Concentration and Dilution of a Solution Assignment **Due: February 9, 2017**

Name: KEY **Grp.** ____

1. One way to express concentration (C) is g/L, expressed as the mass of solute measured in grams dissolved by a solvent in litres of solution. Another is % (m/v), expressed as the number of grams of solute dissolved in mL of solution. Another is % (v/v), expressed as the number of mL of solute dissolved in mL of solution. Another is % (m/m), expressed as the number of grams of solute in grams of solution.

2. Below you will find a table describing four solutions to be made. Calculate their concentrations and then rank these solutions in order, starting with the least concentrated (1) to the most concentrated (4). **Show formula, all work and units below.** (5 marks)

Solution	Mass of Solute	Volume of Solution	Concentration	Rank
1	30 g	2.0 L	15 g/L	1
2	4.5 g	150 ml	30 g/L	3
3	0.1 kg	4.0 L	25 g/L	2
4	0.4 g	10 ml	40 g/L	4
5	5.0 g	100 ml	50 g/L	5

Formula: C=

1) $\frac{30\text{ g}}{2.0\text{ L}} = \frac{15\text{ g}}{\text{L}}$

2) $\frac{4.5\text{ g}}{0.150\text{ L}} = \frac{30\text{ g}}{\text{L}}$

3) $\frac{100\text{ g}}{4.0\text{ L}} = \frac{25\text{ g}}{\text{L}}$

4) $\frac{0.4\text{ g}}{0.010\text{ L}} = \frac{40\text{ g}}{\text{L}}$

5) $\frac{5.0\text{ g}}{0.100\text{ L}} = \frac{50\text{ g}}{\text{L}}$

3. What mass in grams (g) of the solute sodium hydroxide, NaOH, are needed to prepare: (5 marks) Formula: m= C x V

a) 3.0 L of a 45 g/L solution? $m = \left(\frac{45\text{ g}}{\text{L}}\right)(3.0\text{ L}) = 135\text{ g}$

b) 250 ml of a 80 g/L solution? $m = \left(\frac{80\text{ g}}{\text{L}}\right)(0.250\text{ L}) = 20\text{ g}$

c) 100 ml of a 60 g/L solution? $m = \left(\frac{60\text{ g}}{\text{L}}\right)(0.100\text{ L}) = 6\text{ g}$

4. What volume (ml and L) of sugar solution could be prepared if one wants: V= $\frac{m}{C}$ (5 marks) Formula: V=

a) A 25 g/L solution with 40 g of sugar? $V = (40\text{ g})\left(\frac{\text{L}}{25\text{ g}}\right) = 1.6\text{ L}$

b) A 50 g/L solution with 10 g of sugar? $V = (10\text{ g})\left(\frac{\text{L}}{50\text{ g}}\right) = 0.2\text{ L}$

c) A 60 g/L solution with 2.0 kg of sugar? $V = (2000\text{ g})\left(\frac{\text{L}}{60\text{ g}}\right) = 33.3\text{ L}$

5. Dilution is a technique that reduces the concentration of a solution by adding solvent.

6. Given the formulae below, what volume of each aqueous stock salt solution, V_1, would you need to dilute to prepare:

$C_1V_1 = C_2V_2$

$V_1 = \frac{C_2V_2}{C_1}$

$H_2O = V_2 - V_1$

Include the volume of water needed to add to complete the dilution. (8 marks)

a) 100 ml of a 30 g/L sugar solution from a 150 g/L stock solution?

V_2 C_2 C_1

$\left(\frac{150g}{L}\right)(V_1) = (0.100L)\left(\frac{30g}{L}\right)$ $V_1 = 0.02L$ or $20mL$

b) 3.0 L of a 15 g/L salt solution from a 90 g/L stock solution?

V_2 C_2 C_1

$\left(\frac{90g}{L}\right)(V_1) = \left(\frac{15g}{L}\right)(3.0L)$ $V_1 = 0.50L$ or $500mL$

c) 250 ml of a 20 % (v/v) peroxide solution from a 50 % (v/v) stock solution?

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7. What volume of a solution with a concentration of 4.0 g/L could you prepare from 2.0 L of stock solution that has a concentration of 35 g/L? **Include the volume of water needed to add.**
(4 marks)

C_2 V_2 C_1 V_1

$C_1V_1 = C_2V_2$

$\left(\frac{35g}{L}\right)(2.0L) = \left(\frac{4.0g}{L}\right)(V_2)$

$\frac{70g}{4g} = 17.5L$ final volume

$17.5L - 2.0L = 15.5L$ added

8. What would the final concentration of a solution of potassium nitrate, KNO_3, be if you diluted 300 ml of a 120 g/L solution of KNO_3 by adding 1.2 L of water?
(4 marks) V_1 C_1 V_2 $1.2L + 0.300L = 1.5L$

$C_1V_1 = C_2V_2$

$\left(\frac{120g}{L}\right)(0.300L) = C_2(1.5L)$

$C_2 = 24\frac{g}{L}$

final concentration