

In your own words define the following: (2 points each)

1. Aqueous Solution: Solvent is water
2. Concentrated Solution: having a relatively large amt. of solute dissolved in solution
3. Dilute Solution: having a relatively small amt. of solute dissolved in solution
4. Dilution: the process of adding more solvent to a solution
5. Mass Percent: mass of solute compared to mass of solution
6. Molarity moles per liter
7. Saturated solution having the maximum amount of solute in solution for that temperature
8. Solute what is dissolved
9. Solution homogeneous mixture
10. Solvent what does the dissolving
11. Standard Solution: concentration is accurately known
12. supersaturated solution having more than the maximum amt. of solute in solution for a given temperature.
13. unsaturated solution having less than the maximum amt. of solute in solution for a given temperature.
14. volumetric flask a specialized piece of laboratory glassware for making standard solutions.
15. Add acid to water, NOT water to acid
rule for safely diluting concentrated acids.
16. How does a solid substance dissolve in water? (3 pts)
polar water molecule pulls apart ions in the solid which causes the solid to dissolve.
17. What is meant by the expression "LIKE DISSOLVES LIKE"? (3 POINTS)
polar molecules can dissolve other polar molecules
non polar molecules can dissolve other non polar molecules

Solve the following problems. (6 points each)

18. If there are 41.2 grams of CaCl_2 in 250 grams of solution, what is the percent by mass of CaCl_2 in the solution?

$$\frac{41.2}{250} \times 100 = 16.48\%$$

19. If I dissolve 26 grams of CuSO_4 in 350 grams of water, what is the percent by mass of CuSO_4 in the final solution?

$$\frac{26}{350 + 26} \times 100 = 6.91\%$$

20. How many grams of a 17.4% sodium chloride solution would I need to have 375 grams of sodium chloride?

$$17.4\% = \frac{375}{x} \times 100 \quad 2155 \text{ g}$$

21. If I have 59.3 grams of a solution that is 10.5% by mass potassium iodide, how many grams of potassium iodide do I have?

$$10.5\% = \frac{x}{59.3} \times 100 \quad 6.23 \text{ g}$$

22. What is the molarity of my solution if I dissolve 1.35 moles of sodium chloride in enough water to make 2.5 liters of solution?

$$\frac{1.35}{2.5} = 0.54 \text{ M}$$

23. If I have 23.4 mL of a 1.5 M solution of calcium chloride (molar mass = 111. grams/mol), how many grams of calcium carbonate do I have?

$$\frac{23.4 \text{ mL}}{1000 \text{ mL/L}} = 0.0234 \text{ L} \quad 1.5 \text{ M} = \frac{x}{0.0234} = \frac{0.351 \text{ mol} \times 111 \text{ g/mol}}{1} = 3.896 \text{ g}$$

24. If I use 14.06 grams of CaCl_2 (molar mass = 111 grams/mol) to make a 0.35 M solution how many mL of solution did I make?

$$\frac{14.06 \text{ g}}{111 \text{ g/mol}} = .12667 \text{ mol} \quad .35 \text{ M} = \frac{.12667 \text{ mol}}{L} \quad \frac{.3619 \text{ L}}{1 \text{ L}} \times 1000 \text{ mL} = 361.9 \text{ mL}$$

$L = .3619$

25. If I have 0.45 liters of a 2 M solution of AgNO_3 , how many moles of solute do I have?

$$2 \text{ M} = \frac{x}{.45} \quad \text{9 moles}$$

26. If I dilute 45 ml of a 12.0 M solution of HCl to a volume of 1500 mL, what is my final concentration?

$$(12 \times .045) = (x \times 1.5) \quad \text{0.36 M}$$

or

$$(12 \times 45) = (x \times 1500)$$

27. If I have a standard stock solution that is 14 M, how many mL of my stock solution would I need to make 1.5 liters of a 0.575 M solution?

$$(14)(V) = (.575)(1.5) \quad V = \frac{.061607 \text{ L}}{1 \text{ L}} \times 1000 \text{ mL} = 61.61 \text{ mL}$$

or $\frac{1.5 \text{ L}}{1 \text{ L}} \times 1000 \text{ mL} = 1500 \text{ mL} \quad (14)(V) = (.575)(1500) = 61.61 \text{ mL}$

28. **Explain how** to create 500 mL of a 2.5 M HCl solution if you only have 12 M HCl available. Remember to include the proper order for adding your substances and include any special equipment that you should use. (6 points)

$$(12)(V) = (2.5)(500) \quad V = 104.17 \text{ mL}$$

Use 500 mL volumetric flask add an amt. of water to flask (~200 mL) then add 104.17 mL of 12 M Acid (must add acid to water) then fill to fill line with rest of water.

