TED(10)-1003 B
(REVISION-2010)

Reg No.....
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FIRST SEMESTER DIPLOMA EXAMINATION IN ENGINEERING

TECHNOLOGY-OCTOBER, 2010

**APPLIED SCIENCE-1 (Chemistry)**

(Common except DCP and CABM)

[*Time*:$1^1/_2$ hours]

(Maximum marks:50)

## PART-A

(Maximum marks:4) Marks

(Answer the question in one or two sentences. Each question carries 2 marks)

I)

(a)Define pH of a solution?

(b) What is meant by degree of hardness? (2x2=4)

**Answers**

**I)**

(a) It is the negative logarithm of $H^+$ ion concentration that is pH = -log[$H^+$]

(b) It is the number of parts by weight of $CaCO_3$ present in one million ($10^6$) parts by weights of water. Unit= PPM (Parts Per Million)

## PART-B

(Answer any question. Each question carries 8 marks)

II)

(a) Distinguish between normality and molarity of a solution? 4

(b) Account why the pH of the blood remains constent? 4

III)

(a) What are the important disadvantages of hard water? 4

(b) Give any two examples of nanomaterials ? 4

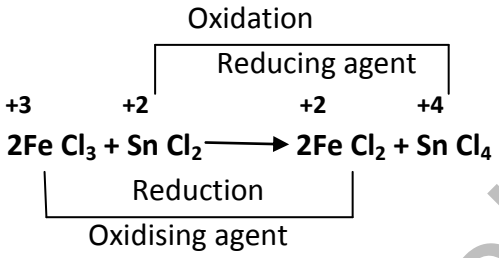
IV)

(a) Point out the oxidizing agent and the reducing agent in the following reaction:

$2FeCl_3 + SnCl_2 \rightarrow 2FeCl_2 + SnCl_4$ 4

(b) Give an account of applications of carbon nanotubes? 4

(2x8=16)




Here oxidising agent is Fe & Reducing agent is Sn

**Answers**

**II)**

**a) Molarity (M):** it is the number of moles of solute present in one litter (1000) of the solution

ie , Molarity M= $\frac{\text{moles of solute}}{\text{Volume of solution in L}}$

**OR** $M = \frac{W_2 \times 1000}{M_2 \times \text{Volume in ml}}$

b)**Normality**: It is the number of gram equivalent of solute present in one litter(1000ml) of the solution

ie, Normality.N = $\frac{\text{Gram equivalent of solute}}{\text{volume of solution in L}}$

$N = \frac{W2 \times 1000}{\text{equivalent mass} \times \text{Volume in ml}}$

**b)** Blood is buffer or due to combined action of $HCO_3^-/CO_3^{2+}$ buffer

**III)**

**a**

**I**) **In laundry :**

i)**Wastage of soap:** because While washing with hard water,soap from lather only after removing all dissolved impurities, so cause wastage of soap.

ii) It cause spot and streak on the cloth.

**II)In steam boiler** :

**i)Wastage of fuel**:- Hard water cause a hard deposit on boiler called scale. It cause wastage of fuel

**ii)Cause explosion of boiler**: Due to intense heat , the scale may crack and Cause explosion of boiler (because it is a heat insulating one.)

iii) **Cause corrosion of the boiler**: Because of the formation of HCl as shown below.

$$MgCl_2 + H_2O \rightarrow Mg(OH)_2 + 2HCl$$

**III)** Not use for cooking, bathing etc.

**b)** It is the study of material having the size 1-100nm range ( nm=Nano meter, $1nm=10^{-9}m$). Examples for nano sized materials are DNA width (2nm), Bucky ball( $C_{60}$)(1nm), Carbon Nano tube(1.3nm), E-collie bacteria

**IV)**

**a)**

Oxidation

Reducing agent

**+3** **+2** **+2** **+4**

$2FeCl_3 + SnCl_2 \rightarrow 2FeCl_2 + SnCl_4$

Reduction

Oxidising agent

Here oxidising agent is $FeCl_3$ & Reducing agent is $SnCl_2$

**b)** i) It strengthen composite material. ii) Act as a molecular size test tube& capsules

for drug delivary. iii) Can act as conductor & semiconductor based on their size. iv) As a tips for analysis of DNA &Proteins by Atomic force Microscopy.

