COLLEGE OF EDUCATION FOR PURE SCIENCES

DEPARTMENT OF CHEMISTRY

FIRST YEAR LECTURE NO.4

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Questions and solutions in concentration and %

Q1\ Asaturated solution of potassium chloride in $20c^0$. Calculate %w\w and (M) concentration if it contains 298 g/l and D=1.17 g/cm^3.

Notice/ At.wt= K=39, Cl=35.5,

M.wt $_{kcl}$ = 39x1+35.5x1=74.5 g/mole.

D= $\frac{w}{v}$ ⟹ w of solvent = D x v = 1.17g/cm^3 x1000cm^3

W of solution = 1170 g

%w/w = $\frac{298}{1170}$x 100 = 25.47%

M= $\frac{w}{M.wt} x \frac{1000}{vml}$ =

$$M = \frac{298}{74.5} X \frac{1000}{1000} = 4 \text{ mole/L}$$

Q2/ What water weight is required to disolve 10 grams of sodium chloride to obtain asolution of equal weight 8.0%

%w/w= $\frac{wt\ of\ solute}{wt\ of\ solvent + wt\ of\ solute}$ x100%

8.0% = $\frac{10}{10 + x}$ x100% =

80 + 8x =1000 ⟶ 8x = 1000 – 80 ⟶ x=920/8 =115g

Q3/ Calculate the Molarity and Normality of a solution containing 10.6g of sodium carbonate in one liter of aqueous solution .AT.WT: C=12 , O =16 , Na =23 g/mole

M.wt of Na_2CO_3 = 23X2 + 12X1 +16 X3 = 106 g/mole.

M= $\frac{wt}{M.wt} x \frac{1000}{vml}$ =

M = $\frac{10.6\ g}{106 g/mole} x \frac{1000}{1000}$ = 0.1M

N = $\frac{wt}{eq.wt} X \frac{1000}{v\ (ml)}$ =

*Eq. wt = $\frac{M.wt}{n}$ = $\frac{106}{2}$ =53 g/eq

N= $\frac{10.6\ g}{53 g/eq} x \frac{1000}{1000}$ =0.2 N

Or

يمكن ايجاد التركيز النورمالتي من العلاقه التاليه:

N = n . M

N = 2 X 0.1 = 0.2

Q4/ Calculate the number of grams of solute in

(a) 1Liter of 0.2N $Ba(OH)_2$ solution . At.wt H=1, O = 16 Ba=137.

Eq.wt $Ba(OH)_2$ = $\frac{M.wt}{n} = \frac{137+(16x2+1x2)}{2} = \frac{171}{2}$ = 85.5 g/eq

N = $\frac{wt}{eq.wt} X \frac{1000}{v\ (ml)}$ =

Wt = N X eq.wt x $\frac{v}{1000}$ = N X eq.wt x v (L) =

= 0.2 x 85.5 x 1L = 17.14 g of $Ba(0H)_2$

(b) 5 Liter of 0.2N NaOH solution. At.wt;H =1,O =16,Na=23 g/mole.

Eq.wt NaOH $= \frac{M.w}{n} = \frac{23x1+16x1+1x1}{1} = 40$

N $= \frac{wt}{eq.wt} X \frac{1000}{v\ (ml)} =$

Wt = N X eq.wt x v (L) =

Wt = 0.2 x 40 x5L =

Wt = 0.2 x 40 x 5= 40 g of NaOH

(c) 2 Liter of 0.1M H_2SO_4 .At.wt; H= 1, 0 =16,S =32 g/mole.

M.wt = 2x1 +32x1 +16x4 =98 g/ mole

M $= \frac{wt}{M.wt} X\ v(L) =$

Wt g = M. M.wt .V(L) =

Wt= 0.1X 98X 2 L=19.6g

Q5/ How many grams of 0.2N sodium carbonate in 250ml solution? (M.wt=106 g/mole)

Eq.. wt Na $_2CO_3 = \frac{M.w}{n} = \frac{106}{2} =$ 53 g/eq

N $= \frac{wt}{eq.wt} X \frac{1000}{v\ (ml)} =$

Eq.wt=M.wt/n

Wt = N X Eq.wt x $\frac{v\ (ml)}{1000} =$

$= 0.2 \times 53 \times \frac{250}{1000} = 2.650g$

Q6/ Calculate the number of equivalent weights (3 mole H_3PO_4)

n. Eq= л* x n = 3 x 3 =9

Q7/Calculate the normality (N) of solution result from dissolving 0.5g of $Cu(OH)_2$ in100ml of D.W.distilled water.

