EASTERN UNIVERSITY, SRI LANKA
THIRD YEAR IN SCIENCE
SECOND SEMESTER 2002/2003 (2004)
CH 306 SURFACE CHEMISTRY & MOLECULAR SPECTROSCOPY

Answer All Questions **Time: 1hour**

($h = 6.626 \times 10^{-34}$ JS, $R = 8.315$ $JK^{-1}mol^{-1}$, $C = 3.0 \times 10^{8}$ mS^{-1}, $N = 6.023 \times 10^{23}$ mol^{-1})

1. (a) Show that the surface area of an adsorbent is given by the following equation.

Surface area = $V_m N / 22.4 (V_{liq} / N)^{2/3}$ Where V_m is the volume of the liquid adsorbate required to form mono layer, V_{liq} is the volume of one mole of liquid adsorbate and N is the Avogadro number.

(b) Consider the following first-order surface reaction:

$A_{(g)} \rightarrow A_{(ads)} \rightarrow B_{(g)}$

This reaction has a rate of 1.8×10^{-4} mol dm^{-3} S^{-1}. The surface has a dimension of 1.0 cm by 3.5 cm. Calculate the rate of reaction if the dimensions of the two sides of the surface were each doubled. (Assume that $A_{(g)}$ is in excess)

2. (a) If two masses m_1 and m_2 are joined by a rigid bar of length r_0, show that the moment of inertia (I) = μr_0^2 where μ is the reduced mass.

(b) Given that r_0 = 156 pm and force constant (K) = 250 for ^{6}Li ^{19}F, use the rigid rotator-harmonic oscillator approximation to construct an approximate energy level diagram for the first five rotational levels in the v=0 to v=1 vibrational states.