## PART-C

(Answer *two* full questions. Each question carries 15 marks)

UNIT I

V)

(a) calculate the molecular weight of the following compounds:

(1)$C_{12}H_{22}O_{11}$ (2) $FeSO_4(NH_4)_2SO_4.6H_2O$
(At.wt.of Fe= 55.85 & S=32) 3

(b) Illustrate with suitable examples, Lewis acids &bases ? 3

(c)Explain the ionic product of water? 3

(d) Which indicator is suitable for the titration of a strong acid against a weak base and explain ? 3

(e)20 ml KOH solution containing 8.5 g of KOH per liter of the solution is titrated against sulphuric acid solution. The volume of the acid required is 19.2 ml. calculate the normality and strength of the acid solution? 3

**OR**

VI)

(a) Write the molecular formula of the following compounds:

1. Ammonium Sulphate 2. Potassium dichromate 3

(b) Illustrate redox reaction with suitable example? 3

(c) A solution is prepared by dissolving 0.4 g of NaOH in ml of water. What is the pH of the solution? 3

(d) Explain the terms:

1. Standard solution 2.Indicator 3

(e) 5600 ml of hydrogen gas at NTP is required to fill a balloon. Calculate the weight of Zn required to produce this amount of hydrogen by reaction with dil.$H_2SO_4$
(Zn=65) 3

**Answers**

**V)**

**a)**

(i) $C_{12}H_{22}O_{11}$ =(12x12) + (22x1) + (11x6)
=144+22+176
=<u>342</u>

(ii) $FeSO_4 (NH_4)_2 SO_4 6H_2O$ =55.85+32+64+28+8+32+64+12+96
=<u>391.85</u>

**b) Lewis concept:**

| ACID | BASE |
|---|---|
| ❖ Electron pair acceptor<br>❖ Electron deficient<br>❖ Ex: $H^+$,$BF_3$,$AlCl_3$,$FeCl_3$,all cations. | ❖ Electron pair donor<br>❖ Electron rich<br>❖ Ex: $NH_3$,$H_2O$,$OH^-$,all anions. |

**c) Ionic product of water [Kw]** is the product of concentration of $H^+$ and $OH^-$ ions in water.

It was experimentally found that at $25^0$C , $[H^+]=[OH^-]=10^{-7}$ mol/liter.

So Kw =$10^{-7}$ x $10^{-7}$ mol/liter at $25^0$C

OR

Kw = $10^{-14}$ $mol^2/liter^2$

**d)** For the titration of a strong acid against a weak base we use methyl orange indicator. Because for the titration of strong acid+ Vs weak base, pH range at the end point is 3.5 to 7.5.

**e)** Normality of KOH $sol^n$ = $\frac{\text{weight/liter}}{\text{Eqvt weight}}$

= 5.6/56

=<u>0.1N</u>

Here N1= 0.1N $V_1$=20ml $N_2$=? $V_2$=19.2ml

$N_1V_1=N_2V_2$,

$0.1x20=19.2xN_2$

$N_2=\frac{0.1x20}{19.2}$

=<u>0.104N</u>

Strength of sol$^n$ = Nx Equivalent weight

= 0.104x98 /2

=<u>5.19 g/liter</u>

**OR**

**VI)**

**a)**

(i) $(NH_4)_2(SO_4)$ (ii) $K_2 Cr_2 O_7$

**b) Redox reaction:-** Oxidation and reduction together known as Redox reaction.

Ex:-Daniel cell (ie; Zn-Cu Galvanic cell)

Ie , $Zn \rightarrow Zn^{2+}+2e$ (Oxidation).....(1)

$Cu^{2+}+2e \rightarrow Cu$ (Reduction).....(2)

Redox Reaction

(1)+(2)=> $Zn + Cu^{2+} \rightarrow Zn^{2+} + Cu$

**c)** Molarity M= Conc$^n$ of $OH^-$= $\frac{W2}{M2} \times \frac{1000}{\text{Vol in ml}}$

$$= \frac{0.4}{40} \times \frac{1000}{100}$$

$$= \underline{0.1M}$$

$$[H^+] = \frac{10^{-14}}{(0.1)}$$

$$= \underline{\underline{10^{-13}M}}$$

So $pH = -\log[H^+]$

$= -\log[10^{-13}]$

$= \underline{\underline{13}}$

**d)**

**a)Standard solution:** Solution whose concentration is known Ex: 1N NaOH

**b)Indicator:** Substance added to the conical flask to know the end point. It shows colour change in a particular $P^H$ range. Eg: Methyl orange, phenolphthalein, methyl red etc

