UNIVERSITY OF COLOMBO – Sri Lanka
FACULTY OF TECHNONOGY

BBST (Hons) Degree in Environmental Technology, Agriculture Technology, Instrumentation and Automation Technology
First Year – Semester I –Examination – September 2018

FT 1005 Chemistry
(Theory)

R=0.0821 L atm/mol K, F=96500 C mol^{-1}

Answer **only 4** questions Time: Two hours

1. i. List out and describe the types of intermolecular forces. [Marks 15]

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ii. State the Coulomb's law and express in the form of an equation. [Marks 15]

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iii. How do electrostatic interactions between charged particles contribute to the potential energy of a system consisting of two point charges. [Marks 20]

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iv. At a temperature of 220 K, the volume of a sample of a gas in a cylinder with a smoothly fitting frictionless piston is 0.0032 m^3. The cylinder is heated while allowing the gas to expand at constant pressure. Calculate the volume of the gas at 310 K. [Marks 25]

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v. Dry ice is carbon dioxide in the solid state. 1.36 g of dry ice is placed in a 5.00 L chamber that is maintained at 37.2^0 C. What is the pressure in the chamber after all of the dry ice has sublimed? [Marks 25]

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2. i. State the Law of Conservation and conversion of energy. [Marks 10]

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ii. Forms of the transfer of motion and related conversions can be divided into two groups. What are the two groups? Explain using one example for each. [Marks 20]

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iii. A sample of 350g of water is heated from 10.5°C to 15.0°C. The specific heat of water is 4.184 J g^{-1} $°C^{-1}$. Calculate the amount of heat absorbed by the sample. [Marks 20]

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iv. At 29°C, the enthalpy change of a reaction, $\Delta H = +25$ kJ mol^{-1} and its entropy change $\Delta S = +40$ J K^{-1} mol^{-1}. Calculate the associated change in Gibbs energy (ΔG). [Marks 20]

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v. Calculate the internal energy change, ΔU when 1.00 mol of H_2O goes from 25.0°C and 1.00 atm to 30.0°C and 1.00 atm. Density of water at 0^0C is 0.9970 g/cm^3 and at 100°C is 0.9956 g/cm^3. Constant pressure heat capacity (Cp) of water = 4.184 $JK^{-1}g^{-1}$. [Marks 30]

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3. i. State the phase rule for a one component system. [Marks 10]

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ii. Illustrate and explain the significant points of a one component phase diagram. [Marks 20]

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iii. Write an expression for the mole Fraction of liquid A (X_A) in a mixture of liquids A and B. [Marks 20]

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iv. State the principle involved and explain the processes of isothermal distillation and fractional distillation. [Marks 50]

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4. i. Explain the followings with regard to an elementary chemical reaction (i) rate law (ii) rate constant (iii) order of the reaction. [Marks 15]

ii. Do all rate laws have a reaction order? [Marks 05]

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iii. Write the Arrhenius equation that describes the temperature-dependence of the rate constant? [Marks 10]

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iv. Consider the elementary reaction: $2B \rightarrow C + 3D$. In one experiment it was found that at 310 K the rate constant is 0.144 L/(mol. s). A second experiment showed that at 460 K, the rate constant was 0.589 L/(mol. s). Determine the activation energy of the reaction. [Marks 20]

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v. For the reaction R → P, the concentration of a reactant changes from 0.03 M to 0.02 M in 25 minutes. Calculate the average rate of reaction in terms of the rate of change of the concentrations of P using units of time both in minutes and seconds. [Marks 20]

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iv. Balance each of the following equations.

$FeBr_3 + H_2SO_4 \rightarrow Fe_2(SO_4)_3 + HBr$

$HSiCl_3 + H_2O \rightarrow H_{10}Si_{10}O_{15} + HCl$

$B_2Br_6 + HNO_3 \rightarrow B(NO_3)_3 + HBr$

$NaBr + Cl_2 \rightarrow NaCl + Br_2$

$FeS + O_2 \rightarrow Fe_2O_3 + SO_2$

$Na_3PO_4 + HCl \rightarrow NaCl + H_3PO_4$ [Marks 30]

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5. i. . Identify the different types of (a) carbons and (b) hydrogens in alkanes.
[Marks 40]

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ii. Give the IUPAC name for the following compounds. [Marks 30]

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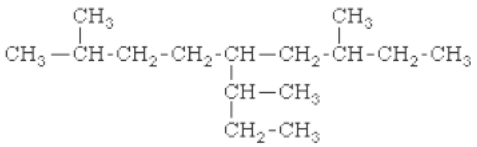

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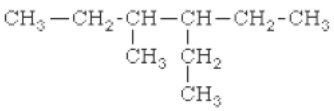

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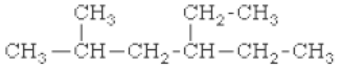

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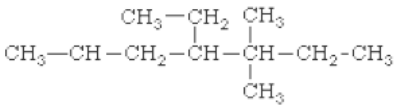

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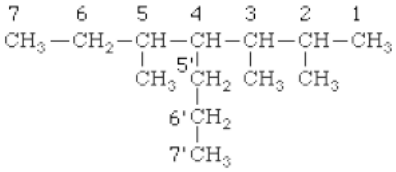

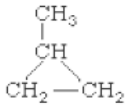

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iii. Illustrate the structures of the following compounds [Marks 30]

a. 2,5,5-trimethyl-2-hexene **b.** 2-propyl-1-pentene
c. 4-ethyl-2-methyl-3-hexene **d.** 2-ethyl-3,4-dimethyl-1,4-pentadiene
e. 4-isopropyl-1-methylcyclohexene **f.**1-cyclobutyl-3-methyl-1-butyne

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6. i. Describe the two reactions in a voltaic cell consisting of Zn/Zn^{2+} electrode and hydrogen electrode. [Marks 10]

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ii. State the Faraday's laws of electrolysis. [Marks 10]

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iii. What are the conclusions of the Faraday's Experiment? [Marks 20]

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iv. Explain the electrolysis of water using an equation and illustrations. [Marks 20]

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v. How much Ca will be produced in an electrolytic cell of molten $CaCl_2$, if a current of 0.452 A is passed through the cell for 1.5 hours? Ca = 40 g mol^{-1}, F=96500 C mol^{-1}. [Marks 20]

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vi. Explain EMF of a cell and give the equation for standard Electro motive force (EMF) of a cell. [Marks 20]

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