FIRST SEMESTER DIPLOMA EXAMINATION IN ENGINEERING

TECHNOLOGY-MARCH, 2011

APPLIED SCIENCE-1 (Chemistry)

(Common except DCP and CABM)

(Maximummarks:50)   [*Time*:$1^1/_2$ hours]

PART-A

(Maximum marks:4)   Marks

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

I)

(a) Write down the molecular formula of potassium dichromate and ferric sulphate?

(b) Define degree of hardness of water?   (2x2)

Answers

(a)

K$_2$Cr$_2$O$_7$= Potassium dichromate
Fe$_2$(SO$_4$)$_3$= Ferric Sulphate

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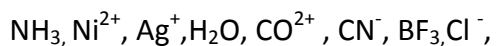
PART-B

(Answer any full questions .in Each question carries 8 marks).

II)

(a) The equivalent mass of a monobasic acid is 63.Its salt with a very weak base is used as an explosive and as a fertilizer. Enlist the acid and base and give the chemical reaction . ?   4
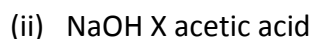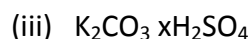
(b) Classify the following as Lewis acid and Lewis base :

NH_3, Ni^{2+}, Ag^+, H_2O, CO^{2+}, CN^-, BF_3, Cl^-,   4

III)

(a)What is acid-base indicator? What type of indicators are used in the following set of titrations:

(i)   NaOH x HCl   (iii) K_2CO_3 xH_2SO_4

(ii) NaOH X acetic acid   4

(b) Relate the diameter range of nano particles and enumerate three other particles coming in the nano size range?   4

IV)

(a) A plywood factory constantly uses deep borewell water directly for running the plant as well as boilers. One day the boiler plant met with an explosion and caused casualities due to superheated steam burns. Examination the reasons for the explosion and suggest a safe method for future?   4

(b) Enumerate the disadvantages of hard water?   4

(2x8=16)

Answers

II)

a) Acid is HNO_3 & Base is K_2CO_3

Chemical equation is $2HNO_3 + K_2CO_3 \rightarrow 2KNO_3 + H_2O + CO_2$
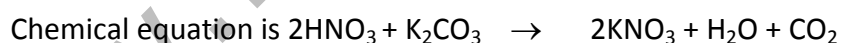
(b)

Lewis acids	Lewis Bases
Ni^{2+}	NH_3
Ag^+	H_2O
CO^{2+}	CN^-
BF_3	Cl^-

III)

a) 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.

(i) Phenolphthalein/Methyl orange

(ii) Phenolphthalein

(iii) Methyl orange

b) 1-100 nm range (nm=Nano meter,1nm=10^{-9}m).Examples for nano sized materials are DNA width(2nm),Bucky ball(C60)(1nm),Carbon Nano tube(1.3nm),E-colie bacteria

IV)

a) The explosion is due to cracking of boiler scale. Scale formation is due to use of hard water. Safer method for future is either use of soft water **or** remove hardness of hard water.

b)

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.

> $$MgCl_2 + H_2O \rightarrow Mg(OH)_2 + 2HCl$$
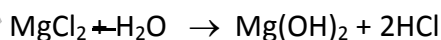
III) Not use for cooking, bathing

PART-C

(Answer one full question from each unit. Each carries 15 mark)

UNIT-I

V)

(a) 3.15 g of oxalic acid is dissolved in 100 ml water, calculate its normality and molarity?   3

(b)Define pH and mention its three uses?   3

(c) Applying the following equation compute the equivalent mass of NH_4OH.

