Engineering Chemistry VTU CBCS Question Paper Set
2018
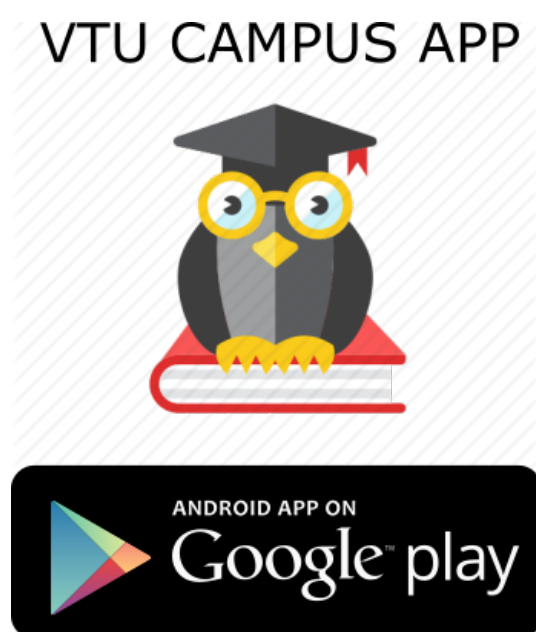
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CBCS Scheme

USN

First Semester B.E. Degree Examination, Dec.2017/Jan.2018
Engineering Chemistry

Time: 3 hrs.

Max. Marks: 100

Note: *Answer any FIVE full questions, choosing one full question from each module.*

Module-1

1 a. What are reference electrodes? Describe the construction and working of Calomel electrode, mention the uses. **(07 Marks)**
   b. Define Battery. Explain construction, working and uses of Ni-metal Hydride battery. **(07 Marks)**
   c. What are fuel cells? Explain the construction and working of Methanol oxygen cell. **(06 Marks)**

OR

2 a. Define single Electrode Potential? Derive Nernst equation for single electrode. **(07 Marks)**
   b. What are concentration cells? The cell potential of Ag concentration cell,

   $$\frac{Ag_{(s)}}{AgNO_3}(0.001M)(AgNO_3(XM)/Ag_{(s)}$$ is 0.0659 V at 25°C. Write the cell reactions and

   calculate the value of X. **(07 Marks)**
   c. Write a note on: (i) Capacity (ii) Cycle life (iii) Voltage **(06 Marks)**

Module-2

3 a. Define corrosion. Explain electrochemical theory of corrosion by taking Iron as an example. **(07 Marks)**
   b. What is Anodizing? Explain anodizing of aluminium, mention uses. **(07 Marks)**
   c. Define Electroless plating. What are the differences between electro plating and electroless plating? **(06 Marks)**

OR

4 a. What is differential aeration corrosion? Explain pitting corrosion with anode and cathode reactions. **(07 Marks)**
   b. Define metal finishing? Explain electroplating of Nickel by Watt's bath, mention the uses. **(07 Marks)**
   c. What is cathodic protection? Explain the sacrificial anode method and impressed current method. **(06 Marks)**

Module-3

5 a. Define GCV and NCV? How calorific value of a solid/liquid fuel is determined using bomb colorimeter. **(07 Marks)**
   b. Define octane and cetane number? What is the objective of reforming of petrol and discuss the various methods of reforming. **(07 Marks)**
   c. What are solar cells? Describe the method of purification of silicon by zone refining. **(06 Marks)**

OR

6 a. A coal sample containing 92% C, 7% H_2 and 3% Ash is subjected to combustion in a bomb calorimeter. Calculate the Gross and Net calorific values. Given that mass of coal sample is 0.85×10^{-3} kg, mass of water in copper calorimeter is 2 kg, water equivalent of calorimeter is 0.75 kg, rise in temperature of water is 2.5°C, latent heat of steam is 2454 kJ/kg and specific heat of water is 4.187 kJ/kg/°C. **(07 Marks)**

b. Describe the production of solar grade Si by union carbide process. **(07 Marks)**

c. Explain the construction and working of a PV cell. **(06 Marks)**

Module-4

7 a. What are polymers? Illustrate the mechanism of addition polymerization by taking vinyl chloride as an example. **(07 Marks)**

b. Describe the manufacture of, (i) PMMA (ii) Kevlar. Mention the uses. **(07 Marks)**

c. Define addition and condensation polymerization process with one example each. **(06 Marks)**

