

Lab Math Worksheet Key

- 1) Calculate the weight in grams of NaCl required to prepare 200mL of a 25 mM solution of NaCl (gram molecular weight of sodium chloride is 58.44 g).

- Molecular weight of sodium chloride = 58.44 grams/mole
- Molarity of sodium chloride needed = 25 mM = 25/1000 M = 0.025 M
- Volume of solution = 200 mL = 200/1000 = 0.2 liters
- Solute required = 58.44 grams/mole x 0.025 moles/liter x 0.2 liters = 0.2922 grams

- 2) How many grams of NaOH will be required to prepare 1 liter of a stock solution of 40% NaOH?

From this stock solution, describe the steps you would take to prepare 500ml of 10% NaOH solution. (amount of solute and solvent)

- (a) This is the basic 40% solution preparation which means that we can think of 40% NaOH
- $$= \frac{40 \text{ g NaOH}}{100 \text{ ml H}_2\text{O}}$$

In order to find the number of grams, x , needed to prepare 1 liter of a stock solution of 40% NaOH, we need to solve a proportion

$$\begin{aligned}\frac{x \text{ g NaOH}}{1000 \text{ ml H}_2\text{O}} &= \frac{40 \text{ g NaOH}}{100 \text{ ml H}_2\text{O}} \\ x \text{ g NaOH} &= \frac{(40 \text{ g NaOH})(1000 \text{ ml H}_2\text{O})}{100 \text{ ml H}_2\text{O}} \\ &= 400 \text{ g NaOH}\end{aligned}$$

It will take 400 grams of NaOH to prepare 1 liter of a stock solution of 40% NaOH.

- (b) To prepare 500 ml of a 10% solution from the 40% stock solution use the formula $V_1C_1 = V_2C_2$, where $V_1 = x$ ml of 40% solution, $C_1 = 40\%$, $V_2 = 500$ ml, and $C_2 = 10\%$. Substituting these values into the formula and solving for x results in

$$\begin{aligned}(x \text{ ml})(40\%) &= (500 \text{ ml})(10\%) \\ x \text{ ml} &= \frac{(500 \text{ ml})(10\%)}{40\%} \\ &= 125 \text{ ml}\end{aligned}$$

It will take 125 ml of the 40% stock solution of NaOH to have 500 ml of a 10% solution of NaOH.

- 3) You weigh out 4.5 g of CaCl_2 (111 g = MW) and dissolve it to 250 mL with distilled water. What is the percent solution (W/V)? What is the molarity?

$$4.5\text{g}/250\text{mL} = 1.8\%$$

$$4.5\text{g}/(0.25\text{L} \times 111\text{g/mol}) = 0.16\text{M}$$

- 4) You need to prepare 5 mL of a 2% NaCl solution. You already have a stock solution of 10% NaCl that you are asked to use. How many μL of the 10% NaCl solution would you need to make 5 mL of a 2% NaCl solution?

Method 1: Using the equation $C_1V_1 = C_2V_2$. Use the common equation $C_1V_1 = C_2V_2$, where

$$\begin{aligned} C_1 &= \text{the original concentration,} \\ V_1 &= \text{the original volume,} \\ C_2 &= \text{the final concentration, and} \\ V_2 &= \text{the final volume.} \end{aligned}$$

Note that C_1 and C_2 have to have the same units as do V_1 and V_2 . The units on both sides of the equation need to be the same.

In this problem, $C_1 = 10\%$, $V_1 = x$, $C_2 = 2\%$, and $V_2 = 5 \text{ mL (} 5000 \mu\text{L)}$. Substituting these values in the equation, leads to

$$\begin{aligned} (10\%)(x) &= (2\%)(5000 \mu\text{L}) \\ x &= \frac{(2\%)(5000 \mu\text{L})}{10\%} \\ x &= 1000 \mu\text{L} = 1 \text{ mL} \end{aligned}$$

You will need $1000 \mu\text{L}$ of the 10% NaCl solution in order to make 5 mL of a 2% NaCl solution.

