

NAME: _____

DATE: _____

Concentration, Acid Base Neutralization and pH

1. What is the formula for calculating moles from mass?

$$\text{Moles} = \frac{\text{Mass}}{\text{molar mass}}$$

2. How many moles is 120g of HCl?

$$120\text{g} / 36.5\text{g/mol} = 3.28 \rightarrow 3.3\text{ mol}$$

3. How many moles is 96g of NaOH?

$$96\text{g} / 40\text{g/mol} = 2.4\text{ mol}$$

4. How many moles of hydrogen are in 150g of HCl?

$$150\text{g} / 36.5\text{g/mol} = 4.1095\text{ mol} \times 1\text{ mol H} / \text{mol} = 4.1\text{ mol H}$$

5. How many moles of OH are there in 222.5g of NaOH?

$$222.5\text{g} / 40\text{g/mol} = 5.563\text{ mol} \times 1\text{ mol OH} / \text{mol} = 5.563\text{ mol}$$

6. What is the formula for concentration?

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

7. Explain what molarity is

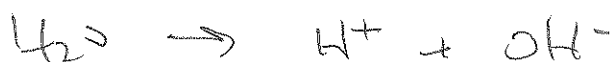
the amount of solute (solid usually) dissolved in a solvent. typically solute is less than solvent.

8. What happens chemically when you mix an acid with an Arrhenius base?

the H^+ from the acid (HA) combines with the OH^- from the base (BOH) to make H_2O

9. Why is water neutral with a pH of 7?

Because water breaks up into equal parts of an acid (H^+) and a base (OH^-) which cancel each other out.



10. If I mix 100g of HCl and 100g of NaOH together in 1000ml of water, would the resulting solution be acidic or basic?

$$\frac{100\text{g}}{36.5\text{g/mol HCl}} = 2.74\text{ moles Acid} \quad \frac{100\text{g}}{40\text{g/mole NaOH}} = 2.5\text{ moles Base}$$

Acidic

11. How many grams of NaOH would I need to neutralize 200g of HCl?

$$\frac{200\text{g}}{36.5\text{g/mol}} = 5.479\text{ moles HCl} \times 40\text{g/mol NaOH} = 219\text{ grams}$$

12. How many grams of HCl would I need to neutralize 200g of NaOH?

$$\frac{200\text{g}}{40\text{g/mole}} = 5.0\text{ moles} \times 36.5\text{g/mol} = 182.5 \rightarrow 183$$

13. If I mix 110g of HCl into 750ml of water, what would the concentration be?

$$\frac{110\text{g}}{36.5\text{g/mol}} = 3.0137\text{ mol} / 0.750\text{ li} = 4.02 \rightarrow 4.0\text{ M}$$

14. If I mix 96g of NaOH into 1.25 liters of water, what would the concentration be?

$$\frac{96\text{g}}{40\text{g/mol}} = 2.4\text{ moles} / 1.25\text{ li} = 1.92\text{ M}$$

15. How many moles is 150ml of 2.00 M HCl?

$$150\text{ ml} = 0.15\text{ li} \times 2\text{ mol/li} = 0.30\text{ moles HCl}$$

16. How many moles is 75ml of 5.25 M NaOH?

$$75\text{ ml} = 0.075\text{ li} \times 5.25\text{ mol/li} = 0.39\text{ mol}$$

↑
loops

17. How many grams of hydrogen are in 550ml of 2.50 M HCl?

$$550\text{ ml} = 0.550\text{ li} \times 2.5\text{ mol/li} = 1.375\text{ mol} \times \frac{1\text{ mol H}}{\text{mol HCl}} = 1.38\text{ mol}$$

or
 $\frac{1.4\text{g}}{3} = \frac{1\text{g}}{\text{mol}} \times 1.4\text{ mol}$

18. How many grams of OH are there in 125ml of 4.50 M NaOH?

$$125_{ml} = 0.125 L \times 4.5 \text{ mol/L} = 0.5625 \text{ mol} \times 40 \text{ g/mol NaOH} = 22.5 \text{ g}$$

9.56 g
oops

19. If I mix 525 ml of 2.00 M HCl and 125ml of 5.00 M NaOH together, would the resulting solution be acidic or basic?

Acid 2 M HCl 0.525 L

0.525 L × 2 mol/L = 1.05 moles Acid

0.125 L × 5 mol/L NaOH = 0.625 moles Base

more 5.0 M NaOH

Base 0.125 L

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

Acid 2 M HCl 0.750 L

0.75 L × 2 mol/L = 1.5 moles Acid = 1.5 moles NaOH

$M = \frac{\text{mol}}{L}$ $\frac{\text{mol}}{M} = L$ $\frac{1.5 \text{ mole}}{0.1 \text{ mol/L NaOH}} = 15 L \text{ NaOH}$