**e)** $Zn + 2HCl \longrightarrow Zn Cl_2 + H_2$

65 22400ml

? 5600ml

$$\text{Weight of Zn} = \frac{65 \times 5600}{22400}$$

$$= \underline{\underline{16.25g}}$$

UNIT II

VII)

(a) Distinguish between temporary hardness and permanent hardness? 3

(b) One ml of a sample of EDTA solution is found to be equivalent to 1.75 mg $CaCO_3$.If 25 ml of this solution is required by 10 ml of a water sample, calculate the total hardness of water? 3

(c) Explain any two methods for the synthesis of carbon nanotubes? 3

(d) List any three applications of nano materials? 3

(e) What are the important disadvantages of hard water when used in steam boilers? 3

**OR**

VIII)

(a) How will you determine the degree of hardness of water by EDTA method? 3

(b)What are the important properties of carbon nanotubes? 3

(c) How the hardness of water can be removed using ion exchange method? 3

(d) What are the different types of carbon nanotubes? 3

(e) Describe the important characteristics of potable water? 3

(2x15=30)

## Answers

VII)

a) **Temporary hardness:** It is due to $HCO_3$ of Ca and Mg. It can be removed by boiling.

**Permanent hardness:** It is due to Cl-, $SO_4^{2-}$ Of Ca and Mg. It can be removed by ion exchange method using synthetic resins like cation exchanger ($E\text{-}H^+$)or anion exchanger($E\text{-}OH^-$)

b)Out of syllabus

c)

a)**High pressure Carbon Monoxide Deposition Method (HiPCO**):
CO(g)&atoms of iron cluster are heated in a chamber at high pressure. So that Fe breaks the CO molecules as C&$O_2$ by acting as a catalyst. This 'C' atom bind with other 'C' atoms form nanotube lattice. $O_2$ react with unburnt CO form $CO_2$

**b) Chemical Vapor deposition Method (CVD):** Here $CH_4$ is heated in a chamber containing Fe as catalyst at high temperature. So that C-H bond breaks from 'C' atom. This 'C' atom binds with other 'C' atoms form nano tube lattice.

d) i) It strengthen composite material. ii) Act as a molecular size test tube& capsules

for drug delivary. iii) Can act as conductor & semiconductor based on their size. iv) As a tips for analysis of DNA &Proteins by Atomic force Microscopy.

e) **In steam boiler** :

**i)Wastage of fuel**:- Hard water cause a hard deposit on boiler called scale. It cause wastage of fuel

**ii)Cause explosion of boiler**: Due to intense heat , the scale may crack and Cause explosion of boiler (because it is a heat insulating one.)

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$$MgCl_2 + H_2O \rightarrow Mg(OH)_2 + 2HCl$$

**OR**

**VIII)**

**a)**Out of syllabus

**b)**

1.nVery strong

2. High tensile strength & thermal conductivity

3.High Young's modulus ( force required to bent a material)

4. High electrical conductivity

**c)** It can be removed by using synthetic resins like Cation exchanger [E-$H^+$] or anion exchanger [E-$OH^-$] as shown below

**Step 1:**

Hard water passed through a tank containing [E-$H^+$] so the following occur

$$2\ E\text{-}H^+ + Ca^{2+} \rightarrow E_2Ca + 2H^+$$

**Step 2:**

This water coming out of cation exchanger is then passed through anion exchanger [E-$OH^-$]

ie $E\text{-}OH^- + Cl^- \rightarrow ECl + OH^-$

and $H^+ + OH^- \rightarrow H_2O$

**d) Carbon Nano Tube(CNT):** Its structure seemed to be formed by rolling the sheet of graphite in to the shape of cylindrical tube either closed or open at the end

Two varieties of CNT are **SWNT** [Single Walled Carbon Nano Tube, It is like single cylinder] and **MWNT** [Multi Walled Carbon Nano Tube, It contains multiple concentric nano tube cylinder].

Based on orientation of lattice , nano tubes are **Classified** in to three types

**1)**Arm Chair

**2)** Zig Zag.

**3)** Chiral

**e)**

- It should be clear and order less.
- It should be free from micro organisms like bacteria etc.
- It should be free from dissolved gases like $H_2S$,$CO_2$ etc. and minerals like $NO_3^{1-}$, $NO_2^{1-}$ etc.
- It should be free from suspended impurity.
- pH should be in between 6.5 to 8.5