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Reg. No.:_____   Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
FIRST/SECOND SEMESTER B.TECH DEGREE EXAMINATION, JULY 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 molecule can give an IR spectrum? Give reason. (a)H_2 (b) N_2 (c) HCl (d) Cl_2

2. What are redox electrodes? Indicate the electrode reaction and electrode potential with a suitable example.

3. Distinguish between the terms conductance and specific conductance.

4. What is Kevlar? Mention its two important properties.

5. Differentiate between HCV and LCV.

6. How does graphite acts as a lubricant?

7. In the deionisation process water is first passed through cation exchanger and then through anion exchanger. Why?

8. A water sample contains 204 mg of $CaSO_4$ per litre. Calculate the hardness in terms of $CaCO_3$ equivalent?

PART B
Answer all questions, each question carries 3 marks

9. Derive Beer-Lambert's law.

10. Write the origin of electrode potential. Electrode potential of zinc is assigned a negative value, whereas that of copper a positive value. Give reason.

11. What do you mean by R_f value in chromatography? Give the use of the term in the technique.

12. Give the structure and any two properties of ABS.

13. What are the advantages of liquid fuels over solid fuels?

14. What is the significance of viscosity index of a lubricant? How can you calculate it?

15. How BOD differs from COD?

16. What do you understand by hardness of water? Distinguish between temporary and permanent hardness of water.

PART C

Each question carries 10 marks

17. (a) State the principle of vibrational (IR) spectroscopy. Arrange the following bonds in the order of increasing stretching frequencies C-C, C=C and C≡C; Write suitable explanation for your answer. (5)

(b) What is spin-spin splitting? Write the splitting pattern in the NMR spectrum of CH_2Cl-CH_2-CH_2Cl. (3)

(c) Write two important applications of electronic spectroscopy. (2)

OR

18. (a) Explain the principle of NMR spectroscopy. Which of the following nuclei can have a presence in NMR spectrum? (i) $^{16}_{8}O$ (ii) $^{13}_{6}C$ (iii) $^{2}_{1}H$. Reason for your answer. (4)

(b) Define chemical shift. Interpret the number of signals, the position of signals and the intensity of signals in the NMR spectrum of $CH_3CH_2CH_2Cl$. (4)

(c) Most absorption bands in the electronic spectra are very broad. Give reason. (2)

19. (a) How is a calomel electrode constructed? Sketch the electrode. (4)

(b) Give the working principle of H_2-O_2 fuel cell with cell reactions. (4)

(c) A hydrogen electrode at $25°C$ is immersed in a solution of pH 2.5 and coupled with the half-cell SHE. Calculate the emf of the cell. (2)

OR

20. (a) How does a lithium–ion cell work? Write the cell reactions. (4)

(b) Calculate the emf of the following cell at $25 °C$;

$Zn \mid Zn^{2+}(a= 0.0004) \parallel Cd^{2+}(a=0.2) \mid Cd$;

Given $E^0 Zn^{2+} \mid Zn$ = -0.76 V ; $E^0 Cd^{2+} \mid Cd$ = -0.403 V (3)

(c) Give the principle of acid-base titration by potentiometry. (3)

21. (a) Draw the block diagram of TGA apparatus. (4)

(b) State the principle and applications of GC. (4)

(c) Write the demerits of TGA. (2)

OR

22. (a) What is the basic principle of thermo gravimetric analysis? List its important applications.

(b) Write experimental arrangement and procedure for measuring conductance of an electrolytic solution.

(c) List important applications of TLC. (3+4+3)

23. (a) How is polyaniline synthesised? Mention two applications of polyaniline.

(b) Write a note on OLED.

(c) What is silicone rubber? List two important propertiesof silicone rubber. (4+3+3)

OR

24. (a) What are carbon nanotubes?

(b) Write the characteristic properties of carbon nano tubes.

(c) What are fullerenes? List two applications of fullerenes. (4+3+3)

25. (a) 0.72g of a fuel containing 80% C, when burnt in a bomb calorimeter increased the temperature of water from 27.3 to 29.1°C. If the calorimeter contains 250g of water and its water equivalent is 150g, calculate the HCV of the fuel.

(b) Write a method of preparation of biodiesel .What are its merits and demerits?

(c) Distinguish between flash and fire points, write the significance of the terms in the selection of a lubricant. (3+3+4)

OR

26. (a) What do you mean by a lubricant? Write its functions.

(b)Calculate gross and net calorific value of a fuel having following composition82% C, 8% H, 5% O, 2.5% S, 1.4%N and 2.1% ash.

(c) What is knocking? Mention disadvantages of knocking. (3+4+3)

27. (a)How is reverse osmosis process applied in the desalination of brackish water? Mention the advantages of the process.

(b) What is the principle of EDTA method? 0.30 g of $CaCO_3$ was dissolved in HCl and the solution was made to one litre with distilled water. 100 mL of the above solution required 30 mL of EDTA solution. 100 mL of hard water required 33mL of the EDTA solution on titration. After boiling 100 mL of this water required 10 mL of EDTA solution. Calculate temporary and permanent hardness of water. (5+5)

OR

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

(b)What are the factors which govern the amount of dissolved oxygen in water?

(c) A sample of water is found to contain 16.2mg/L calcium bicarbonate, 7.3mg/L magnesium bicarbonate, 9.5mg/L magnesium chloride, and 13.6mg/L calcium sulphate. Calculate temporary and permanent hardness? What happen to the temporary and permanent hardness of the water sample if 10.6mg/L Na_2CO_3 is added? (4+3+3)