At.wt/ Cu=63.5 ,O=16 ,H=1

M.wt $_{cu(OH)2}$ =63.5 +2X16 + 2X1= 97.5 g/mole

Eq.wt= $\frac{M.wt}{n}$ =$\frac{97.5}{2}$ =48.75

$N = \frac{wt}{eq.wt} X \frac{1000}{v\ (ml)} =$

$N = \frac{0.5}{48.75} X \frac{1000}{100} = 0.1025\ N$

Q8/ Calculate of solvent volume required to dissolved 20g from potassium cyand KCN to make 0.3M solution .

At.wt / K=39 ,C=12 ,N=14

$M = \frac{wt}{M.wt} x\ V(L) =$

M.wt KCN = 39 X1 +12X1 +14 X1 =65 g/ mole.

$V(L) = \frac{.wt}{M\ X\ M.wt} = \frac{20}{0.3\ X65} = 1.02$ L.

Q9/How many ml of a 2.50M NaOH solution are required to make 525ml of a 0.15M NaOH solution ?

$M_1\ V_1 = M_2\ V_2$

$2.5\ XV_1 = 0.15\ X\ 525$

$V_1 = \frac{0.15\ X\ 525}{2.5} = 31.5$ ml

Q10/ Calculate of mole Fraction to Methanal 8.5g dissolved in 224g disitled water .At.wt; H =1,C =12 ,O =16

Mole fraction $CH_3OH = \frac{NO.of\ moles\ (cH30H)}{NO.of\ mole(cH30H)+NO.of\ mole(H2O)} =$

No.of mole(CH_3OH) $= \frac{Wt}{M.wt} = \frac{8.5\ g}{(12+4X1+16X1)} = 0.26mole$

No.of mole(H_2O) $= \frac{Wt}{M.wt} = \frac{224\ g}{(2x1+16x1)} = 12.4$ mole.

***Mole fraction $_{CH3OH} = \frac{0.26}{0.26+12.4} = 0.02$

Q11/ What volume of 0.12M H_2SO_4 must be added to exactly 500ml of 0.09M H_2SO_4 obtain 0.1M H_2SO_4

500 X 0.09 +V X0.12 =0.1(V+500)

V=250ml.

Q12/ What weight of 14%w/w aqueous solution of substance B must be added to 35g of 6%w/w aqueous solution of substance B to obtain 7%w/w solution

w X 0.14 + 35 X 0.06 = (35+w) X 0.07

W= 5g of 14%w/w

Q13/Calculate the number of moles and meli moles in;

(1) 5.76 gm potaissum iodate ;

At.wt;I =127 , K =39.

No.of moles $=\frac{wtkl}{M.wt\ kl}$ =

M.wt(KI)= (39x1) + (127x1) =166

No.of moles = 5.67/166 $=3.47x10^{-2}$

NO.of mmole =No of mole x 1000

$=3.47x10^{-2}$ x 1000 = 34.7 .

(2) 6gm of acetic acid

M.wt.(CH_3COOH)= (12 x2)+(1x4)+(16x2)=60

No.of moles=6.0/60=0.1

No.ofm moles =0.1 x 1000=100

Q14/Prepare :

(1) 500 mililiter of 0.2M from silver nitrate (salt)

M.wt($AgNO_3$) =(108 X1) + (14 X1) +(16 X 3)=170

$M = \frac{wt}{M.wt} \; x \; \frac{1000}{vml}$

$Wt = M \; X \; M.wt \; x\frac{v}{1000} =$

$Wt = (0.2 \times 170 \times \frac{500}{1000}) = 17 \; g$

يتم وزن 17غرام من ملح نترات الفضه واذابتها في 500 مل من الماء المقطر.

