Enrollment No......................................

Faculty of Engineering
End Sem (Even) Examination May-2018
EN3BS04 Engineering Chemistry

Programme: B.Tech.   Branch/Specialisation: All

Duration: 3 Hrs.   **Maximum Marks: 60**

Note: All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d.

Q.1 i. Chemical equivalent of $CaCO_3$ is   1
     (a) 50   (b) 100   (c) 150   (d) 200

   ii. 1ppm is equal to   1
     (a) 0.1mg/l   (b) 1mg/l   (c) 10mg/l   (d) 1.8 mg/l

   iii. The Calorific value of fuel is expressed as   1
     (a) Kcal/cm   (b) Kcal/cm^3 (c) Kcal/Kg   (d) Cal/m^3

   iv. Calorific value of carbon in Dulong's formula is: 1
     (a) 34,500 Kcal/Kg   (b) 8080 Kcal/Kg
     (c) 2240 Kcal/Kg   (d) None of these

   v. Viscosity Index is zero for   1
     (a) Paraffin base Gulf oil   (b) Paraffin base Pennsylvanian oil
     (c) Napthanic base Gulf oil   (d) Napthanic base Pennsylvanian oil

   vi. Which of the following is used as solid lubricant   1
     (a) Graphite   (b) Talc   (c) Soap   (d) All of these

   vii. ISI specification of cement is   1
     (a) 0.66-1.02   (b) 1.02-3.22   (c) 1.02-2.01   (d) 0.56-0.66

   viii. Refractories are used in the inner lining of   1
     (a) Reverberatory furnace   (b) Blast furnace
     (c) Muffle furnace   (d) All of these

   ix. The process of splitting of the molecule into ions of an electrolyte is called   1
     (a) Ionization   (b) Solvation   (c) Protonation   (d) Electrolysis

   x. Beer Lambert's Law is applicable only to   1
     (a) Concentrated solution   (b) Dilute solution
     (c) Acidic solution   (d) Buffer solution

Q.2 i. Which types of impuirities are responsible for scale formation in high pressure boiler and low pressure boiler?Explain with reason **2**

ii. Discuss any three methods used for the disinfection of water. **3**

iii. Calculate the amount of lime (88.3% pure) and soda (99.2% pure) required to soften 24,000 litres of water per day for a year containing the following if 20 percent extra chemicals are used. **5**
$CaCO_3$: 1.85 mg/l, $MgCO_3$: 0.42 mg/I, $MgSO_4$: 0.90mg/l, SiO_2: 2.32 mg/1, $CaSO_4$: 0.34 mg/l, $MgCl_2$: 0.76 mg/l and NaCl: 2.34 mg/l.
Fe_2O_3.: 2 ppm
Also calculate the total hardness of water

OR iv. 1.0 gm of $CaCO_3$ was dissolved in HCl and diluted to 500 mL. 25 mL of this solution required 25 mL of EDTA solution for titration. In another titration 50 mL of hard water sample required 45 mL of EDTA solution. 50 mL of same hard water sample on boiling, cooling and filtering etc. required 20 mL of EDTA solution using Erichrome Black-T as indicator. Calculate Total hardness, Temporary hardness and Permanent hardness of water sample in different units. **5**

Q.3 i. Write any four difference between octane number and cetane number **3**

ii. A sample of coal was found to have the following % composition by weight: C=75%, H=5.2%, O=12.1%, N=3.2% and ash=4.5%. Calculate (i) the minimum amount of oxygen and air necessary for complete combustion of coal sample (ii) volume of air required; if 40% excess air is supplied (iii) Also calculate the dry product composition **7**

OR iii. A producer gas has following composition by volume: CH_4 = 4%, CO=26.0%, H_2=10%, CO_2 = 10%, N_2=50%. Calculate minimum quantity of air required for complete combustion of 1 m^3 of the fuel gas and percentage composition of dry products of combustion by volume when 20% excess air is used. **7**

Q.4 i. A Lubricating oil has Saybolt Universal viscosity of 58 seconds at 210°F and 560 seconds at 100°F. The low V.I. standard Gulf oil has Saybolt universal viscosity of 58 seconds at 210°F and 752 seconds at 100°F. The high V.I. standard Pennsylvanian oil has Saybolt universal viscosity of 58 seconds at 210°F and 410 seconds at 100°F. Calculate V.I. of the lubricating oil. **3**

ii. Write preparation, properties and uses of any two of the following: **7**
(a) Biopolymer (b) Silicon resin   (c) Teflon   (d) Nylon6:6

OR iii. Write short note with significance on: **7**
(a) Viscocity with viscocity index number
(b) Flash and fire point

Q.5 i. Discuss any two important property of refractory's. **4**

ii. How can you manufacture Portland cement by rotary kiln? Explain with diagram and Reactions of different zones. **6**

OR iii. Write detail note on the following **6**
(a) Fullerane (b) Carbon nanotube (c) Nanomaterials

Q.6 Attempt any two:

i. Draw a labelled diagram of Gas Chromatograph and write its applications. **5**

ii. Discuss the principle and applications of IR spectroscopy. **5**

iii. Write any four applications of EMF measurements. **5**

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Marking Scheme
EN3BS04 Engineering Chemistry