$NH_4OH + HCl \rightarrow NH_4Cl + H_2O$ 3

(d) Write down the balanced equation of combustion of methane in air. Calculate the mass of methane required to produce 55 g of CO_2 gas at STP by burning in air. 3

(e) Write down three chemical equations which involve reduction process?   3

OR

VI)

(a) Calculate the weight of zinc required to produce 2 gm of hydrogen gas at STP conditions from dil. Hydrochloric acid (At wt of Zn 65.5)?   3

(b) Silver nitrate solution is taken in a beaker and a copper metal rod is dipped in I it. The following reaction occurs:

$Cu(s) + 2Ag^+(aq) \rightarrow Cu^{2+}(aq) + 2Ag(s)$

What type of reaction is this? What all changes you can observe during the reaction?   3

(c) What is a buffer solutions ? Give one example each for acid buffer and basic buffer?   3

(d) 40 ml of 0.5normal hydrochloric acid exactly combines with 0.42 g of a chemical substance. Calculate the equivalent mass of the compound?   3

(e)Give the electronic concept of oxidation and reduction .Give one example each for those reactions.   3

Answers

V)

a) $N = \dfrac{W_2 \times 1000}{\text{Eqvt wt} \times \text{Vol in ml}}$

$= \dfrac{3.15 \times 1000}{63 \times 100}$

$= \underline{0.5\ N}$

Molecular mass of oxalic acid=126

Equivalent weight=126/2=63

$$M = \frac{W_2 \times 1000}{M_2 \times \text{Vol in ml}}$$

$$= \frac{3.15 \times 1000}{126 \times 100}$$

= <u>0.25</u> M M_2= ***Molecular mass of oxalic acid=126***

b) It is the negative logerithem of H^+ ion concentration.Its value varies from 0 to 14

  Ie, pH = -log[H^+]

  * To find out the nature of the medium

  * Can calculate the [H^+] ion

  * In textile industry: Acidity of water used for bleaching cotton is harmful. So they should control

c) Here 1 mol NH_4OH neutralized by 1 mol of HCl. So equivalent weight of NH_4OH=

$$= \frac{\text{Molecular Mas}}{\text{Acidity}}$$

$$= \frac{35}{1}$$

= <u>35</u>

d) Balanced equation is $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$

                 16g   44g

                 ?   55g

$\therefore$ Mass of methane = $\dfrac{16 \times 55}{44}$

$$= \underline{20\ g}$$

e)

1. $Cu^{2+} + 2e^- \rightarrow Cu$
2. $Zn^{2+} + 2e^- \rightarrow Zn$
3. $Cl^- + 1e \rightarrow Cl^-$

OR

VI)

a) Balanced equation is $Zn + 2HCl \rightarrow ZnCl_2 + H_2$

$$65.5 \qquad\qquad\qquad 2g$$

$$? \qquad\qquad\qquad 2g$$

$\therefore$ Weight of Zn $= \dfrac{65.5 \times 2}{2}$

$$= 65.5 \text{ g}$$

b) Redox Reaction: Here solution changes to Blue color. Because Cu displaces Ag from its solution (or oxidation occure to Cu).

c) Buffer solution: Solution which resist change in pH when small amount of acid or base added to it. Ex: $CH_3COOH + CH_3COONa$, $NH_4OH + NH_4Cl$

d) $N = \dfrac{W_2 \times 1000}{Eqvt \ wt \times Vol \ in \ ml}$

$\therefore$ eqvt weight $= \dfrac{W_2 \times 1000}{N \times Vol \ in \ ml}$

$$= \dfrac{0.42 \times 1000}{0.5 \times 40}$$

$$= \underline{21}$$

e)

Oxidation: Losing of electron is called oxidation. During oxidation, oxidation number increases   ex: $Zn \rightarrow Zn^{2+} + 2e$

Reduction: Gaining of electron is called reduction. During reduction, oxidation number decreases Ex : $Cu^{2+} + 2e \rightarrow Cu$

UNIT-II

VII)

(a) Mention three uses of nano particles in medicine?   3

(b) Propose and comment on the structure of carbon nanotubes?   3

(c) Give reason of hardness of water and how we can remove temporary hardness.3

(d) Propose a suitable method for the purification of a water sample containing dissolved salts in small quantities?   3

(e) What is sterilization of water? Mention the different methods of sterilization of water?

