Tutorial 1 Answer Sheet

1- Calculate the following:

a. The weight in grams of 0.45 moles of glucose ($C_6H_{12}O_6$)

No. of moles = wt_g /MWT thus, wt_g = No. of moles × MWT
MWT of glucose = (12×6) + (1×12) +(16×6) = 180g/mole
wt_g = 0.45 ×180 = 81 g

b. The weight in grams of 1×10^{23} molecules of NaCl.

1 mole has 6.023×10^{23}

? mole has 1×10^{23}
= 0.166 mole

MWT of NaCl = (1× 23) + (1× 35.5)= 58.5g/mole
wt_g = 0.166 × 58.5 = 9.71 g

c. The number of molecules in 2.25 g of glycine.

MWT of glycine = (2×12) + (1×14) + (2×16) + (5×1) = 75g/mole.
1 mole has 75g
? mole has 2.25
= 0.03 mole
Since 1 mole has 6.023×10^{23}
0.03 mole has ? molecules
$=0.03 \times 6.023 \times 10^{23}$
$= 0.18 \times 10^{23}$

2- Calculate the normality of the following solutions:

a. 250 ml of HCl containing 18.25 g of HCl.

N = No. of equivalents / $V_{(L)}$
No. of equivalents = wt_g of solute / equivalents weight
EW= MWT of solute / n
MWT of HCl= (1×35.5) + (1×1) = 36.5g/mole
n = 1
EW= MWT of solute / n
= 36.5 / 1 = 36.5
No. of equivalents = wt_g of solute / equivalents weight
= 18.25 /36.5
= 0.5

N = No. of equivalents / $V_{(L)}$
= 0.5 / 0.25
=2 normal

b. 49 g of H_2SO_4 in 250 ml.

MWT of H_2SO_4 = (2×1) + (1×32) + (4×16) = 98g/mole
n=2
EW = MWT of solute / n
= 98/ 2 = 49
No. of equivalents = wt_g of solute / equivalents weight
= 49 /49
= 1
N = No. of equivalents / $V_{(L)}$
= 1 / 0.25
= 4 normal

3- 12.25 g of phosphoric acid was dissolved in water and the volume made up to 100 ml, calculate:
   a. The normality of the solution.
   b. The molarity of the solution.

N = M × n
M = No. of moles of solute / $V_{(L)}$
No. of moles = wt_g /MWT
MWT of H_3PO_4 = (3×1) + (1×31) + (4×16) = 98g/mole.
No. of moles = wt_g /MWT
= 12.25 / 98
= 0.125 mole
M = No. of moles of solute / $V_{(L}$
= 0.125 / 0.1
= 1.25 molar

n = 3
N = M × n
= 1.25 × 3
= 3.75 normal

4- 20 g of NaCl is dissolved in 200 ml water, what is its W/V%?

20 g in 200 ml
? in 100 ml

= 10g NaCl in 100 ml water so the W/V% is 10

5- Calculate the percent V/V% of ethanol in a solution prepared by diluting 30 ml of ethanol to 250ml.

V/V% = the volume in ml of a solute / 100 ml of solution
30 ml of ethanol in 250 ml
? ----------> 100 ml
V/V% = (30 × 100) / 250
= 12%

6- Calculate the number of grams of $BaCl_2.H_2O$ that you would need to prepare 100 ml of a 0.2 M solution.

Volume = 100/1000
= 0.1 L
M =no. of moles/Volume(L)
No. of moles = M × Volume(L)
= 0.2 × 0.1
= 0.02 moles
no. of moles = WT(g)/MWT
WT(g) = no. of moles × MWT
MWT = 137.33 + (35.45 × 2)+ (1 × 2) + 16
= 226.23 g/mol

WT(g) = 0.02 × 226.23
= 4.52 g

7- Calculate the molarity and osmolality of a 10 W/V % $MgCl_2$ solution.

10 g in 100 ml
= 10g NaCl in 100 ml water so the W/V% is 10

MWT $MgCl_2$= (1×24) + (2×35.5) = 95g/mole
No. of moles = wt_g /MWT
= 10/ 95 = 0.1 mole
M = No. of moles of solute / $V_{(L)}$
= 0.1 / 0.1
= 1 molar

Osmolarity = M × n
n=3

N= 1 × 3
= 3 Osmolarity

8- How would you prepare 0.2 L of 0.3 $MgCl_2$ W/V% solution.