Q.1   i.   Chemical equivalent of $CaCO_3$ is   **1**
(a) 50

ii.   1ppm is equal to   **1**
(b) 1mg/l

iii.   The Calorific value of fuel is expressed as   **1**
(c) Kcal/Kg

iv.   Calorific value of carbon in Dulong's formula is: **1**
(b) 8080 Kcal/Kg

v.   Viscosity Index is zero for   **1**
(c) Napthanic base Gulf oil

vi.   Which of the following is used as solid lubricant   **1**
(d) All the above

vii.   ISI specification of cement is   **1**
(a) 0.66-1.02

viii.   Refractories are used in the inner lining of   **1**
(d) All of these

ix.   The process of splitting of the molecule into ions of an electrolyte is called   **1**
(d) Electrolysis

x.   Beer Lambert's Law is applicable only to   **1**
(b) Dilute solution

Q.2   i.   Which type of impuirities are responsible for scale formation in high pressure boiler and low pressure boiler. ?   1mark   **2**
Explain with reason   1 mark

ii.   Discuss any three methods used for the disinfection of water.   **3**
Three methods   1 mark each

iii.   Calculate the amount of lime (88.3% pure) and soda (99.2% pure) required to soften 24,000 litres of water per day for a year containing the following if 20 percent extra chemicals are used.   **5**
$CaCO_3$: 1.85 mg/l, $MgCO_3$: 0.42 mg/I, $MgSO_4$: 0.90mg/l, SiO_2: 2.32 mg/1, $CaSO_4$: 0.34 mg/l, $MgCl_2$: 0.76 mg/l and NaCl: 2.34 mg/l. Fe_2O_3.: 2 ppm

Also calculate the total hardness of water
Lime and soda calculation chemical equivalent   2 marks
Lime and soda calculation   2 marks
Total Hardness   1 mark

OR   iv.   1.0 gm of $CaCO_3$ was dissolved in HCl and diluted to 500 mL. 25 mL of this solution required 25 mL of EDTA solution for titration. In another titration 50 mL of hard water sample required 45 mL of EDTA solution. 50 mL of same hard water sample on boiling, cooling and filtering etc. required 20 mL of EDTA solution using Erichrome Black-T as indicator. Calculate Total hardness, Temporary hardness and Permanent hardness of water sample in different units.   **5**

Standarization of EDTA   1mark
Total hardness, Temporary hardness and Permanent hardness
1 mark each (1*3=3 marks)
Answer in different units   1 mark

Q.3   i.   Write main three difference between octane number and cetane number   **3**
1 mark each (1*3=3 marks)

ii.   A sample of coal was found to have the following % composition by weight: C=75%, H=5.2%, O=12.1%, N=3.2% and ash=4.5%. Calculate   **7**
(1) the minimum amount of oxygen and air necessary for complete combustion of coal sample   3 marks
(2) volume of air required; if 40% excess air is supplied   1 mark
(3) Also calculate the dry product composition   3 marks

OR   iii.   A producer gas has following composition by volume: CH_4 = 4%, CO=26.0%, H_2=10%, CO_2 = 10%, N_2=50%.   **7**
1. Calculate minimum quantity of air required for complete combustion of 1 m^3 of the fuel gas and   4 marks
2. percentage composition of dry products of combustion by volume when 20% excess air is used.   3 marks

Q.4   i.   A lubricating oil has Saybolt Universal viscosity of 58 seconds at   **3**

210°F and 560 seconds at 100°F. The low V.I. standard Gulf oil has Saybolt universal viscosity of 58 seconds at 210°F and 752 seconds at 100°F. The high V.I. standard Pennsylvanian oil has Saybolt universal viscosity of 58 seconds at 210°F and 410 seconds at 100°F. Calculate V.I. of the lubricating oil

  Formula of viscosity index 1 mark

  Calculation of VI 2 marks

ii.   Write preparation, properties and uses of any two of the following: **7**

(a) Biopolymer (b) Silicon resin(c) Teflon (d)Nylon 6:6

Preparation 1.5 marks each (1.5 mark * 2)   3 marks

Properties 1 mark (1 mark * 2)   2 marks

Uses 1 mark each (1mark * 2)   2 marks

OR iii.   Write short note with significance on any two of the following: **7**

(a) Iodine value   (b) Flash and fire point

 (c) Viscosity with Viscosity Index   (d) Saponification Number

Defination 1 mark each (1mark * 2)   2 marks

Procedure with instrument 1.5 marks each (1.5 mark * 2)   3 marks

Significance   1 mark each (1mark * 2)   2 marks

Q.5 i.   Discuss any two important property of refractories   **4**

    2 marks each with their detail process and importance

ii.   How can you manufacture Portland cement by rotaory kiln? Explain with diagram and Reactions of different zones.   **6**

    Method detail with diagram   4 marks

    Reaction of different zones   2 marks

OR iii.   Write detail note on the following   **6**

(a) Fullerane (b) Carbon nanotube (c) Nanomaterials

2 marks each also mention the applications along with the details of smart material

Q.6   Attempt any two:

i.   Draw a labelled diagram of Gas Chromatograph and write its applications   **5**

    Gas chromatography   1.5 marks

    Diagram   1.5 marks

    Applications   2 marks

ii.   Discuss the principle and applications of IR spectroscopy.   **5**

    Principle   2.5 marks

    Applications   2.5 marks

iii.   Write any four applications of EMF measurements   **5**

    Emf explain   1 mark

    Applications one mark each (1 mark * 4)   4 marks

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