OR

8 a. Define Glass Transition Temperature. Explain any three factors affecting Tg. **(07 Marks)**

b. What are Elastomers? Give the synthesis and applications of, (i) Silicone rubber (ii) Epoxy resin. **(07 Marks)**

c. A polymer sample containing 50, 100 and 150 molecules having molar mass 2000 g/mol, 2500 g/mol and 3000 g/mol respectively. Calculate the number average and weight average molecular mass of polymer. **(06 Marks)**

Module-5

9 a. What is Boiler Feed Water? Explain the differences between scale and sludge formation in boiler. **(07 Marks)**

b. What is desalination? Explain the desalination of sea water by electrodialysis. **(07 Marks)**

c. What are nano materials? Explain the synthesis of nano material by Sol.gel method. **(06 Marks)**

OR

10 a. Define COD and BOD. In COD test 25.5 cm^3 and 12.5 cm^3 of 0.05 N FAS solution are required for blank and sample titration respectively. The volume of the test sample used is 26 cm^3. Calculate the COD of the sample solution. **(08 Marks)**

b. Describe the synthesis of nano materials by chemical vapor condensation process. **(06 Marks)**

c. Write a note on CNT and Dendrimers. **(06 Marks)**

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First/Second Semester B.E. Degree Examination, June/July 2016
Engineering Chemistry

Time: 3 hrs.

Max. Marks: 80

Note: Answer any FIVE full questions, choosing one full question from each module.

Module-1

1   a. Explain the construction and working of silver-silver chloride electrode. **(05 Marks)**
    b. What are ion selective electrodes? Discuss the construction and working of a glass electrode. **(06 Marks)**
    c. Explain the construction and working of Zinc-Air cell. **(05 Marks)**

OR

2   a. Derive Nerst expression for single electrode potential. **(05 Marks)**
    b. Explain the following battery characteristics ;
        i)   Energy efficiency
        ii) Shelf life
        iii) Cycle life **(06 Marks)**
    c. Explain the construction and working of Methanol - Oxygen fuel cell with H_2SO_4 electrolyte. **(05 Marks)**

Module-2

3   a. Explain electrochemical theory of corrosion with an example. **(05 Marks)**
    b. Discuss the differential metal corrosion with an example. **(05 Marks)**
    c. What is electroless plating? Mention the differences between electoplating and electroless plating. **(06 Marks)**

OR

4   a. Discuss the following factors influencing nature of electrodeposit. **(06 Marks)**
        i)   Brighteners
        ii) Levellers and
        iii) pH
    b. Explain electroplating of Decorative chromium. **(05 Marks)**
    c. Discuss the process of Galvanization of Iron sheet. **(05 Marks)**

Module-3

5   a. How Calorific value of a solid fuel is determined using bomb calorimeter? **(05 Marks)**
    b. What is meant by cracking? Describe with a neat diagram, fluidized bed cracking method. **(06 Marks)**
    c. Explain the construction and working of a photovoltaic cell. **(05 Marks)**

OR

6 a. 0.75g of coal containing 2% hydrogen, when burnt in a bomb calorimeter, increased the temperature of 2.7kg water from 27.2°C to 29.7°C. If the water equivalent of calorimeter is 1.2kg. Calculate gross and net calorific value (specific heat of water 4.187kJ/kg/°C, latent heat of steam 2457 kJ/kg). **(06 Marks)**

   b. Explain production of solar grade silicon by union carbide process. **(05 Marks)**

   c. Discuss the zone refining process of purification of silicon. **(05 Marks)**

Module-4

7 a. Explain free radical mechanism of addition polymerization of vinyl chloride. **(05 Marks)**

   b. Give the synthesis and applications of the following polymers ;
   - i) PMMA
   - ii) Polycarbonate. **(06 Marks)**

   c. What are polymer composites? Explain synthesis, properties and applications of Kevlar. **(05 Marks)**

OR

8 a. A polymer sample contains 200 molecules of molecular mass 2000, 300 molecules of molecular mass 3000 and 500 molecules of molecular mass 5000. Calculate number average and weight average molecular masses of the polymer. **(06 Marks)**

   b. What is glass transition temperature? Explain any THREE factors that influence the glass transition temperature. **(05 Marks)**

   c. What are conducting polymers? Give the mechanism of conduction in polyaniline and two applications. **(05 Marks)**

