Date _____ Name _____

Section _____ Team _____

Instructor _____ _____

Pre-Lab Study Questions | 14

1. Why does an oil-and-vinegar salad dressing have two separate layers?

Salad dressing forms layers because oil is not soluble in water. This causes a heterogeneous mixture, which is seen as two separate layers.

2. What is meant by the mass percent (m/m) concentration of a solution?

It describes the grams of solute in the grams of solution multiplied by 100.

3. What is molarity?

It is a concentration unit. It is the moles of solute in the liters of solution.

4. Why are some electrolytes considered strong, whereas others are considered weak?

Strong electrolytes, such as strong acids, form many ions in solution.
Weak electrolytes, such as weak acids, form few ions in solution.

5. A solution is prepared with 3.26 g KCl and water to make 25.0 mL of KCl.
a. What is the % (m/v) of the KCl solution?

$$\%(^{m}/_{v})\text{KCl} = \frac{3.26\text{g KCl}}{25.0\text{mL sol'n}}(100) = 13.04 \approx 13.0\%$$

b. What is the molarity (M) of the KCl solution?

$$\text{M}_{\text{KCl}} = \frac{3.26\text{g KCl}\left(\frac{1\text{ mole KCl}}{74.6\text{g KCl}}\right)}{25.0\text{ mL sol'n}\left(\frac{1\text{ L}}{1000\text{ mL}}\right)} = 1.747989 \approx 1.75\text{ M KCl}$$

Date _____ Name _____

Section _____ Team _____

Instructor _____

REPORT SHEET | LAB

Solutions, Electrolytes, and Concentration | 14

A. Polarity of Solutes and Solvents

Solute	1. Soluble/Not Soluble in		2. Identify the Solute as Polar or Nonpolar
	Water	Cyclohexane	
$KMnO_4$	**Yes**	**No**	**Polar**
I_2	**No**	**Yes**	**Nonpolar**
Sucrose	**Yes**	**No**	**Polar**
Vegetable oil	**No**	**Yes**	**Nonpolar**

B. Electrolytes and Nonelectrolytes

Substance	1. Observations (Intensity of Lightbulb)	2. Type of Electrolyte (Strong, Weak, or Nonelectrolyte)	3. Type of Particles (Ions, Molecules, or Both)
0.1 M NaCl	**Bright light**	**Strong**	**Ions**
0.1 M Sucrose	**No light**	**Nonelectrolyte**	**Molecules**
0.1 M HCl	**Bright light**	**Strong**	**Ions**
0.1 M $HC_2H_3O_2$, Acetic acid	**Dim light**	**Weak**	**Both**
0.1 M NaOH	**Bright light**	**Strong**	**Ions**
0.1 M NH_4OH	**Dim light**	**Weak**	**Both**
0.1 M C_2H_5OH, Ethanol	**No light**	**Nonelectrolyte**	**Molecules**

Questions and Problems

Q1 Why are some solutes soluble in water, but others are soluble in cyclohexane?
Only polar solutes are soluble in polar water because their polarities are the same. Similarly nonpolar solutes are soluble in nonpolar cyclohexane because their polarities are the same.

Q2 For the three solutes tested in **B**, write an equation for their dissolution in water:

HCl(*aq*) $\mathbf{HCl_{(aq)} \rightarrow H^{1+}_{(aq)} + Cl^{1-}_{(aq)}}$

$NH_4OH(aq)$ $\mathbf{NH_4OH_{(aq)} \leftrightarrow NH^{1+}_{(aq)} + OH^{1-}_{(aq)}}$

$C_6H_{12}O_6(aq)$ $\mathbf{C_6H_{12}O_6(aq) \rightarrow C_6H_{12}O_6(aq)}$

Q3 Classify the solutes in each of the following equations as a weak electrolyte, a strong electrolyte, or a nonelectrolyte in water:

