

8



Teach

Name: _____

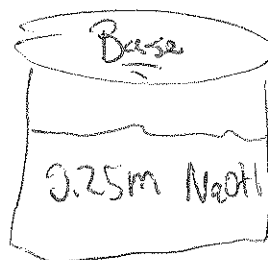
Date: _____

Balancing Acids/Bases and Concentration

How many moles of NaOH would you need to neutralize 750 ml of a 2M HCl solution? Then convert this quantity to grams. Then convert it to ml of a 0.25 M solution. (Think in terms of "buckets" that each contain an acid or a base that need to balance)



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



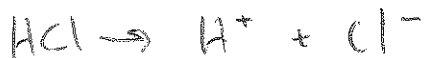
Volume = ?

50

$$\begin{aligned} \text{mol} &= M \times L \\ &= 2 \text{ M} \times 0.75 \text{ L} \\ &= 1.5 \text{ mol HCl} \end{aligned}$$

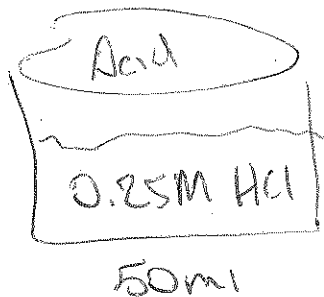
$$\begin{aligned} &1:1 \\ 1.5 \text{ mol HCl} &= \\ &1.5 \text{ mol } H^+ \end{aligned}$$

$$\begin{aligned} 1.5 \text{ mol } H^+ &\text{ needs } 1.5 \text{ mol } OH^- \\ 1.5 \text{ mol} \times 40 \text{ g/mol NaOH} &= 60 \text{ gr} \end{aligned}$$

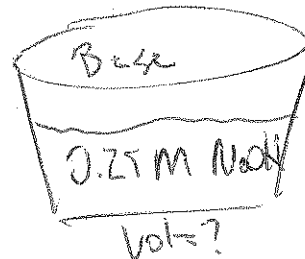


$$\frac{1.5 \text{ mol}}{0.25 \text{ M}} = 6 \text{ liters}$$

How many moles of NaOH would you need to neutralize 50 ml of a 0.25M HCl solution? Then convert this quantity to grams. Then convert it to ml of a 0.35 M solution.



$$\begin{aligned} M &= \frac{\text{mol}}{\text{L}} \\ \text{mol} &= M \times L \quad L = \frac{\text{mol}}{M} \end{aligned}$$



Vol = ?

0.0125 mol OH⁻ needed

$$0.25 \text{ M} \times 0.050 \text{ L} = 0.0125 \text{ mol}$$

$$\underline{\underline{0.0125 \text{ mol } H^+}}$$

$$\text{Vol} = \frac{0.0125 \text{ mol}}{0.35 \text{ M}}$$

$$= 0.0357 \text{ L}$$

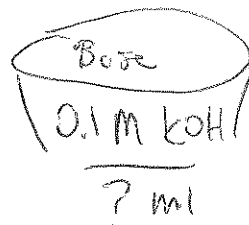
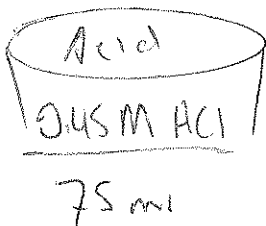
$$= 35.7 \text{ ml}$$

Name: _____

Date: _____

Balancing Acids/Bases and Concentration

How many grams of KOH would you need to neutralize 75 ml of a 0.45M HCl solution? How many milliliters of a 0.1M solution would you need to neutralize this acid?