15,000 ml

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

Acid 0.1 M HCl 50 ml

$L = \frac{\text{mol}}{M} = \frac{0.005 \text{ mol}}{0.025 \text{ mol/L NaOH}} = 0.2 L$

0.050 L × 0.1 mol/L = 0.005 mol

200 ml

22. How many milliliters of 0.3 M Ca(OH)₂ (careful there are 2 OH- here), would you need to neutralize 70ml of 2.5M HCl?

Acid 2.5 M HCl 0.07 L

0.07 L × 2.5 mol/L = 0.175 mole

$L = \frac{\text{mol}}{M} = \frac{0.0875 \text{ mole}}{0.3 \text{ mol/L}} = 0.292 L$

Base 0.292 L

292 ml

23. If I add 25 mL of water to 125 mL of a 0.15 M NaOH solution, what will the molarity of the diluted solution be?

$M_1 V_1 = M_2 V_2$ $M_2 = \frac{M_1 V_1}{V_2}$

$V_1 = 125 \text{ ml}$ $V_2 = 150 \text{ ml}$

$M_1 = 0.15 \text{ M}$ $M_2 = ?$

$\frac{0.15 \text{ M} \times 125 \text{ ml}}{150 \text{ ml}} = 0.125 \text{ M}$

24. If I add water to 100 mL of a 0.15 M NaOH solution until the final volume is 150 mL, what will the molarity of the diluted solution be?

$$V_1 = 100 \text{ ml} \quad V_2 = 150 \text{ ml}$$

$$M_1 = 0.15 \text{ M} \quad M_2 = ?$$

$$M_1 V_1 = M_2 V_2$$

$$M_2 = \frac{M_1 V_1}{V_2} = \frac{0.15 \text{ M} \times 100 \text{ ml}}{150 \text{ ml}} = 0.1 \text{ M}$$

25. How much 0.05 M HCl solution can be made by diluting 250 mL of 10 M HCl?

$$V_1 = 250 \text{ ml} \quad V_2 = ?$$

$$M_1 = 10 \text{ M} \quad M_2 = 0.05 \text{ M}$$

$$\frac{M_1 V_1}{M_2} = V_2$$

→ 50 L

$$\frac{10 \text{ M} \times 250 \text{ ml}}{0.05 \text{ M}} = 50,000 \text{ ml}$$

26. I have 345 mL of a 1.5 M NaCl solution. If I boil the water until the volume of the solution is 250 mL, what will the molarity of the solution be?

$$M_1 = 1.5 \text{ M} \quad M_2 = ?$$

$$M_2 = ?$$

$$V_1 = 345 \text{ ml} \quad V_2 = 250 \text{ ml}$$

$$\frac{M_1 V_1}{V_2} = M_2 = \frac{1.5 \text{ M} \times 345 \text{ ml}}{250 \text{ ml}}$$

$$= 2.07 \rightarrow 2.1 \text{ M}$$

27. What is the resulting pH from problem 10

$$0.24 \text{ moles of acid in } 1 \text{ L} = 0.24 \text{ M}$$

$$\text{pH} = -\log(0.24) = 0.62$$

Very acidic

28. What is the resulting pH from problem 19?

$$0.425 \text{ mole xs acid in } 650 \text{ ml}$$

$$\frac{0.425 \text{ M}}{0.650 \text{ L}} = 0.65 \text{ M}$$

$$-\log(0.65) = 0.19$$

29. What is the resulting pH of a solution if I add 90 grams of HCl and 90 grams NaOH into 5 liters of water?

$$\frac{90 \text{ g}}{36.5 \text{ g/mol HCl}} = 2.47 \text{ moles HCl}$$

$$\frac{90 \text{ g}}{40 \text{ g/mol NaOH}} = 2.25 \text{ mol base}$$

$$2.47 \text{ mol Acid}$$

$$-\log(0.044) = 1.36$$

$$\text{pH} = 1.36$$

$$\frac{0.22 \text{ mol}}{5 \text{ L}} = 0.044 \text{ M H}^+$$

30. What is the resulting pH of a solution if I add 90 grams of H₂SO₄ (2H⁺!!!! per mole) and 32 grams NaOH into 10 liters of water?

$$\frac{90 \text{ g}}{98 \text{ g/mol}} = 0.918 \text{ mol H}_2\text{SO}_4 \times 2 \text{ H}^+ = 1.837 \text{ mol H}^+$$

$$\frac{32 \text{ g}}{40 \text{ g/mol}} = 0.8 \text{ mol Base}$$

$$-\log(0.1037) = 0.98$$

$$\frac{1.837 \text{ mol H}^+ - 0.8 \text{ mol OH}^-}{10 \text{ L}} = 0.1037 \text{ M H}^+$$

$$\text{pH} = 0.98$$