- 5) Using a commercially obtained, concentrated hydrochloric acid (12 M), you are to prepare 600 mL of a 1 M HCl solution.

Calculate the amount of stock solution needed.

Calculation of amounts needed: Use the equation $V_1C_1 = V_2C_2$ to organize the information, where

$$\begin{aligned} V_1 &= \text{the required volume of the stock solution,} \\ C_1 &= 12 \text{ M (the concentration of the commercial stock solution),} \\ V_2 &= 1.0 \text{ M, the desired concentration of the diluted solution, and} \\ C_2 &= 600 \text{ ml, the desired volume of the diluted solution.} \end{aligned}$$

Plugging the values into the equation gives

$$\begin{aligned} V_1(12 \text{ M}) &= (600 \text{ ml})(1 \text{ M}) \\ V_1 &= \frac{600 \text{ ml} \times 1 \text{ M}}{12 \text{ M}} \\ V_1 &= 50 \text{ ml of the 12 M HCl} \end{aligned}$$

- 6) A 150 mg/mL glucose solution was diluted 1:2. Then 0.5 mL of it was added to 4.5 mL saline. 2 mL of this solution was diluted to 10 mL. What is the final concentration of glucose?

$$150 \text{ mg/dL} \times 1 \text{ dL}/100 \text{ mL} \times 1/2 \times 1/10 \times 1/5 = 0.015 \text{ mg/mL}$$

- 7) A urea [(NH₂)₂CO] solution of 3.5 mM would be equivalent to how much in mg/dL (MW of urea = 60.06 g)?

$$3.5 \text{ mmoles/L} \times 1 \text{ mole/1000 mmoles} \times 60.06 \text{ g/mole} \times 1\text{L}/10 \text{ dL} \times 1000\text{mg}/1\text{g} = 21.02 \text{ mg/dL}$$

- 8) You have ordered some DNA primers and it arrives freeze-dried. It is labeled "77 nmoles." How would you make a 100 μL working stock with a concentration of 10 pmoles/μL?

First, make a stock solution of 100uM, or 100pmol/ μL

77nmols = 7.7×10^4 pmols. Add **770uL** to make 100pmol/ μL

Use $V_1C_1 = V_2C_2$ to make 100uL of a 10pmol/ μL working stock from a 100pmol/ μL stock.

$$(100\text{pmol}/\mu\text{L})(\text{Vol}) = (10\text{pmol}/\mu\text{L})(100\mu\text{L})$$

$$\text{Vol} = 10\mu\text{L}$$

- 9) You have 300 μL of a protein sample that you have determined has a concentration of 125 μg/L. How much total protein do you have?

$$(125\mu\text{g}/\text{L})(1\text{L}/1 \times 10^6\mu\text{L})(300\mu\text{L}) = 0.0375\mu\text{g}$$

- 10) You have been asked to prepare 500 mL of 1X TAE buffer. The lab keeps a 10X TAE stock. How would you do this?

$$\text{Use } V_1C_1 = V_2C_2 \text{ (500mLs)(1x) = (V}_2\text{)(10x)}$$

$$V_2 = 50\text{mLs}$$

Use 50mLs 10x stock and bring up to 500mLs with H₂O.

- 11) You have stock solutions of A (17 μM), B (21 μM), and C (36 μM) in a common solvent and that you need to combine with more solvent to make 10 mL of a stock with 5 μM of each. What volume of each solution and of solvent do you need?

Consider each stock solution individually using $V_1C_1 = V_2C_2$

$$(17\mu\text{M})(X) = (10\text{mLs})(5\mu\text{M}) \rightarrow X = 2.9\text{mLs}$$

$$(21\mu\text{M})(X) = (10\text{mLs})(5\mu\text{M}) \rightarrow X = 2.4\text{mLs}$$

$$(36\mu\text{M})(X) = (10\text{mLs})(5\mu\text{M}) \rightarrow X = 1.4\text{mLs}$$

Bring it up to 10mLs with 3.3mLs of solvent (10mLs – 2.9 – 2.4 – 1.4)