$$\text{mole} = 0.0338$$

$$l' = \frac{\text{mol}}{\text{M}}$$

$$\text{mol H}^+ = 0.075 \text{ l} \times 0.45 \text{ mol/l}$$

$$= 0.0338 \text{ mol H}^+ \Rightarrow 0.0338 \text{ mol OH}^-$$

$$= 0.0338 \text{ mol KOH}$$

$$= 0.0338 \text{ mol} \times (39.1 + 1 + 16)$$

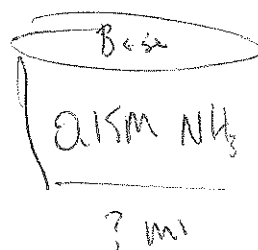
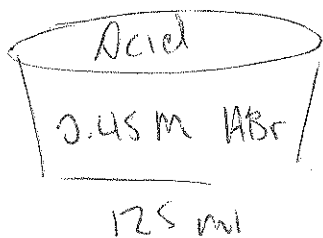
$$= \underline{1.90 \text{ g KOH}}$$

$$= \frac{0.0338 \text{ mol}}{0.1 \text{ M}}$$

$$= 0.338 \text{ l}$$

$$= \underline{338 \text{ ml}}$$

How many grams of NH₃ would you need to neutralize 125 ml of a 0.45M HBr solution? (remember that each NH₃ can take up one H⁺) How many milliliters of a 0.15M solution would you need to neutralize this acid?



$$\text{mole} = 0.0563 \text{ mol NH}_3$$

$$l' = \frac{\text{mol}}{\text{M}}$$

$$\text{mol H}^+ = 0.125 \text{ l} \times 0.45 \text{ M}$$

$$= 0.0563 \text{ mol H}^+ = 0.0563 \text{ mol NH}_3$$

$$\times \frac{17 \text{ g/mol NH}_3}{0.956 \text{ g}}$$

$$\underline{0.956 \text{ g}}$$

$$= \frac{0.0563 \text{ mol}}{0.15 \text{ M}}$$

$$= 0.375 \text{ l}$$

$$= \underline{375 \text{ ml}}$$

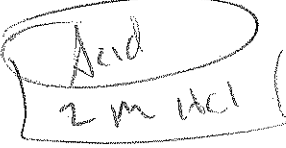
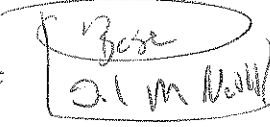
$$M = \frac{\text{mol}}{\text{L}}$$

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Neutralization of Acids with Bases

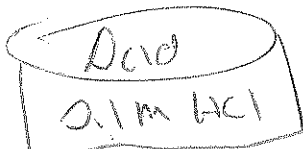
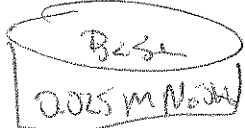
1. How many milliliters of 0.1 M NaOH would you need to neutralize 750ml of 2M HCl?


 = moles =
 

$\text{mol} = M \cdot V$
 $= 2 \text{ M} \times 0.75 \text{ L} = 1.5 \text{ mol}$

$V = \frac{\text{mol}}{M} = \frac{1.5 \text{ mol}}{0.1 \text{ M}} = 15 \text{ L}$
 $= \underline{\underline{15,000 \text{ ml}}}$

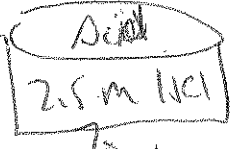
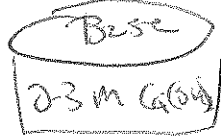
2. How many milliliters of 0.025 M NaOH would you need to neutralize 50ml of 0.1M HCl?


 = moles =
 

$\text{mol} = M \cdot V$
 $= 0.1 \times 0.05 \text{ L} = 0.005 \text{ mol}$

$V = \frac{\text{mol}}{M} = \frac{0.005 \text{ mol}}{0.025 \text{ M}} = 0.2 \text{ L}$
 $= \underline{\underline{200 \text{ ml}}}$

3. How many milliliters of 0.3 M $\text{Ca}(\text{OH})_2$ (careful there are 2 OH^- here), would you need to neutralize 70ml of 2.5M HCl?




 = moles =
 
 $\frac{1}{2}$ as much base

$\text{mol} = 0.07 \text{ L} \times 2.5 \text{ mol/L} = 0.175 \text{ moles}$

$V = \frac{\text{mol}}{M} = \frac{0.175 \text{ mol}}{0.3 \text{ M}} = 0.583 \text{ L}$
 $= \underline{\underline{292 \text{ ml}}}$

4. How many milliliters of 0.1 M NaOH would you need to neutralize 750ml of 2M H_3PO_4 (again, be careful because there are 3 H^+ for each mole of acid)?

