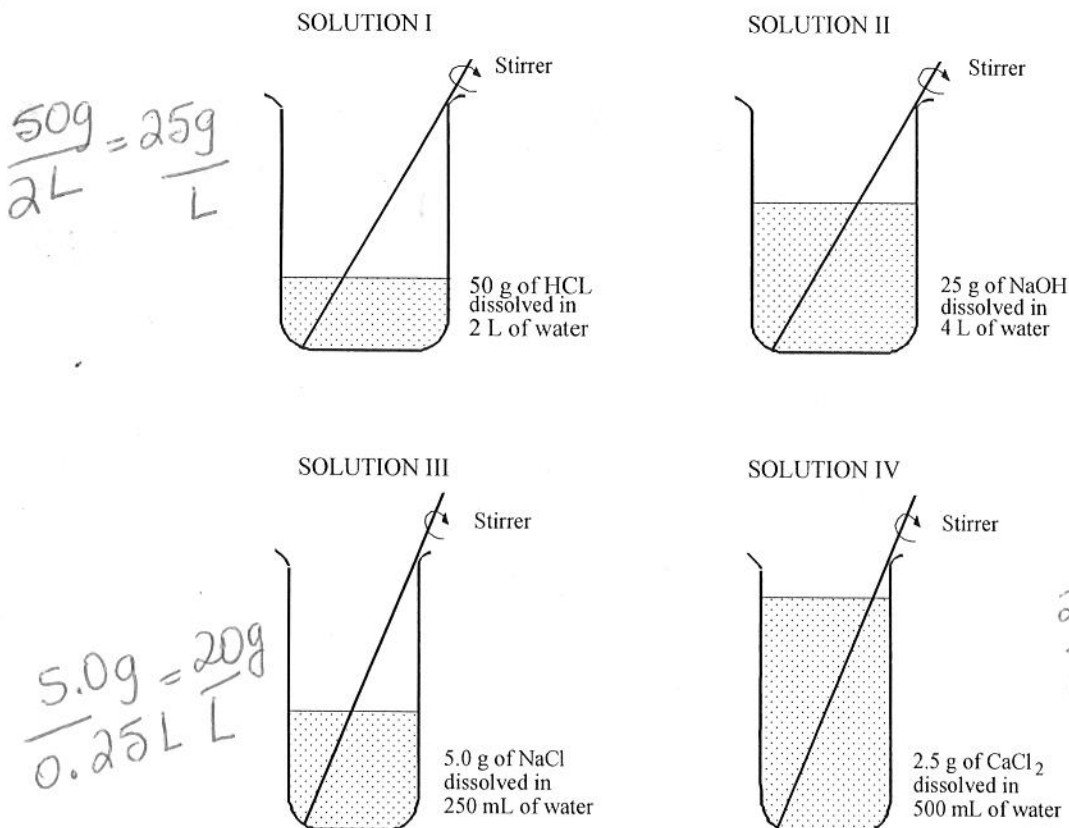


## Review Moles and Solutions

\*\*\* look for more problems under Review moles & Soln's Worksheet

In the laboratory Sylvia prepared four solutions which were different in concentration and volume.

The following is the diagram from Sylvia's procedure.



In her report Sylvia listed the solutions in **increasing order** of concentration (g/L).

In which order were the solutions listed?

- A) IV, II, III and I  
 B) II, I, IV and III  
 C) IV, III, II and I  
 D) I, III, II and IV

low  $\rightarrow$  hi  
 IV  $\rightarrow$  III  $\rightarrow$  II  $\rightarrow$  I

= to compare the soln all must be the same units

2 A laboratory technician has to prepare 1.5 L of an aqueous solution of sodium chloride, NaCl, whose concentration is to be 50 g/L.

What procedure should be followed to prepare this solution?

- mass 75g NaCl
- put into 1.5L volumetric
- add some water & swirl to dissolve
- add water to the 1.5 L line

$$C \times V = \text{solute}$$

$$1.5L \times \frac{50g}{L}$$

75g NaCl

- NaCl

3 You are asked to prepare 200 mL of a salt solution with a concentration of 4 mol/L.

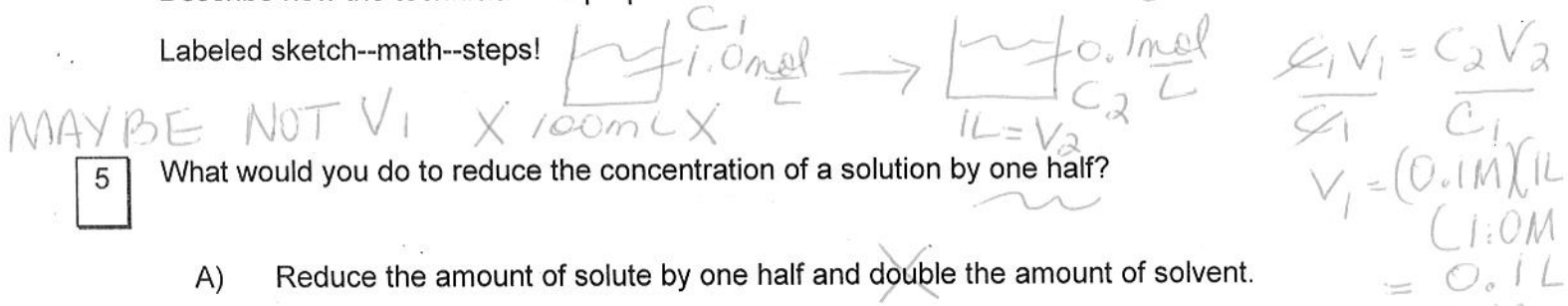
How many grams of salt must be dissolved in 200 mL of solution?