Module-5

9 a. Explain the scale and sludge formation in boiler. **(06 Marks)**

   b. What is desalination? Explain reverse osmosis process of desalination of sea water. **(05 Marks)**

   c. Explain synthesis of nano-material by sol-gel process. **(05 Marks)**

OR

10 a. Define COD. Calculate COD of 25CC of an effluent sample which requires 8.3CC of 0.001M $K_2Cr_2O_7$ for its complete oxidation. **(05 Marks)**

    b. Explain treatment of sewage by activated sludge process. **(06 Marks)**

    c. Explain synthesis of nano materials by precipitation method. **(05 Marks)**

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First/Second Semester B.E. Degree Examination, June/July 2017
Engineering Chemistry

Time: 3 hrs.   Max. Marks: 80

Note: *Answer FIVE full questions, choosing one full question from each module.*

Module-1

1   a. Write Electrode reactions and Net cell reaction of
        i) Nickel – Metal hydride battery   ii)   Methanol – oxygen fuel cell.   **(06 Marks)**
    b. Describe the construction and working of Lithium ion battery.   **(05 Marks)**
    c. Derive Nernst equation for Single Electrode Potential.   **(05 Marks)**

OR

2   a. What are Concentration Cells? Calculate the cell potential of the following cell at 298K.
        $Ag/Ag\,Cl\,(0.005M)\,//\,Ag\,Cl\,(0.5M)/\,Ag$ **(06 Marks)**
    b. Explain the measurement of electrode potential using Calomel electrode as secondary
        reference electrode.   **(05 Marks)**
    c. Define Fuel Cell. What are the differences between Fuel cell and Conventional cell?
        (05 Marks)

Module-2

3   a. What is Galvanisation and Tinning? Explain Galvanisation process by Hot dipping method.
        (06 Marks)
    b. Explain Electrochemical theory of corrosion with an example.   **(05 Marks)**
    c. What is Electroplating? What are the differences between Electroplating and Electroless
        plating?   **(05 Marks)**

OR

4   a. Explain Electroless plating of copper with suitable reactions.   **(06 Marks)**
    b. Describe Electroplating of Nickel using Watt's bath.   **(05 Marks)**
    c. Explain the following factors affecting the rate of corrosion : i) Nature of corrosion product
        ii) Ratio of Anodic to Cathodic area   iii) Conductivity.   **(05 Marks)**

Module-3

5   a. Define Gross calorific and Net calorific value of a fuel. Calculate the gross and net calorific
        value of a sample of coal from following data :   **(06 Marks)**
        Weight of coal = 0.95g   ;   Weight of water = 2500g   ;
        Water equivalent of calorimeter = 400g   ;   Specific heat of water = 4.187 J/g / K ;
        Rise in temperature = 3K   ;   % of Hydrogen in coal = 6
        Latent heat of steam = 2454 J/g/K.
    b. Write a short note on Power Alcohol and Biodiesel.   **(05 Marks)**
    c. Explain Modules, Panels and Arrays of photovoltaic cells.   **(05 Marks)**

OR

6   a. Explain the production of solar grade silicon by Union Carbide process.   **(06 Marks)**
    b. Explain Doping of silicon by diffusion technique to produce n – type and p – type
        semiconductors.   **(05 Marks)**
    c. Describe Synthesis of petrol by Fischer – Tropsch process.   **(05 Marks)**

Module-4

7 a. Explain Free Radical mechanism of addition polymerisation taking vinyl chloride as an example. **(06 Marks)**

b. What are Elastomers? Explain synthesis, properties and applications of silicone rubber. **(05 Marks)**

c. What is Glass Transition Temperature? Explain any two factors affecting glass transition temperature. **(05 Marks)**

OR

8 a. A polymer is found to contain the following composition : **(06 Marks)**
   200 molecules of molecular mass 2000 g/mol,
   300 molecules of molecular mass 3000 g/mol,
   500 molecules of molecular mass 5000 g/mol. Calculate number average molecular weight and weight average molecular weight of polymer.