3H^+ per acid


 = moles =
 

$\text{mol} = 0.75 \text{ L} \times 2 \text{ M} = 1.5 \text{ mol} = 4.5 \text{ mol H}^+$
 $\times 3 \text{ H}^+/\text{mol}$

$V = \frac{\text{mol}}{M} = \frac{4.5 \text{ mol}}{0.1 \text{ M}} = 45 \text{ L}$
 $= \underline{\underline{45,000 \text{ ml}}}$

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

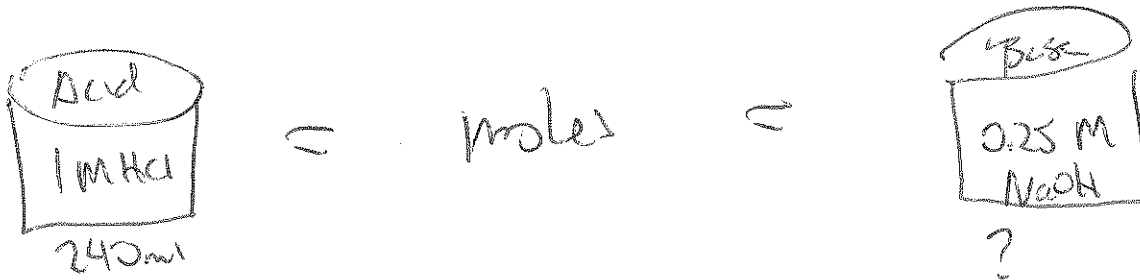
Name: _____

Date: _____

Balancing Acids/Bases and Concentration

THESE ARE AS TOUGH AS THEY GET, BE PROUD OF YOURSELF!!!!

How many milliliters of a 0.25 M solution of NaOH do you need to neutralize 240 milliliters of a 1.0 M HCl solution?



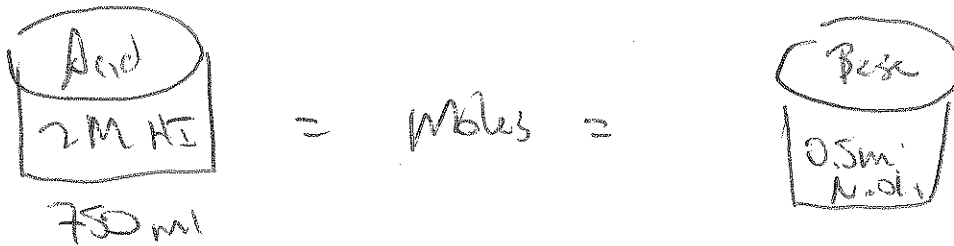
$$\text{moles} = M \times \text{L} = 1 \text{ M} \times 0.240 \text{ L} = 0.24 \text{ mol}$$

$$\frac{\text{mol}}{\text{L}} \times \text{L}$$

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

$$= \frac{0.24 \text{ mol}}{0.25 \text{ M}} = 0.96 \text{ L}$$

How many milliliters of a 0.5 M solution of NaOH do you need to neutralize 750 milliliters of a 2.0 M HI solution? 960 ml



$$\text{moles} = M \times \text{L}$$
$$2 \text{ M} \times 0.75 \text{ L}$$

$$= 1.5 \text{ mol}$$

$$\text{L} = \frac{1.5 \text{ mol}}{0.5 \text{ mol/L}}$$

$$3 \text{ L}$$

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

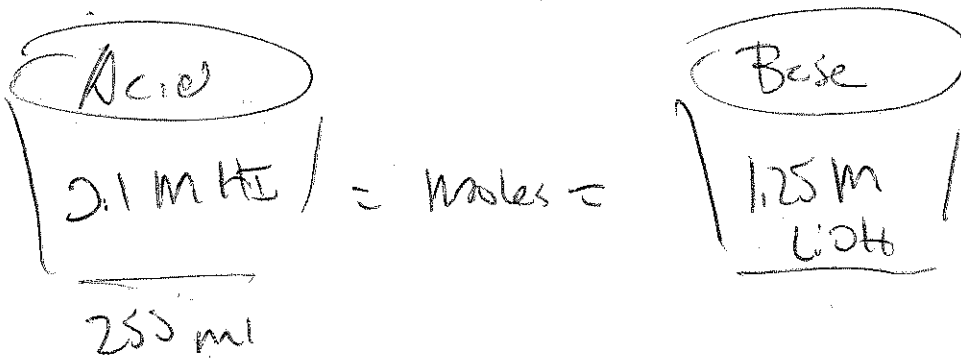
How many milliliters of a 1 M solution of NaOH do you need to neutralize 50 milliliters of a 0.75 M HI solution?