$200\text{ mL} \times \frac{1\text{ L}}{1000\text{ mL}} \times \frac{4\text{ mol}}{1\text{ L}} \times 58.5\text{ g NaCl} = 46.8\text{ g NaCl}$

4 A technician has 100 mL of 1.0 mol/L NaOH. A teacher asks for 1 L of 0.1 mol/L NaOH.

Describe how the technician will prepare the second solution from the first. dilution

Labeled sketch--math--steps!



5 What would you do to reduce the concentration of a solution by one half?

- A) Reduce the amount of solute by one half and double the amount of solvent. ~~X~~
- B) Add an amount of solvent equal to the volume of the original solution. soln vol.
- C) Evaporate half of the solvent present in the solution.  $\frac{1}{2}$  dilution
- D) ~~Double the amount of solute.~~

$C_1 V_1 = C_2 V_2$   
 $\frac{C_1}{C_2} = \frac{V_2}{V_1}$   
 $V_1 = \frac{(0.1\text{ M})(1\text{ L})}{1.0\text{ M}}$   
 $= 0.1\text{ L}$   
but it is  $V_1$  in this case

6 A 5 litre container of bleach contains an aqueous solution of sodium hypochlorite (NaClO) whose concentration is 60 g/L. Using this solution, you are to prepare 300 mL of another aqueous solution of NaClO whose concentration is 20 g/L.

What is your procedure?

Specify all the steps of your procedure and include any calculations.

$C_1 V_1 = C_2 V_2 = (20\text{ g/L})(300\text{ mL})$   
 $\frac{C_1}{C_2} = \frac{V_2}{V_1}$   
 $(60\text{ g/L}) = 100\text{ mL}$

7 How much chlorine should be added to a 24 000 L pool in order to obtain 1.8 ppm of chlorine?

$1.8\text{ ppm} = \frac{1.8\text{ mg}}{1\text{ L}} \times 24\text{ 000 L} = 43\text{ 200 mg of Cl}_2$

8 Calculate the percent by mass of the solute in an aqueous solution of 2.0 g I<sub>2</sub> in 125 g methanol.

$= \frac{2.0\text{ g I}_2}{127.0\text{ g soln}} \times 100 = 1.57\% \text{ m/m}$

9 How much potassium bromide (KBr), in grams, should be added to water to prepare a 0.50 L of solution with a molarity of 0.125 M?

$0.50\text{ L} \times 0.125\text{ mol/L} \times 119\text{ g KBr} = 7.44\text{ g KBr}$

10 **Sample Problem:** Rubbing alcohol is commonly used as an antiseptic for small cuts. It is sold as 70% (v/v) solution of isopropyl alcohol in water. What volume of isopropyl alcohol is used to make 500 mL of rubbing alcohol?

$= 500\text{ mL soln} \times \frac{70\text{ mL alc}}{100\text{ mL soln}} = 350\text{ mL alc}$

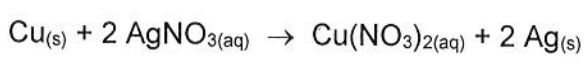
11 Calculate the percent mass/volume % (m/v) for the solute in each of the following solutions:

(a). 2.50 g of KCl in 50.0 mL of solution  $a) = \frac{2.50\text{ g}}{50.0\text{ mL}} \times 100 = 5\% \text{ m/v}$

(b). 7.5 g of casein in 120 mL of low-fat milk  $b) = \frac{7.5\text{ g}}{120\text{ mL}} \times 100 = 6.25\% \text{ m/v}$

- 12 Which statement correctly describes a mole?
- A) The mass of a certain amount of matter
  - B) A fixed number of particles**
  - C) The amount of matter that occupies a fixed volume
  - D) A stable density of atoms of the same element

13 You need 2.0 g of silver (Ag) for an experiment. However, you can only find silver nitrate ( $\text{AgNO}_3(\text{aq})$ ). You decide to extract the silver from the silver nitrate using copper (Cu), according to the following equation:



What mass of silver nitrate will you require in order to obtain the 2.0 g of silver that you need?