29. How many mL of a 0.15 M sulfuric acid solution would I need to add to 25 ml of a 4.5 M solution of sodium hydroxide to neutralize it before disposal. The equation for the reaction is: $2 \text{NaOH} + \text{H}_2\text{SO}_4 \rightarrow \text{Na}_2\text{SO}_4 + 2\text{HOH}$. (6 points)

$$\frac{25 \text{ mL}}{1000 \text{ mL}} = .025 \quad 4.5 \text{ M} = \frac{x}{.025} = .1125 \text{ mol NaOH} \quad \frac{.1125 \text{ mol NaOH}}{2 \text{ mol NaOH}} \times 1 \text{ mol H}_2\text{SO}_4 = .05625 \text{ mol H}_2\text{SO}_4$$

$$.15 \text{ M} = \frac{.05625 \text{ mol}}{x} \quad x = .375 \text{ L} \quad \frac{.375 \text{ L}}{1 \text{ L}} \times 1000 \text{ mL} = 375 \text{ mL}$$

30. If there are 55.7 grams of NaCl in 588 grams of salt solution, what is the percent by mass of NaCl in the solution?

$$\frac{55.7}{588} \times 100 = 9.47\%$$

31. If I dissolve 3.8 grams of silver nitrate in 250 grams of water, what is the percent by mass of silver nitrate in the final solution?

$$\frac{3.8}{250 + 3.8} \times 100 = 1.497\%$$

32. How many grams of a 47.6% sodium hydroxide solution would I need to have 20 grams of sodium hydroxide?

$$47.6\% = \frac{20}{x} \times 100 = 42.02g$$

33. If I have 2.5 grams of a solution that is 1.55% by mass sugar, how many grams of sugar do I have?

$$1.55\% = \frac{x}{2.5} \times 100 = .03875g$$

34. What is the molarity of my solution if I dissolve 0.35 moles of glucose in enough water to make 1.2 liters of solution?

$$\frac{.35}{1.2} = 0.292M$$

35. If I have 300 mL of a 1.5 M solution of CuCl₂ (molar mass = 134.45 grams/mol), how many grams of CuCl₂ do I have?

$$\frac{300 \text{ mL}}{1000 \text{ mL}} = .3L \quad 1.5M = \frac{x}{.3} \quad \frac{.45 \text{ mol}}{1 \text{ mol}} \times 134.45g = 60.50g$$

36. If I use 21.2 grams of CuCl_2 (molar mass = 134.445 g/mol) to make 0.65 M solution how many mL of solution did I make?

$$\frac{21.2 \text{ g}}{134.445 \text{ g/mol}} = .1577 \text{ mol} \quad .65 \text{ M} = \frac{.1577}{x}$$

$$.24259 \text{ L} \times \frac{1000 \text{ mL}}{1 \text{ L}} = 242.6 \text{ mL}$$

37. If I have 2.5 liters of a 10.4 M solution of NaNO_3 , how many moles of solute do I have?

$$10.4 \text{ M} = \frac{x}{2.5} \quad 26 \text{ moles}$$

38. If I dilute 230 mL of a 4.5 M solution of HCl with 500 mL of water, what is my final concentration?

$$(4.5)(230) = (x)(500) \quad 2.07 \text{ M}$$

$$\text{or } (4.5)(.230) = (x)(.500)$$

39. If I have a standard stock solution that is 2.55 M, how many mL of my stock solution would I need to make 1.25 liters of a 0.5 M solution?

$$(2.55)(x) = (.5)(1.25) \quad .245 \text{ L} \times \frac{1000 \text{ mL}}{1 \text{ L}} = 245 \text{ mL}$$

$$\text{or } \frac{1.25 \text{ L}}{1 \text{ L}} = 1250 \text{ mL} \quad (2.55)(x) = (.5)(1250) \quad 245 \text{ mL}$$

40. **Explain how** to create 250 mL of a 1.5 M NaCl solution if you only have solid NaCl (molar mass 58.44 g/mol) available. Remember to include the proper order for adding your substances and include any special equipment that you should use. (6 points)

$$\frac{250 \text{ mL}}{1000 \text{ mL}} = .25 \text{ L} \quad 1.5 \text{ M} = \frac{x}{.25} = .375 \text{ mol} \times \frac{58.44 \text{ g}}{1 \text{ mol}} = 21.92 \text{ g}$$

Use 250 mL volumetric flask. Weigh out 21.92 g NaCl . Put some water in bottom of flask ~150 mL add salt add more water to fill line.

41. How many mL of a 1.75 M Sodium sulfate solution would I need to add to 15 mL of a 6.05 M solution of barium nitrate in order for it to react completely. The equation for the reaction is: $\text{Ba}(\text{NO}_3)_2 + 2 \text{Na}_2\text{SO}_4 \rightarrow \text{BaSO}_4 + 2 \text{NaNO}_3$ (6 points)

$$\frac{15 \text{ mL}}{1000 \text{ mL}} = .015 \text{ L} \quad 6.05 \text{ M} = \frac{x}{.015} \quad .09075 \text{ mol} \times \frac{2 \text{ mol Na}_2\text{SO}_4}{1 \text{ mol Ba}(\text{NO}_3)_2} = .1815 \text{ mol Na}_2\text{SO}_4$$

$$1.75 \text{ M} = \frac{.1815}{x} \quad x = \frac{.1815}{1.75} = 0.1037 \text{ L} \times \frac{1000 \text{ mL}}{1 \text{ L}} = 103.7 \text{ mL}$$