0.3 g in 100 ml is 0.3% W/V% but since 200 ml is needed
? g in 200 ml
= (0.3 × 200) / 100
= 0.6 g of $MgCl_2$
0.6 g of $MgCl_2$ is dissolved in a little volume of distilled water then the volume was made up to 200ml with distilled water

9- A solution was prepared by dissolving 8 g of solid ammonium sulfate (MWT = 132.14) in 39.52 ml of water. Express the concentration in terms of: g/L, M, N, W/V%, mg%, osmolarity.

g/L
8g --------> 39.52 ml
? ---------> 1000 ml
? = (8 × 1000)/39.52 = 202.4 g/l

M = no. of moles/$volume_{(L)}$
no. of moles = wt/MWT = 8/132.14 = 0.0605 mole
volume(L) = 39.52 ml/1000 = 0.03952 L
M= 0.0605/0.03952
= 1.53 molar

N = n × M
= 1 × 1.53
= 1.53 N

W/V% = wt in g/ volume in 100 ml of solution
8g --------> 39.52 ml
? ---------> 100 ml
? = (8 × 100)/39.52 = 20.24 %

mg%
from W/V% = 20.24%
mg% =20.24 × 1000
= 2024 mg%

Osmolarity = n × M

= 2 × 1.53
= 3.06 osmolar

10- A solution contains 15 g of $CaCl_2$ in a total volume of 190 ml. Express the concentration of this solution in terms of: g/L, M, W/V%, mg%, osmolarity.

g/L
15g -------- > 190 ml
? --------- > 1000 ml
? = (15 × 1000)/190 = 78.9 g/l

M = no. of moles/volume$_{(L)}$
no. of moles = wt/MWT = 15/(40 + (35 × 5)) = 0.135 mole
volume(L) = 190 ml/1000 = 0.19 L
M= 0.135/0.19
= 0.711 molar

W/V% = wt in g/ volume in 100 ml of solution
78.9g -------- > 1000 ml
? --------- > 100 ml
? = (78.9 × 100)/1000 = 7.89 %

mg%
from W/V% = 7.89%
mg% =7.89 × 1000
= 7890 mg%

Osmolarity = n × M
= 3 × 0.711
= 2.134 osmolar

Tutorial 2 Answer Sheet

1. How many ml of 0.8 M acetic acid (CH_3COOH) are needed to prepare 200ml of 0.4N acetic acid?

N = M × n

so M = N / n
n of the acetic acid =1
M of the required solution = 0.4 / 1 = 0.4 molar
$C_1 \times V_1 = C_2 \times V_2$
$0.8 \times V_1 = 0.4 \times 200$
$0.8 \times V_1 = 80$
$V_1 = 80 / 0.8$
$V_1 = 100$ ml
So 100 ml of the 0.8M solution is needed and make up the volume to 200ml with distilled water.

OR YOU CAN USE THIS WAY

$N = M \times n$
so M = N/n
n of the acetic acid =1
M of the required solution = 0.4/ 1= 0.4 molar
M = No. of moles of solute / thus $V_{(L)}$ thus
No. of moles of required solution = $M \times V$
$= 0.4 \times 0.2$
$= 0.08$ moles needed
From the molarity of the stock solution:
0.8 mole in 1000 ml solution
0.08 moles in ? ml solution
$= (0.08 \times 1000) / 0.8$
= 100 ml
So 100 ml of the 0.8M solution is needed and make up the volume to 200ml with distilled water.

2. Describe the preparation of 2L of a 0.23M H_2SO_4 solution starting from a stock solution of H_2SO_4 92% W/W%, SG=1.84 g/ml?

MW of $H_2SO_4 = (2\times1) + (1\times32) + (4\times16) = 98$g/mole.
M = No. of moles of solute / $V_{(L)}$
No. of moles = $M \times V_{(L)}$
$= 0.23 \times 2 = 0.46$ mole
wt_g = No. of moles × MWT
$= 0.46 \times 98 = 45.08$g
Since 92g of H_2SO_4 stock solution in 100g solution
45.08g of H_2SO_4 required solution in ?g solution

= (45.08 × 100) / 92
= 49g of solution
V= wt /ρ = 49/ 1.84
= 26.6ml
So 26.6ml of the stock solution is taken then complete up the volume to 2 liters with distilled water.

3. Calculate the molarity of H_2SO_4 which has a molality of 6.8 molal, P = 1.48 g/ml?

Molality means 6.8 mole of solute in 1000 g of solvent.
MWT of H_2SO_4 = (2×1) + (1×32) + (4×16) = 98g/mole.
No. of moles = wt_g /MWT
thus wt_g = No. of moles × MWT
= 6.8 × 98
= 666.4g
The weight of solution = weight of solvent + weight of solute.
= 1000 + 666.4
= 1666.4 g
V= wt /ρ
= 1666.4 / 1.48
= 1125.9 ml
Since 6.8 mole of solute in 1125.9 ml of solution
? mole of solute in 1000 ml of solution
= 6.04 molar