a. $XY_2(s) \longrightarrow X^{2+}(aq) + 2Y^{-}(aq)$ **Strong**

b. $HX(g) \rightleftharpoons H^{+}(aq) + X^{-}(aq)$ **Weak**

c. $XYZ(s) \longrightarrow XYZ(aq)$ **Nonelectrolyte**

d. $YOH(s) \longrightarrow Y^{+}(aq) + OH^{-}(aq)$ **Strong**

C. Electrolytes in Body Fluids

1. Type of IV Solution	Lactated Ringer's (mEq/L)	5% Isolyte P (mEq/L)	Plasnalyte (mEq/L)
2. Cations	**Na^{1+} = 130** **K^{1+} = 4** **Ca^{2+} = 3**	**Na^{1+} = 25** **K^{1+} = 20** **Mg^{2+} = 3**	**Na^{1+} = 140** **K^{1+} = 5** **Mg^{2+} = 3**
3. Anions	**Cl^{1-} = 109** **HPO_4^{2-} = 28**	**Cl^{1-} = 22** **HPO_4^{2-} = 3** **Ac^{1-} = 23**	**Cl^{1-} = 98** **Glu^{1-} = 23** **Ac^{1-} = 27**
4. Total Charge of Cations (+)	**137**	**48**	**148**
5. Total Charge of Anions (–)	**137**	**48**	**148**
6. Sum of the Charges	**0**	**0**	**0**

Questions and Problems

Q4 What would be the overall charge in any IV solution? Why?

The overall IV solution charge is always zero because positive charges are always equal to negative charges.

D. Concentration of a Sodium Chloride Solution

1.	Mass of evaporating dish	**36.21**	g
2.	Volume of NaCl solution	**10.0**	mL
3.	Mass of dish and NaCl solution	**47.41**	g
4.	Mass of dish and dry NaCl	**38.01**	g

Calculations

5.	Mass of NaCl solution	**11.20**	g
6.	Mass of the dry NaCl salt	**1.80**	g
7.	Mass/mass percent (*Show calculations*.) $\frac{\mathbf{1.80g\ NaCl}}{\mathbf{11.20\ g\ sol'n}}\mathbf{(100) = 16.07142}$	**16.1**	% (m/m)
8.	Mass/volume percent (*Show calculations*.) $\frac{\mathbf{1.80g\ NaCl}}{\mathbf{10.0\ mL}}\mathbf{(100) = 18}$	**18.0**	% (m/v)
9.	Moles of NaCl (*Show calculations*.) $\mathbf{1.80\ g\ NaCl}\left(\frac{\mathbf{1\ mole\ NaCl}}{\mathbf{58.5\ g\ NaCl}}\right) = \mathbf{0.03079}$	**0.0308**	moles
10.	Volume of sample in liters (*Show calculations*.) $\mathbf{10.0\ mL}\left(\frac{\mathbf{1\ l}}{\mathbf{1000\ mL}}\right) = \mathbf{0.01}$	**0.0100**	L
11.	Molarity of NaCl solution (*Show calculations*.) $\frac{\mathbf{0.03079\ moles\ NaCl}}{\mathbf{0.0100\ L\ sol'n}} = \mathbf{3.079}$	**3.08**	M

Questions and Problems

Q5 A 15.0-mL sample of NaCl solution has a mass of 15.78 g. After the NaCl solution is evaporated to dryness, the dry salt residue has a mass of 3.26 g. Calculate the following concentrations for the NaCl solution.

a. % (m/m)

$$\frac{3.26\text{ g NaCl}}{15.78\text{ g sol'n}}(100) = 20.7\%(^{\text{m}}/_{\text{m}})\text{NaCl}$$

b. % (m/v)

$$\frac{3.26\text{ g NaCl}}{15.0\text{ mL}}(100) = 21.7\%(^{\text{m}}/_{\text{v}})\text{NaCl}$$

c. molarity (M)

$$\frac{3.26\text{ g NaCl}\left(\frac{1\text{ mole NaCl}}{58.5\text{ g NaCl}}\right)}{15.0\text{ mL sol'n}\left(\frac{1\text{ L sol'n}}{1000\text{ mL sol'n}}\right)} = 3.72\text{ M NaCl}$$

Q6 How many grams of KI are in 25.0 mL of a 3.0 % (m/v) KI solution? (Use % as a conversion factor)

$$25.0\text{ mL KI}\left(\frac{3.0\text{ g KI}}{100\text{ mL KI}}\right) = 0.75\text{ g KI}$$

Q7 How many milliliters of a 2.5 M $MgCl_2$ solution contain 17.5 g $MgCl_2$? (Use M as a conversion factor)

$$17.5\text{ g MgCl}_2\left(\frac{1\text{ mole MgCl}_2}{95.21\text{ g MgCl}_2}\right)\left(\frac{1\text{ L sol'n}}{2.5\text{ mole MgCl}_2}\right)\left(\frac{1000\text{ mL}}{1\text{ L sol'n}}\right)$$

$$= 73.52168 \approx 74\text{ mL sol'n}$$