(2) 2Liter of 0.1M from 0.5M of solution

$M_1 V_1 = M_2 V_2$

0.5 X V1 = 0.1 X 2000

V_1= 0.1 X 2000 /0.5

V_1 = 400ml (or) V_1=0.4L

Q15/The molecular weight of perchloric acid is 100.5 , the density is 1.6 , the percentage concentration is 70%

Calculate :

(1) Molar concentration of solution .

$$M = \frac{10X\ P\ XD}{M.wt} =$$

$$M = \frac{10\ X\ 70\ \ X1.6}{100.5} = 11.14 \text{ mole /L}$$

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(2) Nomber of grams of the acid in each liter ;

Wt(g) = M X M.wt xv(L) =

Wt(g) = 11.14 x 100.5 x1L =1121 g.

Q16/ Calculate the number of grams of sodium chloride which used for preparing 500ml of 0.85% (w/v) solution.

$$\%(w/v)=\frac{Wt.(gm)}{V.(ml)}\ x\ 100$$

Wt.(gm) =(% X V) / 100

=(0.85 X 500) / 100

=4.25g.

Q17/ How many grams of sodium chloride which used for preparing a solution of 100 ppm of sodium in 250 ml?

100ppm = 100mg/L

$100ppm_{Na}$ = 0.1 gm/L

= 0.1 X 250/1000

= 0.025gm/250ml

اما باستخدام طرقة النسبه والتناسب:

	Na	Nacl
M.wt	23	58.5
Wt	0.025	X

X= 0.0636 gm of Nacl

او باستخدام القانون التالي :

$$g = ppm \times \frac{M.wt}{At.wt} =$$

$$= 0.025 \times \frac{58.5}{23} = 0.063.$$

Q18/Calculate the volume percentage concentration (%V/V) for solution of 50 ml of Ethanol in 200ml distilled water?

Vol.of solution = vol of solute + vol of solvent

=50 + 200 = 250ml

$$\%V/V = \frac{V\ of\ solute}{V\ .of\ solution} \quad X100$$

$$\%V/V = \frac{50}{250} \quad X100 \quad = 20\%V/V$$

Q19/Calculate the weight percentage concentration (%w/w) for a solution which prepared by dissolving 5grams of silver nitrate in 100ml of distilled water?

$$D\ of\ water = \frac{wt}{v.}$$

wt of solvent =D(solvent) X V

=1.00 X 100 =100

Wt of solution =wt of solvent + wt of solute

=100+5 =105

$$(\%w/w) = \frac{wt.of\ solute}{wt.of\ solution} \quad x100$$

$$(\%w/w) = \frac{5\ g}{105\ g} \quad x100 = 4.76\%$$

Q20/ If the ratio of weight by volume (w/v) for a Glucose solution is 5% , Calculate the number of Glucose grams dissolved in a liter.

$$\%w/v = \frac{wt\ of\ solute}{v.of\ solution} \quad x\ 100$$

Wt of solute = %w/v x V .of solution /100

$$= \frac{5 \ X \ 1000}{100} = 50 \text{ g.}$$

Q21/1Liter solution of acetic acid containing 80 grams of the acid at $20c^0$, calculate the Molar , Normal , molali and the weight percantag concentration for the solution

NOTE: the density of the acetic acid is 1.099 gm/cm^3 .

At.wt ; H =1, C =12, O = 16.

M.wt CH_3 COOH =12X2 +4X1 +16 X2 =60

$$M = \frac{W\,t.}{M.wt} \times \frac{1000}{V\,(ml)} = \longrightarrow$$

$$= \frac{80}{60} \times \frac{1000}{1000} = 1.34 \text{ mole /L}$$

$N=nM \longrightarrow N = 1 \times 1.34 \longrightarrow N=1.34$ eq/L

D =wt / V ⟶ wt. of solution = D X V

Wt. of solution = 1.099 X1000 =1099g

$$m = \frac{Wt}{M.wt} \ x \frac{1000}{Wt.solvent} =$$

wt.solution =wt. solute + wt solvent

$$m = \frac{80}{60} \times \frac{1000}{1099-80} = 1.32 \text{ mole /Kg}$$

$$W/W\% = \frac{wt\ solute}{wt\ of\ solution} \times 100$$

$$W/W\% = \frac{80}{1099} \times 100 = 7.27\%$$

Q22/ 50 grams of solution of 25%(w/w) is mixed with 43gm of 35%(w/w) of sodium chloride calculate the new percentage concentration .