b. Discuss Structure property relationship of polymers with respect to **(05 Marks)**
   i) Elasticity   ii) Chemical resistivity.

c. Explain the Mechanism of conduction in polyaniline. **(05 Marks)**

Module-5

9 a. Write a note on Nanocomposites. Mention its applications. **(05 Marks)**

b. Discuss the synthesis of nanomaterials by Sol – gel process and by precipitation method. **(06 Marks)**

c. Explain the Activated Sludge treatment of sewage water. **(05 Marks)**

OR

10 a. Define BOD. Discuss the experimental determination of BOD of waste water. **(06 Marks)**

b. 50cm³ of sewage water was refluxed with 20cm³ of 0.1N acidified $K_2Cr_2O_7$. The unreacted acidified $K_2Cr_2O_7$ consumed 10.2cm³ of 0.1NFAS. 20cm³ of 0.1N $K_2Cr_2O_7$ when titrated under identical condition consumed 31.1cm³ of 0.1NFAS. Calculate the COD of sewage water **(05 Marks)**

c. Write a note on Carbon nanotubes. **(05 Marks)**

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CBCS Scheme

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First Semester B.E. Degree Examination, Dec.2015/Jan.2016
Engineering Chemistry

Time: 3 hrs.   Max. Marks: 80

Note: Answer any FIVE full questions, choosing one full question from each module.

Module-1

1   a.   Derive Nernst equation for single electrode potential.   **(05 Marks)**
    b.   What is electrolyte concentration cell? The emf of the cell $Cu/CuSO_{4(0.001M)} \| CuSO_{4(XM)}/Cu$ is 0.0595V at 25°C. Find the value of X.   **(05 Marks)**
    c.   Explain the following battery characteristics :
       i)   Cell potential
       ii)   Capacity
       iii) Shelf life.   **(06 Marks)**

OR

2   a.   Define reference electrode. Discuss the construction and working of calomel electrode.   **(05 Marks)**
    b.   Describe the construction and working of Ni-MH battery. Mention its applications.   **(05 Marks)**
    c.   What is fuel cell? Distinguish between conventional cell and fuel cell.   **(06 Marks)**

Module-2

3   a.   Define corrosion. Explain the electro-chemical theory of corrosion by taking iron as an example.   **(06 Marks)**
    b.   Explain the following factors affecting corrosion.   **(05 Marks)**
       i)   Ratio of anodic to cathodic areas
       ii)   Nature of corrosion product
       iii) Temperature.
    c.   Describe electroplating of nickel using Watt's bath. Mention its applications.   **(05 Marks)**

OR

4   a.   Explain differential aeration corrosion with one example.   **(05 Marks)**
    b.   What is metal finishing? Mention the technological importance of metal finishing. **(06 Marks)**
    c.   Define electroless plating. Distinguish between electroplating and electroless plating.   **(05 Marks)**

Module-3

5   a.   Explain the determination of calorific value of a solid fuel using bomb calorimeter.   **(06 Marks)**
    b.   What is reforming of petroleum? Give any three reactions involved in reforming.   **(05 Marks)**
    c.   What is photovoltaic cell? Explain the construction and working of photovoltaic cell.   **(05 Marks)**

1 of 2

OR

6 a. 0.75g of coal sample (carbon-90%), hydrogen-6% and ash 4%) was subjected to combustion in a bomb calorimeter. Mass of water taken in the calorimeter was 3500g and the water equivalent of the calorimeter was 750g. The rise in temperature was found to be 3.2°C. Calculate the gross and net calorific values of a sample (Specific heat of water = 4.187kJ/Kg/°C ; Latent heat of steam = 2454kJ/Kg)　　**(05 Marks)**

　 b. Explain the modules, panels and arrays of PV cells.　　**(06 Marks)**

　 c. Explain the production of solar grade silicon by Union – Carbide process.　　**(05 Marks)**

Module-4

7 a. Explain the types of polymerization with example.　　**(04 Marks)**

　 b. What is glass transition temperature? Discuss any two factors affecting the glass transition temperature.　　**(06 Marks)**

　 c. Explain the synthesis and applications of the following :
　　　i) Plexi glass
　　　ii) Polycarbonate　　**(06 Marks)**