4. A solution of H_2SO_4 is 4% W/W%, density is 1.84g/ml. Calculate the molarity, normality and molality?

Molarity
MWT of H_2SO_4 = (2×1) + (1×32) + (4×16) = 98g/mole.
Since 4% W/W is 4 g H_2SO_4 in 100g solution.
No. of moles = wt_g /MWT
= 4 / 98
= 0.04 mole
V= wt /ρ
= 100/ 1.84
= 54.35 ml of solution
So 0.04 mole in 54.35ml solution

? Mole in 1000 ml of solution
= (0.04 × 1000) / 54.35
= 0.74 molar

Normality
N = M × n
n= 2
N= 0.74 × 2
= 1.48 normal

Molality
Since the weight of solution = weight of solvent + weight of solute.
Thus, the weight of solvent = weight of solution - weight of solute.
= 100g – 4 g
= 96g
0.04 mole of solute in 96 g of solvent
? mole of solute in 1000 g of solvent
No. of moles of solute 1000 g of solvent = (0.04 × 1000) / 96
= 0.42 moles
The molality is 0.42

5. Describe how to prepare a 400 ml ,1:8 dilution of a disinfectant solution from a stock solution provided using water as your diluent.

Since DF=Vf / Vi thus Vi = Vf / DF
DF is 8
Vi = 400 / 8
= 50 ml.
To prepare, we need 50ml of the stock solution and make up the volume to 400ml with water

6. You are provided with 3ml of a 100 mg/ml stock solution of ampicillin and requested to prepare dilute it a final concentration of 25mg/ml and final volume of 200µl. Calculate the volume of stock solution needed? Describe the preparation process.

$C_1 \times V_1 = C_2 \times V_2$
C_1 = 100 mg/ml, C_2 = 25mg/ml, V_2 = 200µl, V_1 = ?
$100 \times V_1 = 25 \times 200$

$V_1 = (25 \times 200) / 100$

$= 50\mu l$

To prepare, we need 50µl of the stock solution and make up the volume to 200µl with water.

NOTE: I did not convert volume!!

7. A 100.0 mL of 2.500 M KBr solution is on hand. You need to prepare a 0.5500 M KBr. What is the final volume of solution that results?

$C_1 \times V_1 = C_2 \times V_2$

$C_1 = 2.5$ M, $C_2 = 0.55$ M, $V_1 = 100$ml, $V_2 = ?$

$2.5 \times 100 = 0.55 \times V_2$

$V_2 = (2.5 \times 100) / 0.55$

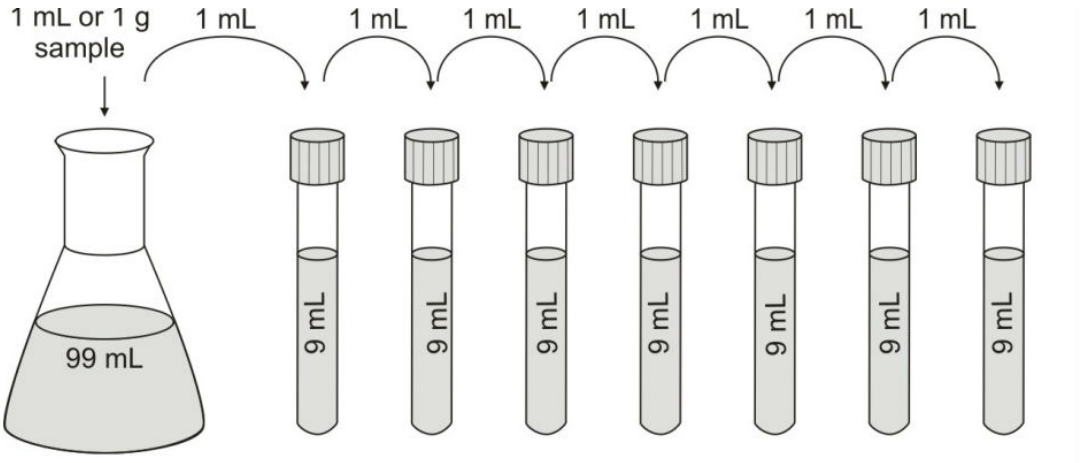
$V_2 = 454.55$ml.

The final volume of the solution is 454.55ml

8. From the following serial dilution answer the following (stock solution is 0.4M);

a- The dilution factor ?

b- Calculate the concentration of tube 4 and 7 in the serial dilution .



a- DF:

DF= Vf / Vi

$= 10 / 1$

DF = 10

b- Serial dilution:

For tube 4 = $10 \times 10 \times 10 \times 10 = 10000$. The concentration is $0.4/10000 = 4 \times 10^{-5}$ M

For tube 7 = $10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 = 10000000$. The concentration is $0.4/10000000 = 4 \times 10^{-8}$M