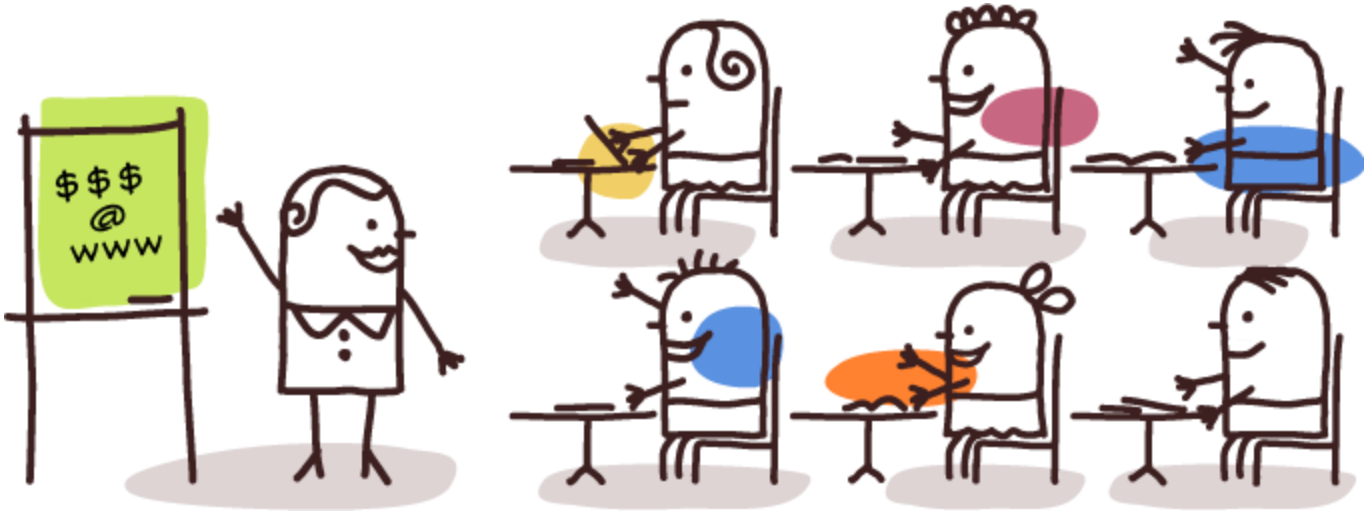

TUTORiAL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Q1: Calculate the following:

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

No. of moles = wt_g /MW

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)The weight in grams of $1*10^{23}$ molecules of NaCl?

1 mole has $6.023 * 10^{23}$ **(Avogadro's number)**

? mole has $1 * 10^{23}$

→ no of moles = 0.166 mole.

MW 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 2.25g glycine ($C_2H_5NO_2$)?

MW of glycine = (2*12) + (1*14) + (2*16) + (5*1) = 75g/mole.

1 mole has 75g

? mole has 2.25g

→ no of moles = = 0.03 mole.

Since 1 mole→ $6.023 * 10^{23}$ **(Avogadro's number)**

0.03 mole→ ? molecules

→ no. of molecules = $0.03 * 6.023 * 10^{23}$

$= 0.18 * 10^{23}$ molecule

Q2: Calculate the normality of the following solutions:

A) 250ml of HCl containing 18.25g of HCl

Given values:

wt= 18.25g

V=250 ml =0.25 L

Mwt = 35.5+1= 36.5g/ mol

n=1 **($HCl \rightarrow H^+ + Cl^-$)**

N=?

N = No. of equivalents / $V_{(L)}$

No. of equivalents = wt_g of solute / EW

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.

B) 49 g of H_2SO_4 in 250ml?

No.of moles= wt / mwt

= 49/98

= 0.5 moles

M= no.of moles/ $V_{(L)}$

= 0.5/0.25 =2 M

N= M x n

= 2 x 2

= 4 normal.

Given values:

wt=49 g

V=250 ml =0.25 L

Mwt = (2*1) + (1*32) + (4*16) = 98g/mole

n=2 **($H_2SO_4 \rightarrow 2H^+ + SO_4^-$)**

N=?

Q3: 12.25g of H_3PO_4 was dissolved in water and the volume made up to 100ml calculate the normality of the solution?

N = M * n

M = No. of moles of solute / $V_{(L)}$

No. of moles = wt_g /MW

= 12.25 / 98

= 0.125 mole.

Given values:

wt=12.25 g
V=100 ml =0.1L
Mwt= (3*1) + (1*31) + (4*16) = 98g/mole.
n=3 **($H_3PO_4 \rightarrow 3\ H^+ + PO_4^-$)**
N=?

M = No. of moles of solute / $V_{(L)}$

= 0.125 / 0.1

= 1.25 molar

N = M * n

= 1.25 * 3

= 3.75 normal.

Q4: 20g of NaCl was dissolved in 200ml of water what is its W/V%?

20 g in 200 ml

? in 100 ml **(according to w/v% definition)**

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

Note : make sure that the units are the same

Q5: How many ml of 0.8M acetic acid (CH_3COOH) are needed to prepare 200ml of 0.4N acetic acid?

Given values:

M=0.8M

V_1=?

N= 0.4 N

V_2=200 ml

n=1 **($CH_3COOH \rightarrow CH_3COO^- + H^+$)**

N = M * n so M = N/n

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.

Q6: Calculate the molarity and the Osmolality of a 10% W/V% $MgCl_2$ solution?

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.

Given values:

W/V%=10%

From w/ v% → wt= 10 g V= 100 ml =0.1L

n=3 ($MgCl_2$ → $Mg^+ + 2\ Cl^-$)

MW = (1*24) + (2*35.5) = 95g/mole.

M=?

O=?

O = M * n

= 1 * 3

=3 Osmolarity.

Q7: How would you prepare 0.2L of 0.3% W/V% of $MgCl_2$?

From w/v% → 0.3 g in 100 ml

? g in 200 ml (convert from L to ml [0.2 x 1000])

= (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.

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?

Given values:

M= 0.23 M

V= 2L

MW = (2*1) + (1*32) + (4*16) = 98g/mole

W/W%=92% = 0.92 (as decimal)

SG = ρ = 1.84 g/ml

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 **(from w/w%)**

45.08g of H_2SO_4 required solution in ?g solution

= (45.08 * 100) / 92 = 49g of solution

Or by applying :

Wt (g) = V (ml) ? x w/w% as decimal x SG

V= wt /ρ = 49/ 1.84 → **V= 26.6ml**

So 26.6ml of the stock solution is taken then complete up the volume to 2 liters with distilled water.

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 **(wt of solute)**

The weight of solution = weight of solvent + weight of solute.

= 1000 + 666.4

= 1666.4g

(since M definition requires the volume of solution)

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 → **M= 6.04 molar.**

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

Given values:

w/w%=4%

From w/w% →

wt of solute = 4 g

Wt of solution= 100 g

Mwt = (2*1) + (1*32) + (4*16) = 98g/mole

n=2 **(H_2SO_4 → $2H^+ + SO_4^-$)**

M, m, N=?

A) Molarity

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 = 0.05435 L

M = no of moles/ V (L)

= 0.04 / 0.05435

→M= 0.74 molar.

B) Normality

N = M * n

n= 2

N= 0.74 * 2

→N = 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