Tutorial 1

Lecture 3

Questions

- Q1: Calculate the following:
- A)The weight in grams of 0.45 moles of glucose?
- B)The weight in grams of $1*10^{23}$ molecules of NaCl?
- C)The number of molecules in 2.25g glycine?
- **A)** No. of moles = wt_g /MW thus, wt_g = No. of moles * MW
- MW of glucose = (12*6) + (1*12) +(16*6) = 180g/mole.
- wt_g = 0.45 *180 = 81 g.
- ----------
- **B)** 1 mole has 6.023 * 10^{23}

  ? mole has 1 * 10^{23}

= 0.166 mole.

- MW of NaCl = (1* 23) + (1* 35.5)= 58.5g/mole.
- wt_g = 0.166 * 58.5 = 9.71 g.

Questions Continue

- **C)**
- MW 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

$=0.03 * 6.023 * 10^{23}$

$= 0.18 * 10^{23}$

Questions Continue

- Q2: Calculate the normality of the following solutions:
- A) 250ml of HCl containing 18.25g of HCl
- B) 49 g of H_2SO_4 in 250ml?
- **A)** N = No. of equivalents / $V_{(L)}$
- No. of equivalents = wt_g of solute / equivalents weight
- EW= MW of solute / n
- MW of HCl= (1*35.5) + (1*1) = 36.5g/mole.
- n=1
- EW= MW 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.

Questions Continue

- **B)**
- MW of H_2SO_4 = (2*1) + (1*32) + (4*16) = 98g/mole.
- n=2
- EW= MW 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.

Questions Continue

- Q3: 12.25g of H_3PO_4 was dissolved in water and the volume made up to 100ml calculate the normality of the solution?
- **A)** *N* = M * n
- *M* = No. of moles of solute / $V_{(L)}$
- No. of moles = wt_g /MW
- MW of H_3PO_4 = (3*1) + (1*31) + (4*16) = 98g/mole.
- No. of moles = wt_g /MW
- = 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.

Questions Continue

- Q4: 20g of NaCl was dissolved in 200ml of water what is its W/V%?
- **A)** 20 g in 200 ml
- ? in 100 ml
- = 10g NaCl in 100 ml water so the W/V% is 10
- Q5: How many ml of 0.8M 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
- $C_1 V_1 = C_2 V_2$
- 0.8 * V1= 0.4 * 200
- 0.8 * V1= 80
- V1= 80 / 0.8
- V1 = 100 ml
- i.e: 100 ml of the 0.8M solution is needed and make up the volume to 200ml with distilled water.

Questions Continue

- Q5: How many ml of 0.8M acetic acid (CH_3COOH) are needed to prepare 200ml of 0.4N acetic acid?
- OR YOU CAN USE THIS WAY
- $N = M * n$ 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 *V
- = 0.4 * 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 *1000) / 0.8
- = 100 ml i.e: 100 ml of the 0.8M solution is needed and make up the volume to 200ml with distilled water.

Questions Continue

- Q6: Calculate the molarity and the normality 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
- MW $MgCl_2$= (1*24) + (2*35.5) = 95g/mole.
- No. of moles = wt_g /MW
- = 10/ 95 = 0.1 mole.
- *M* = No. of moles of solute / $V_{(L)}$
- = 0.1 / 0.1
- = 1 molar.
- N = M * n
- n= 2
- N= 1 * 2
- = 2 normal.

Questions Continue

- Q7: How would you prepare 0.2L of 0.3% W/V% of $MgCl_2$?
- 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 make up the volume to 200ml with distilled water.

Questions Continue

- Q8: 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*1) + (1*32) + (4*16) = 98g/mole.
- *M* = No. of moles of solute / $V_{(L)}$
- No. of moles = M * $V_{(L)}$
- = 0.23 * 2 = 0.46mole
- wt_g = No. of moles * MW
- = 0.46 * 98 = 45.08g
- 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.

Questions Continue

- Q9: 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.
- MW of H_2SO_4 = (2*1) + (1*32) + (4*16) = 98g/mole.
- No. of moles = wt_g /MW
- thus wt_g = No. of moles * MW
- = 6.8 * 98
- = 666.4g
- The weight of solution = weight of solvent + weight of solute.
- = 1000 + 666.4
- = 1666.4g
- V= wt /ρ
- = 1666.4 / 1.84
- = 905.65ml
- Since 6.8 mole of solute in 905.65 ml of solution
- ? mole of solute in 1000 ml of solution
- = 7.5 molar.

Questions Continue

- Q10: A solution of H_2SO_4 is 4% W/W% ,density is 1.84g/ml. Calculate the molarity, normality and molality?
- **A) Molarity**
- MW 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 /MW
- = 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.

Questions Continue

- **B) Normality**
- N = M * n
- n= 2
- N= 0.74 * 2
- = 1.48 normal.
- **C) 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