*stoich*

$$2.0 \text{ g Ag} \times \frac{1 \text{ mol Ag}}{108 \text{ g}} \times \frac{2 \text{ mol AgNO}_3}{2 \text{ mol Ag}} \times \frac{170 \text{ g}}{1 \text{ mol AgNO}_3} = 3.15 \text{ g AgNO}_3$$

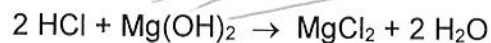
13 Given 4 samples of different substances and their respective mass :

Diagram showing four beakers labeled A, B, C, and D containing NaOH, NaCl, HNO<sub>3</sub>, and HgBr respectively. Handwritten calculations show the number of moles for each:

- A:  $10 \text{ g} \times \frac{1 \text{ mol}}{40 \text{ g}} = 0.25 \text{ mol}$
- B:  $73 \text{ g} \times \frac{1 \text{ mol}}{58.5 \text{ g}} = 1.25 \text{ mol}$
- C:  $126 \text{ g} \times \frac{1 \text{ mol}}{63 \text{ g}} = 2 \text{ mol}$
- D:  $140 \text{ g} \times \frac{1 \text{ mol}}{281 \text{ g}} = 0.50 \text{ mol}$

Which sample contains the greatest number of moles of matter?

14 You spill some hydrochloric acid (HCl) on the counter. To neutralize its effect, you use magnesium hydroxide  $\text{Mg}(\text{OH})_2$ . The neutralization reaction is represented by the following equation:



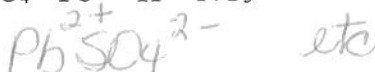
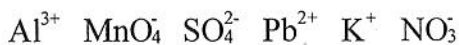
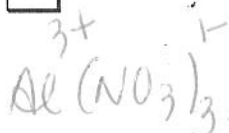
What mass of  $\text{Mg}(\text{OH})_2$  is required to neutralize 4 moles of HCl?

*stoich*

$$4 \text{ mol HCl} \times \frac{1 \text{ mol Mg}(\text{OH})_2}{2 \text{ mol HCl}} \times \frac{58.3 \text{ g}}{1 \text{ mol}} = 116.6 \text{ g Mg}(\text{OH})_2$$

*using a neutralization equation*

15 Use the ions listed below to write formulas for three possible compounds and name them:



16 A student breaks laboratory safety rules when she extinguishes her burner by blowing out the flame. A few moments later, she notices the characteristic smell of methane gas,  $CH_4$ . By this time 80 g of methane have escaped. How many moles of this gas escaped into the laboratory air?

$80g CH_4 \times \frac{1 \text{ mol } CH_4}{16g} = 5 \text{ mol } CH_4$

17 The problem of the survival of human beings in space has been studied for many years. A human being exhales approximately 924 g of  $CO_2$  per day.

In 1938, the British Interplanetary Society suggested the use of  $NaOH$  to absorb the gas  $CO_2$  generated by humans.

The chemical equation for the absorption of  $CO_2$  by  $NaOH$  is as follows :



What mass of  $NaOH$  must be available aboard a spaceship to absorb the  $CO_2$  produced by an astronaut living on-board for ten days?

$924g CO_2 \times 10 \text{ days} \times \frac{1 \text{ mol } CO_2}{44g} \times \frac{2 \text{ mol } NaOH}{1 \text{ mol } CO_2} \times \frac{40g}{1 \text{ mol } NaOH} = 16800g NaOH$

18 Which of the following substances are ionic?

1.  $H_2O$  C
2.  $NaCl$  I
3.  $H_2O_2$  C
4.  $CaO$  I
5.  $Br_2$  C
6.  $KI$  I
7.  $CS_2$  C
8.  $CH_4$  C

m-NM

19 Name the following compounds:

- A)  $H_2SO_4$  sulfuric acid
- B)  $NH_4OH$  ammonium hydroxide
- C)  $NaNO_3$  sodium nitrate
- D)  $CaCO_3$  calcium carbonate

20 Among the following chemical formulas, which contains a radical (complexion) with a charge of -3 ?

*complex ion*

- A)  $(\text{NH}_4)_2\text{SO}_4$  *1+ 2-*
- B)  $\text{NaNO}_3$  *1+ 1-*
- C)  $\text{Ca}_3(\text{PO}_4)_2$  *2+ 3-*
- D)  $\text{MgCO}_3$  *2+ 2-*

21 a) Which of the following is the correct formula for the compound of the aluminum cation and the anion,  $\text{Cr}_2\text{O}_7^{2-}$  ?

- ~~A)  $\text{AlCr}_2\text{O}_7$  *3+ 2-*~~
- ~~B)  $\text{Al}_3(\text{Cr}_2\text{O}_7)_2$  *3+ 2-*~~
- ~~C)  $\text{Al}_2\text{Cr}_2\text{O}_7$  *3+ 2-*~~
- D)  $\text{Al}_2(\text{Cr}_2\text{O}_7)_3$  *3+ 2-*

b) Determine the chemical formula for the compound formed between the anion  $\text{PO}_4^{3-}$  and each of the following cations:

- a) Sodium
- b) Calcium
- c) Aluminum
- d) Ammonium

