Total nos. of printed pages: 02 Roll No.

PRANVEER SINGH INSTITUTE OF TECHNOLOGY, KANPUR

Even Semester Session 2021-22 CT - II

B. Tech. Second Semester

Engineering Chemistry (KAS202T)

CO Number	Course Outcome
CO1	To define (Remember L-1) and to cite (Remember L-1) general definitions, terms and laws in engineering chemistry.
CO2	To describe (Understand L-2) principle and working of different apparatuses and chemical processes used in engineering.
CO3	To apply (Application L-3) different chemical formulae in order to calculate (Application L-3) the amount or volume of materials required in various chemical processes and to solve (Application L-3) related numerical problems competently by identifying the essential part of a problem and formulating a strategy for solving the problem.
CO4	To analyze (Analysis L-4) different chemistry topics and their relevancy in the engineering field and to differentiate (Analysis L-4) the relative terms used in chemistry.

Time: 1.5 Hrs. M. M. 15

Section A

Q1. Attempt all questions: **(1X3 = 3 Marks)**

a) Describe, why coal sample has to be cover with an air tight lid for the estimation of volatile matter percentage? CO1

b) Differentiate between GCV and NCV of a fuel. CO2

c) Calculate number of Calories in 445 British Thermal Units. CO3

Section B

Q2. Attempt all questions: **(2X4 = 8 Marks)**

a i) Discuss the liquid crystalline state, classify them and give their important applications. CO2

Or

ii) Discuss the structure, properties and application of carbon nanotubes. CO2

b i) Calculate G.C.V. and N.C.V. of a fuel having following composition by mass C = 74%, H= 8%, O = 6%, N = 5%, S = 7%, where latent heat of condensation of steam is 587 cal/g. CO3

Or

ii) Calculate the EMF of the following cell. CO3

$$Zn(s) \mid Zn^{2+}\ (0.01M) \parallel Cu^{2+}\ (0.1M) \mid Cu(s)$$

$$Given\ E^0\ of\ Zn^{2+}/Zn = -0.76\ V\ and\ Cu^{2+}/Cu = +0.34\ V$$

c i) Explain the proximate analysis of coal. CO2

Or

ii) Explain the construction and working of electrochemical cell by giving suitable reactions, also give the importance of salt bridge for this cell. CO2

d i) Calculate the weight and volume of air required for complete combustion of 1 m^3 of a gaseous fuel having following composition by volume; H_2= 7%; CH_4= 23%; C_2H_6 = 10%, C_4H_{10} = 18%, CO = 9%; CO_2 = 8%; and rest is nitrogen. CO3

Or

ii) Calculate the volume and weight of air required for complete combustion of 6 Kg of a coal sample having C = 80%, H_2 = 7%, N_2 = 6% and rest is oxygen by mass. CO3

Section C

Q3 **(4X1 = 4 Marks)**

i) Illustrate the construction and working of Bomb Calorimeter for the estimation of higher calorific value of a solid fuel. The following data is obtained in Bomb calorimeter experiment: Weight of Crucible = 3.64g, weight of crucible + fuel = 4.78g, water equivalent of calorimeter 605g, water taken in calorimeter = 2003 g, observed rise in temperature = 2.1°C, cooling correction= 0.05°C, acid correction = 23.6 cal, fuse wire correction =28.5 cal, cotton thread correction = 6.7 cal. Calculate the gross and net calorific value of the sample if the fuel contains 9% hydrogen. Assume latent heat of condensation of steam is 580 cal/g. CO4

Or

ii) Illustrate the construction and working of lead storage battery by giving suitable reactions during discharging and charging. The emf of a Weston cell is 1.018 V at 293K. Its temperature coefficient is 2.1×10^{-5} VK^{-1}. Calculate change in enthalpy, change in entropy and change in Gibbs free energy for this cell. CO4