50 ml
 $\text{mol} = M \times \text{L}$
 $\text{mol} = 0.75 \text{ M} \times 0.05 \text{ L} = 0.0375 \text{ mol}$

$\text{L} = \frac{\text{mol}}{M}$
 $1 \text{ M} = 0.0375 \text{ L}$
 $= 37.5 \text{ ml}$

How many milliliters of a 1.25 M solution of LiOH do you need to neutralize 250 milliliters of a 0.1 M HI solution?



$\text{L} = 0.25 \text{ L}$

$\text{mol} = 0.25 \text{ L} \times 0.1 \frac{\text{mol}}{\text{L}} = 0.025 \text{ mol}$

$\text{L} = \frac{\text{mol}}{M}$
 $= \frac{0.025 \text{ mol}}{1.25 \frac{\text{mol}}{\text{L}}} = 0.02 \text{ L}$
 $= 20 \text{ ml}$

NAME: _____ DATE: _____

Concentration, Acid/Base, Neutralization
and pH review packet

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

1. How many moles of NaCl are in 725 ml of 0.8 M solution?

$$\text{mol} = M \times \text{L} = 0.8 \text{ M} \times 0.725 \text{ L} = 0.58 \text{ mol}$$

2. How many moles of $\text{Ca}(\text{OH})_2$ are in 125 ml of 2.5 M solution?

$$0.125 \text{ L} \times 2.5 \text{ M} = 0.313 \text{ mol}$$

3. How many moles of MgSO_4 are in 505 ml of 1.42 M solution?

$$0.505 \text{ L} \times 1.42 \text{ M} = 0.717 \text{ mol}$$

4. How many moles of NaHCO_3 are in 1.1 L of 0.7 M solution?

$$1.1 \text{ L} \times 0.7 \text{ M} = 0.77 \text{ mol}$$

5. What concentration would you get in moles per liter if you dissolved 30.6g of salt (NaCl) in 1.5 liters of water?

$$\frac{30.6 \text{ g}}{58.5 \text{ g/mol}} = 0.52 \text{ mol} / 1.5 \text{ L} = 0.35 \text{ M}$$

6. What concentration would you get in moles per liter if you dissolved 2.5g of HCl in 0.25 liters of water?

$$\frac{2.5 \text{ g}}{36.5 \text{ g/mol}} = 0.068 \text{ mol} / 0.25 \text{ L} = 0.27 \text{ M}$$

7. What concentration would you get in moles per liter if you dissolved 12.5g of sodium hydroxide (NaOH) in 0.25 liters of water?

$$\frac{12.5 \text{ g}}{40 \text{ g/mol}} = 0.3125 \text{ mol} / 0.25 \text{ L} = 1.25 \text{ M}$$

8. What concentration would you get in moles per liter if you dissolved 300g of KOH in 2.2 liters of water?

$$\frac{300 \text{ g}}{56.1 \text{ g/mol}} = 5.35 \text{ mol} / 2.2 \text{ L} = 2.43 \text{ M}$$

