10009

Reg. No. : ....   Name : ....

SECOND SEMESTER B.TECH. DEGREE EXAMINATION, MAY/JUNE 2016
Course Code : CY100
Course Name : ENGINEERING CHEMISTRY
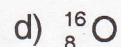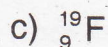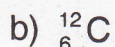
Max. Marks : 100   Duration : 3 Hours

PART – A

Answer **all** questions, **each** question carries **2** marks.

1. Which of the following nuclei can give NMR spectrum ? Give reason.

   a) $^{1}_{1}H$ b) $^{12}_{6}C$ c) $^{19}_{9}F$ d) $^{16}_{8}O$

2. At 25°C the standard emf of a cell having reaction involving two electron charge is found to be 0.295 V. Calculate the equilibrium constant of the reaction.

3. The specific conductivity of N/50 KCl solution at 25°C is 0.0002765 $ohm^{-1} cm^{-1}$. If the resistance of the cell containing this solution is 500 ohm, what is the cell constant ?

4. What are co-polymers ? Give an example.

5. Distinguish between gross and net calorific values of fuel.

6. What is meant by cetane value of a diesel fuel ?

7. Hard water will not give a ready lather with soap solution. Give the chemical explanation.

8. Why do we express hardness of water in terms of $CaCO_3$ equivalent ?

                                                                                        (8×2=16 Marks)

PART – B

Answer **all** questions, **each** question carries **3** marks.

9. The vibrational frequency of HCl molecule is 2886cm^{-1}. Calculate the force constant of the molecule. Reduced mass of HCl is 1.63×10^{-27} kg.

                                                                                        P.T.O.

10. What is meant by potentiometric titrations ? Mention two merits of potentiometric titrations.

11. Give the principle of column chromatography. List the various steps to be undertaken in this method.

12. Draw the structure of bifunctional silicon chloride. How silicone rubber prepared from it ?

13. An oil of unknown viscosity-index has a Saybolt universal viscosity of 58 seconds at 210°F and of 580 seconds at 100°F. The high viscosity index standard (Pennsylvanian) oil has Saybolt viscosity of 58 seconds at 210°F and 430 seconds at 100°F. The low viscosity index standard (Gulf oil) has a Saybolt universal viscosity of 58 seconds at 210°F and 780 seconds at 100°F. Calculate the viscosity index of oil sample.

14. What is natural gas ? Distinguish between LNG and CNG.

15. What is disinfection ? Give the advantages and disadvantages of UV disinfection of water.

16. A sample of water on analysis gives following results. $Ca^{2+} = 320$ mg/L, $Mg^{2+} = 72$ mg/L, $HCO_3^- = 610$ mg/L, $Cl^- = 355$ mg/L and $Na^+ = 23$ mg/L. Calculate the temporary and permanent hardness of water sample.   **(8×3=24 Marks)**

PART – C

Each question carries **10** marks.

17. a) How can you distinguish NMR spectrum of CH_3CH_2Cl and CH_3CHCl_2 applying the concept of spin-spin splitting ?

    b) Which of the following molecules show UV-visible absorption ? Give reason
    (i) ethane (ii) butadiene (iii) benzene (iv) phenol

    c) What is a spectrometer ? Write the principal components of UV-visible spectrometer.   **(3+3+4)**

                              OR

18. a) Predict NMR spectrum of $CH_3 - CHCl - CH_3$.

    b) Write the theory of vibrational spectroscopy.

    c) Sketch the various modes of vibrations possible for CO_2. Which are IR active ? Write reason for your answer.   **(3+2+5)**

19. a) What is meant by standard electrode potential ? How would you measure the single electrode potential of an electrode using a saturated calomel electrode ?

   b) Find the single electrode potential for copper metal in contact with 0.1 M Cu^{2+} solution at 298 K. $E^0 Cu^{2+}/Cu = 0.34$ V

   c) How is glass electrode constructed ? What is its use ?   **(4+2+4)**

                                    OR

20. a) Write electrode reaction and expression for the electrode potential of following electrodes :

      i) Metal-metal ion electrode

      ii) Gas electrode

      iii) Metal-metal insoluble salt electrode

      iv) Redox electrode.

   b) How will you explain the working of $H_2 - O_2$ fuel cell ? Draw a neat labelled diagram of the cell.   **(4+6)**

21. a) What is thermal analysis ? List two techniques of it. Compare their principles.

   b) Write the basic components of a gas chromatographic instrument. Draw the diagram of a gas chromatograph.   **(6+4)**

                                    OR

22. a) Write the procedure for doing column chromatography.

   b) What is HPLC ? Draw a labelled diagram of HPLC instrument. Write its two important applications.   **(5+5)**

23. a) What are conducting polymers ? Write the structure of two conducting polymers.

   b) Write a note on structure and applications of fullerene.

   c) Write a note on biological nanomaterials.   **(3+4+3)**

                                    OR

24. a) What are carbon nanotubes ? How are they classified ? State their two applications.

   b) Write the structure and two applications of Kevlar.   **(6+4)**

25. a) Differentiate between vegetable oil and mineral oil lubricants.

   b) Write the working of a Bomb calorimeter for determining the calorific value of a solid fuel with the help of a neat diagram.   (3+7)

                              OR

26. a) What are lubricants ? How are they classified on the basis of their physical state ? What are their important functions ?

   b) Write any four desirable properties of a lubricant and indicate the significance of the properties.   (5+5)

27. a) What is the main purpose of secondary sewage water treatment ? Explain trickling filter process.

   b) What is desalination ? How is it performed by reverse process ?   (5+5)

                              OR

28. a) How is UASB process useful in waste water treatment ?

   b) What are the factors which governs the amount of dissolved oxygen in water ?   (5+5)

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