OR

VIII)

(a) Propose the chemical vapour deposition method of carbon nanotube synthesis.3

(b) Suggest the peculiar properties and applications of carbon nano particles in near future?   3

(c) Give two advantages of hard and soft water?   3

(d) Write down the EDTA titration method of hardness estimation of water?   3

(e) Give the use of alum in flocculation process of water purification?   3

(2x15=30)

Answers

VII)

a)

1. Act as molecular type test-tube and capsule for drug delivery

2. As a tips for analysis of DNA and proteins by a atomic force microscopy.

3. Can detect and locate tumors accurately.

b) 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 a single cylinder) and MWNT (multi Wallled 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

c)It is due todissolved impurities like HCO_3^-, Cl^-, SO_4^{2-} of Ca and Mg. Temporary

hardness is due to HCO_3^- of Ca and Mg. It can be removed by boiling.

$$M(HCO_3)_2 \rightarrow MCO_3 + H_2O + CO_2 \quad M= Ca \text{ and } Mg$$
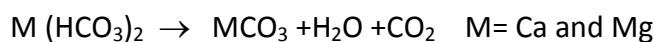
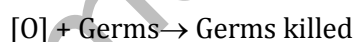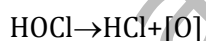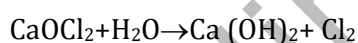**d) Boiling :** By boiling the dissolved salt settle down & and can be removed by filtration.

e) Sterilization it is the destroying of disease causing bacteria and micro organism using fertilizers or disinfectant like bleaching powder etc. These are

a)Chlorination: By passing chlorine gas or chlorine water. Here Hypo chlorous acid produced killed the germs as shown below

$Cl_2 + H_2O \rightarrow HOCl$ (Hypo chlorous acid)

$HOCl \rightarrow HCl + [O]$

$[O] + Germs \rightarrow$ Germs killed
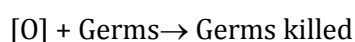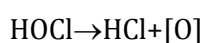
It need less space, Cl_2 available in pure form are advantages, but excess Cl_2 cause unpleasant smell, taste etc

b)Using Bleaching Powder : Mix 1kg $CaOCl_2$ with 1000 kilo liter water. By oxidizing action of Cl, it kills the germs as shown below

$CaOCl_2 + H_2O \rightarrow Ca(OH)_2 + Cl_2$

$Cl_2 + H_2O \rightarrow HOCl$ (Hypo chlorous acid)

$HOCl \rightarrow HCl + [O]$

$[O] + Germs \rightarrow$ Germs killed

c) By Passing Ozone(O_3): On passing O_3 through water , following reaction occure.

$O_3 \rightarrow O_2 + [O]$
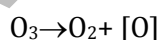
here nascent oxygen produces killed the germs as shown below by oxidizing action

$[O] + Germs \rightarrow$ Germs killed
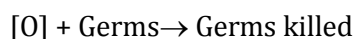
Its excess is not harmful

d) By passing UV radiation: so it kills the germs. It is expensive and is adopted when chemical methods are not suitable

OR

VIII)

a) Chemical Vapor Deposition Method(C V D) : Here CH_4 heated in a chamber containing Fe as catalyst at high temperature. So that C-H bond breaks form 'C' atom. This C atom bind with other C atom form nanotube lattice.

b)) 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.

c)

Soft water	Hard water
➢ Give lather readily with soap	➢ Does not give lather with soap
Advantages:	➢ Contains dissolved impurities like HCO_3^-,$SO_4^{2-}$of Ca and Mg
➢ Used for cooking.	**Advantages:**
➢ Bathing	➢ Contains Ca^{2+} and Mg^{2+} ions required for health
➢ In boiler	➢ Does not dissolve Pb from lead pipe
➢ In laundry purposes etc	

d) Not in syllabus

e)Alum is used to remove finely divided particle from water. While adding alum ,it is settle down & Can be removed by filtration .