^+ : use part w/ less H

OH^- : use part w/ more H & make water too!



Good luck! ☺