

Reg No.: _____

Name: _____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
FIRST/SECOND SEMESTER B.TECH DEGREE EXAMINATION, MAY 2019

Course Code: CY100

Course Name: ENGINEERING CHEMISTRY

Max. Marks: 100

Duration: 3 Hours

PART A

Answer all questions, each carries 2 marks.

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| 1 | CHCl ₃ protons show a shift in frequency of 728 Hz from TMS signal in a 100MHz NMR instrument, How much would be the shift in frequency for the same proton from TMS in a 300 MHz NMR instrument? | (2) |
| 2 | If you take a mixture of ZnSO ₄ and CuSO ₄ solutions in a beaker and a Zinc rod and a Copper rod are inserted in it will you get electricity? Give the reason. | (2) |
| 3 | Explain partition chromatography | (2) |
| 4 | What are Carbon nanotubes? | (2) |
| 5 | Arrange n-heptane, isooctane, benzene, branched alkanes in increasing order of knocking tendency in petrol engine. | (2) |
| 6 | Oils having high viscosity need not be having high viscosity index. Comment. | (2) |
| 7 | A water sample contains 204 mg of CaSO ₄ per litre. Calculate its hardness in terms of CaCO ₃ equivalents. | (2) |
| 8 | Define reverse osmosis. | (2) |

PART B

Answer all questions, each carries 3 marks.

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| 9 | What interpretations are obtained from the chemical shifts in a molecule? | (3) |
| 10 | A Zn rod is dipped in 0.4 M CuSO ₄ solution, displacement reaction takes place and allowed to attain equilibrium. Calculate the equilibrium constant and [Cu ²⁺] at equilibrium. Given that $E^0_{\text{Cu}^{2+}/\text{Cu}} = +0.34\text{V}$ and $E^0_{\text{Zn}^{2+}/\text{Zn}} = -0.76\text{V}$ | (3) |
| 11 | Write the major applications of DTA. | (3) |
| 12 | What are co-polymers? Illustrate with addition co-polymer and condensation co-polymer. | (3) |
| 13 | Describe with the significance: i) cloud and pour points ii) Flash and fire points. | (3) |
| 14 | What is mean by aniline point? How is it determined? | (3) |
| 15 | How is the exhausted resin regenerated from an ion-exchange process? | (3) |
| 16 | What is disinfection? How is it carried out using (a) UV light and (b) | (3) |

Chlorination?

PART C

Answer all questions, each carries 10 marks.

- 17 a) Discuss the factors affecting chemical shift. (5)
b) Draw the instrumentation of UV-visible spectrometer, explain the various parts. (5)

OR

- 18 a) How will you distinguish the isomers of C_4H_{10} using NMR spectroscopy? (5)
b) Calculate the force constant of HF molecule, if it shows IR absorption at 4138 cm^{-1} . Given that atomic masses of hydrogen and fluorine are 1u and 19u respectively. What would be the wavenumber if hydrogen atoms are replaced by deuterium atoms? (5)
- 19 a) What are the various types of electrodes? (5)
b) Calculate the single electrode potentials of H_2 electrode at 25°C and 1 atm pressure when the solution has $\text{pH}=0$ and $\text{pH}=14$. Based on this which metal (Al or Fe) can liberate H_2 only from acids? Which metal can liberate H_2 from both acid and alkali? Given that $E^0\text{ Fe}^{2+}/\text{Fe} = -0.44\text{ V}$ and $E^0\text{ Al}^{3+}/\text{Al} = -1.66\text{ V}$. (5)

OR

- 20 a) Discuss the variation in emf of a Daniel cell with respect to temperature at different concentration ratios of Zn^{2+} and Cu^{2+} (5)
b) A cell reaction is given by $A + B^{n+} \rightarrow A^{n+} + B$. Calculate the E^0_{cell} and number of electrons n involved in cell reaction. Given that concentration ratio of A^{n+} to B^{n+} is 0.1 and the cell shows an emf of 1.13006 V at 30°C and 1.13105 V at 40°C . (5)
- 21 a) Make a comparison between GSC and GLC. (5)
b) Discuss the terms i) Carrier gas ii) columns iii) stationary phase iv) detectors (5)

OR

- 22 a) Write down the experimental procedures for the measurement of conductivity. (4)
b) Describe the terms i) cell constant ii) specific conductance iii) conductivity cell (6)
- 23 a) What is poly pyrrole? How will you synthesise it? (6)
b) Which kind of doping is possible (p or n) in poly pyrrole why? Give two properties and applications. (4)

OR

- 24 a) What is ABS? What are its important properties and applications? (6)

- b) What is Buna-S.? Mention the Historical importance? (4)
- 25 a) A sample of coal contains 60% C, 33% O, 6% H, 0.5% S, 0.2% N, and 0.3% Ash. Calculate the GCV and NCV of coal. (4)
- b) What are greases? Under what conditions they are preferred over a liquid lubricant. (6)

OR

- 26 a) What is Natural gas? Distinguish between LNG and CNG. What is the technical difficulty to use LNG fuel in a car? (5)
- b) Calculate the HCV and LCV of ethanol using Dulong's formula. (5)
- 27 a) 100 mL sewage water is diluted to 1000 mL with dilution water; the initial dissolved oxygen was 7.6 ppm, dissolved oxygen level after five days of incubation was 3.2 ppm. Find the BOD of the sewage water. (5)
- b) Compare aerobic and anaerobic oxidation of sewage water. (5)

OR

- 28 a) Discuss the steps involved in sewage water treatment. (5)
- b) Explain the working of trickling filter process with a neat labelled sketch. (5)
