Eastern University, Sri Lanka

External Degree

Third Year Second Semester Examination in Science

2004/2005 (January/ March 2011)

CH 306 Surface Chemistry and Molecular Spectroscopy

(Proper& Repeat)

Answer all questions

Time: one Hour

1) (a) i. Derive the Langmuir adsorption isotherm equation.

(15 marks)

ii. Discuss the behaviour of Langmuir adsorption isotherm at very high and very law temperature

(10 marks)

iii. For the adsorption of N_2 on ZnO the volumes of N_2 adsorbed were 1.06 and 2.08 $cm^3/$ g when the equilibrium pressures were 183 and 533 torr respectively. Assuming Langmuir behaviour calculate the adsorption equilibrium constant (K) and the volume required for monolayer formation (V_m)

(45 marks)

(b) The surface tension of CCl_4 is 26.95 dyn cm^{-1} and its density is 1.594 g cm^{-3}, both at 20 °C. To what height does the liquid rise in a capillary tube of 0.20 mm radius?

(30 marks)

2) (a) i. State which of the following molecules have rotational adsorption spectra N_2, CO_2, OCS, H_2O, $CH_2=CH_2$, C_6H_6

(10 marks)

ii. Calculate the frequency of the $J = 4 \leftarrow 3$ transition in the pure rotational spectrum of $^{14}N^{16}O$. The equilibrium bond length is 115 pm.

(30 marks)

(b) The fundamental and first overtone transitions of $^{14}N^{16}O$ occur at 1876.06 cm^{-1} and 3724. 20 cm^{-1} respectively. Evaluate the anharmonicity constant (x_e) and the equilibrium vibration frequency (ω_e).

(40 marks)

(c) Briefly explain the appearance of stokes and anti stokes line in the Raman spectroscopy.

(20 marks)

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