Eastern University, Sri Lanka

Third Year Second Semester Examination in Science

External Degree 2008/2009 (February/April 2015)

EXTCH 306 Surface Chemistry and Molecular Spectroscopy

Proper and Repeat

Answer all question Time Allowed: One hour

[h = 6.626 X 10^{-34} J s R = 8.314 J mol^{-1} K^{-1} C = 3x 10^8 ms^{-1}]

1. a) Derive the Langmuir adsorption isotherm.

(15 marks)

b) The volume of N_2 gas adsorbed on the surface of silica at 0° C was 0.275 cm^3 and 1.45 cm^3 at different pressures 6.5x10^4 and 3.0x10^4 atm respectively. Calculate the equilibrium constant (k) and volume required to form a monolayer (v_m)

(40 marks)

c) i) Define the term 'surface excess' and Write the Gibbs adsorption equation for dilute solution in terms of surface tension and concentration of a solution

(10 marks)

ii) The surface tension of ethanol-water mixture follows the equation

$$\gamma = 81.5 + 2C^3 + 0.2C^2 + 3C$$

Where γ is a surface tension (in Nm^{-1}) and C is a concentration (mol l^{-1}) of the solution. Calculate the surface excess of ethanol for a 0.5 mol l^{-1} solution.

(35 marks)

2) a) The rotational spectrum of $^{79}Br^{19}F$ shows a series of equidistant lines spaced 0.7143 cm^{-1} apart. Assuming a simple rigid rotator model.

i) Calculate the rotational constant B, and hence the moment of inertia and bond length of the molecule.

ii) Determine the wave number of the $J = 9 \rightarrow J = 10$ transition

(50 marks)

b) The wave number of the fundamental vibration transition of $^{35}Cl_2$ is 564.9 cm^{-1}. Calculate the force constant of the bond.

(25 marks)

c) Briefly explain the appearance of Stokes and anti-Stokes lines in Raman Spectroscopy.

(25 marks)

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