OR

8 a. In a polymer sample, 20% of molecules have molecular mass 15000g/mol, 45% molecules have molecular mass 25000g/mol remaining molecules have molecular mass 27000g/mol, calculate the number average, weight average molecular mass of the polymer.　　**(06 Marks)**

　 b. Explain the synthesis, properties and applications of silicone rubber.　　**(05 Marks)**

　 c. Explain the mechanism of conduction in polyaniline　　**(05 Marks)**

Module-5

9 a. Explain the scale and sludge formation in boiler.　　**(05 Marks)**

　 b. Define COD. Discuss the experimental determination of COD of waste water.　　**(06 Marks)**

　 c. Write a note on fullerences.　　**(05 Marks)**

OR

10 a. Explain desalination of sea water by ion selective electrodialysis process.　　**(05 Marks)**

　 b. Explain the synthesis of nano materials by Sol-Gel process. Mention its advantages.　　**(06 Marks)**

　 c. Write a note on carbon nano tubes.　　**(05 Marks)**

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CBCS Scheme

USN [   ]   **15CHE12/22**

First/Second Semester B.E. Degree Examination, Dec.2016/Jan.2017
Engineering Chemistry

Time: 3 hrs.   Max. Marks: 80

Note: *Answer FIVE full questions, choosing one full question from each module.*

Module-1

1 a. Describe the construction and working of Li-MnO₂ battery. **(05 Marks)**
   b. Define battery. Explain the following battery characteristics:
      (i)   Electricity storage density.
      (ii) Energy efficiency.
      (iii) Cycle life.
      (iv) Shelf life. **(05 Marks)**
   c. Define reference electrode. Explain the construction and working of Calomel electrode. **(06 Marks)**

OR

2 a. A concentration cell was constructed by immersing two silver electrodes in 0.02 M and 2 M AgNO₃ solution. Write the cell representation, cell reactions and calculate the EMF of the cell at 25°C. **(05 Marks)**
   b. Derive Nernst equation for single electrode potential. **(05 Marks)**
   c. Explain the construction and working of methanol oxygen fuel cell. Mention its application. **(06 Marks)**

Module-2

3 a. What is cathodic protection? Explain how a metal article is protected by sacrificial anodic method. **(05 Marks)**
   b. Explain the following factors affecting the rate of corrosion:
      (i)   Nature of the metal.
      (ii) Ratio of anodic to cathodic areas.
      (iii) pH. **(05 Marks)**
   c. Explain electroless plating of copper with relevant reaction. **(06 Marks)**

OR

4 a. What is metal finishing? Give the technological importance of metal finishing. **(05 Marks)**
   b. Explain the influence of the following factors on the nature of electrodeposit:
      (i)   pH.
      (ii) Temperature.
      (iii) Concentration of the metal ion. **(05 Marks)**
   c. Explain stress and differential metal corrosion with example. **(06 Marks)**

Module-3

5 a. Define cracking. Describe fluidized bed catalytic cracking. **(05 Marks)**
   b. What is biodiesel? Explain the synthesis and advantages of biodiesel. **(05 Marks)**
   c. Explain the production of solar grade silicon by union-carbide process. **(06 Marks)**

OR

6 a. Define photo voltaic cell. Explain the construction and working of photo voltaic cell.
   (06 Marks)

   b. Explain the purification of silicon by zone refining. **(04 Marks)**

   c. A 0.6 g of coal sample (carbon 90%, H_2 3% and ash 7%) was subjected to combustion in a bomb calorimeter. Mass of water taken in the calorimeter was 2000 g and the water equivalent of calorimeter was 400 g. The rise in temperature was 3°C. Calculate the gross and net calorific value of the sample. Given, specific heat of water is 4.187 KJ/kg/°C and latent heat of steam is 2454 KJ/kg. **(06 Marks)**

Module-4

7 a. Explain the free radical mechanism for addition polymerization by taking vinyl chloride as an example. **(06 Marks)**

   b. Explain the synthesis, properties and applications of epoxy resin. **(04 Marks)**

   c. What is glass transition temperature? Explain the following factors affecting glass transition temperature.
   (i) Chain flexibility and
   (ii) Intermolecular forces. **(06 Marks)**