% = 100 25

50 x

X =50 X 25 / 100 =12.5g

% = 100 35

43 x

X = 43 X 35 / 100 = 15g

% = {12.5 + 15 / 43+ 50} X 100%

= 29.59%

Q23/ Calculate the Molar concentration for the sulfuric acid that contain 4.9gm in 400ml .

{The molecular weight(M.wt) of sulfuric acid = 98 }

$$M = \frac{wt}{M.wt} x \frac{1000}{vml} = \frac{4.9}{98} X \frac{1000}{400} = 0.125 \text{ mole /L}$$

Q24/ How many grams of silver nitrate are needed for preparing a solution has a concentration of 0.125M in 500ml .

$$Wt(g) = M \times M.wt \times \frac{V}{1000} =$$

$$= 0.125 \times 169.9 \times \frac{500}{1000} = 10.62g$$

Q25/ How many melimoles of a solute dissolved in a solution of 150ml has a concentration of 0.025M .

No.of melimoles = M X V

= 0.025 X 150 = 3.75 melimoles

Q26/ How many grams of sodium sulfate which is needed for preparing 200ml of a solution has a concentration of 0.5 Normal. (M.wt Na_2SO_4 =142)

$$Eq.wt = \frac{M.Wt}{n} = \frac{142}{2} = 71$$

$$N = \frac{Wt}{Eq.wt} \; X \; \frac{1000}{V(ml)} =$$

$$0.5 = \frac{Wt}{71} \; X \; \frac{1000}{200}$$

$$Wt = 0.5 \times 71 \frac{200}{1000} = 7.1 \text{ g.}$$

Q27/ calculate the Normal concentration for a solution contain 2 equavilant weight for a substance in one liter .

$N = \frac{NO.Eq}{V(L)} \rightarrow$ No.Eq $= \frac{Wt}{Eq.wt} \rightarrow N = \frac{wt}{Eq.wt} \; x\; V\;(L) =$

$N = \frac{2}{1\;L} = 2$ eq /L

Q28 / prepare 0.1N and 0.1M concentration for sulfuric acid in 250ml .

NOTE/ M.wt H_2SO_4 = 98 , Density = 1.09 , percentage concentration = 98%

Eq.wt = $\frac{M.wt}{n} = \frac{98}{2} = 49$

$N = \frac{10\;XP\;Xd}{Eq.wt} = \frac{10\;X\;98\;X\;1.09}{49} = 21.8$ Eq/L

$N_1\;V_1 = N_2\;V_2$

$21.8\;X\;V_1 = 0.1\;X\;250$

$V_1 = \frac{0.1\;X250}{21.8} = 1.147$ml

$M = \frac{10\;XP\;Xd}{M.wt} = \frac{10\;X\;98\;X\;1.09}{98} = 10.9$ mole/L.

$M_1\;V_1 = M_2\;V_2$

$10.9\;X\;V_1 = 0.1\;X\;250$

$V_1 = 2.294$ml

Q29/ Calculate the Normal and Molar concentration for solution contain 3.3 grams of hydrated sodium carbonate ((Na_2CO_3.10 H_2O) in 15ml

NOTE/ M.wt of (Na_2CO_3.10H_2O) = 286g/mole

M.wt =286

Eq.wt = 286 / 2 = 143

$$N = \frac{wt}{Eq.wt} \; x \; \frac{1000}{v} =$$

$$= \frac{3.3}{143} \; x \; \frac{1000}{15} = 1.54 \text{ Eq.L}$$

$$M = \frac{N}{n} = \frac{1.54}{2} = 0.77 \text{ mole /L}$$