9. How many moles of dissolved H^+ are in 1.2 liters of 3.5M hydrochloric acid and water solution?

$$3.5 \text{ M} \times 1.2 \text{ L} = 4.2 \text{ mol } \text{H}^+$$

10. How many moles of dissolved H^+ are in 0.275 liters of 2.25M HNO_3 and water solution?

$$2.25 \text{ M} \times 0.275 \text{ L} = 0.62 \text{ mol } \text{H}^+$$

11. How many moles of dissolved OH^- are in 0.75 liters of 4M sodium hydroxide (NaOH) and water solution?

$$0.75 \text{ L} \times \frac{4 \text{ mol}}{\text{L}} = 3 \text{ moles}$$

12. How many moles of dissolved OH^- are in 1750 milliliters of 0.57M KOH and water solution?

$$1.750 \text{ L} \times \frac{0.57 \text{ mol}}{\text{L}} = 0.998 \text{ moles}$$

mole NaOH →

Mass NaOH →

13. How many grams of NaOH would neutralize 75 milliliters of 3.5M H₃COOH water if this chemical (acetic acid) only gives off one H⁺?

$$\begin{array}{l} \text{NaOH} \\ 0.075 \text{ L} \\ 3.5 \text{ M} \end{array}$$

$$0.075 \text{ L} \times 3.5 \frac{\text{mol}}{\text{L}} = 0.263 \text{ moles} \times 40 \frac{\text{g}}{\text{mol}} = 10.5 \text{ g}$$

14. How many grams of NaOH would neutralize 340 milliliters of 0.725M HNO₃ and water solution?

$$0.340 \text{ L} \times 0.725 \frac{\text{mol}}{\text{L}} = 0.247 \text{ mol} \times 40 \frac{\text{g}}{\text{mol}} = 9.86 \text{ g}$$

15. How many grams of H₂SO₄ (notice 2H⁺) would neutralize 800 milliliters of 2.25M KOH and water solution?

$$0.8 \text{ L} \times 2.25 \frac{\text{mol}}{\text{L}} = 1.8 \text{ moles base} \times \frac{1}{2} = 0.9 \text{ moles H}_2\text{SO}_4$$

$$0.9 \times 98 \frac{\text{g}}{\text{mol}} = 88.2 \text{ g}$$

16. How many grams of HCl would neutralize 0.725 liters of 3M sodium hydroxide (NaOH) and water solution?

$$0.725 \text{ L} \times 3 \text{ M} = 2.175 \text{ mol NaOH}$$

$$\times 36.5 \frac{\text{g}}{\text{mol}} \text{ HCl}$$

$$79.39 \text{ g HCl}$$

17. How many milliliters of a 0.2 M solution of NaOH do you need to neutralize 240 milliliters of a .55 M HCl solution?

$$0.24 \text{ li} \times 0.55 \frac{\text{mol}}{\text{li}} = 0.132 \text{ mol} \div 0.2 \frac{\text{mol}}{\text{li}} = 0.66 \text{ li} \\ = 660 \text{ ml}$$

18. How many milliliters of a 0.5 M solution of NaOH do you need to neutralize 750 milliliters of a 2.0 M HI solution?

$$0.75 \text{ li} \times 2.0 \frac{\text{mol}}{\text{li}} \text{ HI} = 1.5 \text{ mol} \div 0.5 \text{ M} = 3 \text{ li} \\ = 3000 \text{ ml}$$

19. What is the pH of a solution with a $[\text{H}^+]$ of 2.7×10^{-3} M?

$$-\log(2.7 \times 10^{-3}) = 2.57$$

20. What is the pH of a solution with a $[\text{H}^+]$ of 3.5×10^{-8} M?

$$-\log(3.5 \times 10^{-8}) = 7.46$$

21. What is the pH of a solution with a $[\text{H}^+]$ of 1.3×10^{-4} M?

$$-\log(1.3 \times 10^{-4}) = 3.89$$

22. What is the pH of a solution with a $[\text{H}^+]$ of 9.2×10^{-2} M?

$$-\log(9.2 \times 10^{-2}) = 1.04$$

23. What is the concentration of a solution with a pH of 0.65?

$$10^{-0.65} = 0.224 \text{ M/l}$$

24. What is the concentration of a solution with a pH of 3.23?

$$10^{-3.23} = 5.89 \times 10^{-4}$$

25. What is the concentration of a solution with a pH of 2.8?

$$10^{-2.8} = 1.58 \times 10^{-3}$$

26. What is the concentration of a solution with a pH of 6.5?

$$10^{-6.5} = 3.16 \times 10^{-7}$$