OR

8 a. Explain structure – property relationship of polymers with respect to,
   (i) Crystallinity   (ii) Tensile strength **(05 Marks)**

   b. What is polymerization? Explain addition and condensation polymerization with example. **(05 Marks)**

   c. What are polymer composite? Explain the synthesis, properties and application of Kevlar fibre. **(06 Marks)**

Module-5

9 a. Write a note on fullerenes. Mention its application. **(05 Marks)**

   b. Discuss the synthesis of nanomaterials by gas condensation method and chemical vapour condensation processes. **(05 Marks)**

   c. Discuss the experimental determination of Dissolved Oxygen (DO) of waste water. Mention the reactions involved in it. **(06 Marks)**

OR

10 a. What is desalination? Discuss the desalination of sea water by ion exchange process. **(05 Marks)**

   b. What is boiler feed water? Explain the scale and sludge formation in boilers. **(05 Marks)**

   c. Explain any three size dependent properties of nanomaterials. **(06 Marks)**

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15CHE12/22

First/Second Semester B.E. Degree Examination, Dec.2017/Jan.2018
Engineering Chemistry

Time: 3 hrs.

Max. Marks: 80

**Note: Answer any FIVE full questions, choosing
ONE full question from each module.**

Module-1

1 a. What is an ion selective electrode? Explain the method of determining the pH of a solution using glass electrode. **(06 Marks)**
   b. Discuss the construction and working of Zinc – air battery. **(05 Marks)**
   c. What are fuel cells? How it is different from a galvanic cell? Mention any two advantages of fuel cells. **(05 Marks)**

OR

2 a. Describe the construction and working principle of glass electrode. **(06 Marks)**
   b. Explain the construction and working of Ni – metal hydride batteries. **(06 Marks)**
   c. What are concentration cells? The emf of the cell Cu | CuSO$_4$ (0.01M) || CuSO$_4$(XM) | Cu is 0.0295V at 25°C. Find the value of X. **(04 Marks)**

Module-2

3 a. Define corrosion. Explain electrochemical theory of corrosion. **(06 Marks)**
   b. What is Anodization? Explain anodization of aluminium. **(06 Marks)**
   c. Mention the difference between electroplating and electroless plating. **(04 Marks)**

OR

4 a. Write a note on polarization and over potential. **(06 Marks)**
   b. What is galvanization? Describe the galvanization process for iron. **(05 Marks)**
   c. Explain the process of electroplating of hard chromium. **(05 Marks)**

Module-3

5 a. Define calorific value. Explain how calorific value of solid fuel is determined by bomb calorimeter. **(07 Marks)**
   b. Explain the synthesis of petrol by Fischer – Tropsch process. **(05 Marks)**
   c. Write the advantages and disadvantages of PV cells. **(04 Marks)**

OR

6 a. What is knocking in IC engines? Explain its mechanism with chemical reactions. **(06 Marks)**
   b. Explain the modules, panels and arrays of PV cells. **(06 Marks)**
   c. What is reforming of petroleum? Give any three reactions involved in reformation. **(04 Marks)**

Module-4

7 a. What are conducting polymers? Discuss the conduction mechanism in polyaniline and mention any tow applications. **(07 Marks)**
   b. What is glass transition temperature? Explain any 3 factors influencing Tg values. **(05 Marks)**
   c. Explain the synthesis and applications of silicon rubber. **(04 Marks)**

OR

8 a. A polymer has the following composition 100 molecules of molecular mass 1000g/mol, 200 molecules of molecular mass 2000g/mol and 500 molecules of molecular mass 5000g/mol. Calculate the number and weight average molecular weight. **(06 Marks)**
   b. Explain the synthesis and applications of : i) PMMA and ii) Epoxy resin. **(06 Marks)**
   c. Distinguish between addition and condensation polymerization with example. **(04 Marks)**

Module-5

9 a. Define COD. Discuss the experimental determination of COD of waste water. **(06 Marks)**
   b. Define desalination. Explain desalination of sea water by electro dialysis process. **(06 Marks)**
   c. Write a note on carbon nano tubes. Mention its applications. **(04 Marks)**

OR

10 a. Discuss the boiler corrosion due to O_2, CO_2 and $MgCl_2$ and its control. **(07 Marks)**
    b. Explain the synthesis of nano materials by sol-gel process. **(05 Marks)**
    c. Write a note on priming and foaming. **(04 Marks)**

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