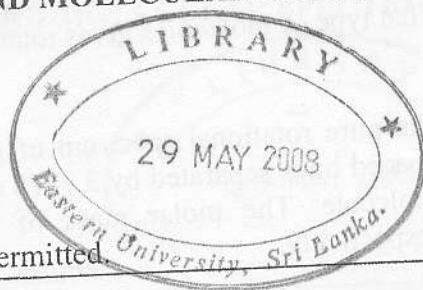# EASTERN UNIVERSITY, SRI LANKA
THIRD EXAMINATION IN SCIENCE 2005/2006
SECOND SEMESTER (MARCH 2008) - PROPER
CH 306: SURFACE CHEMISTRY AND MOLECULAR SPECTROSCOPY

Time allowed: **ONE Hour**

Answer all questions.

The use of non-programmable calculator is permitted.

Planck constant (h) = 6.626 X 10^{-34} J s, Rest mass of electron (m_e) = 9.1 x 10^{-31} kg, Gas constant (R) = 8.314 J K^{-1} mol^{-1}, Velocity of light (c) = 3 x 10^8 m s^{-1}, Avogadro constant (N_A) = 6.023 x 10^{23} mol^{-1}

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1. (A) i. Write down the equation for the B.E.T adsorption isotherm and explain the terms involved in it.

     (15 marks)

   ii. Illustrate how you would proceed to find out the volume of the monolayer adsorption using B.E.T isotherm.

     (20 marks)

   (B) i. Write down the expression for the Gibbs adsorption isotherm for a dilute solution.

     (10 marks)

   ii. The surface tension of Ethanol – Water mixture follows the equation

   $$\gamma(Nm^{-1}) = 72.75 + C \ (mol \ l^{-1}) + 0.2 \ C^2 \ (mol^2 \ l^{-2})$$

     a. Determine $\dfrac{d\gamma}{dC}$

     b. Calculate the surface excess of ethanol for a 0.5 mol l^{-1} solution.

     (30 marks)

   (C) Why the capillary active substances decrease the surface tension of the solvent?

     (25 marks)

2. (A) i. What type of molecules gives rotational spectra and give two examples.

(10 marks)

ii. The pure rotational spectrum of gaseous molecule CN has a series of equally spaced lines separated by 3.7978 cm^{-1}. Calculate the internuclear distance of the molecule. The molar mass of C and N are 12.011 and 14.007 g mol^{-1} respectively.

(25 marks)

(B) i. Write the energy equation for anharmonic vibration

(05 marks)

ii. The fundermental and first overtone transitions of $^{14}N^{16}O$ occur at 1876.06 cm^{-1} and 3724.20 cm^{-1} respectively. Evaluate,

    a) the equilibrium vibration frequency (ω_e)
    b) the anharmonicity constant (x_e)
    c) the exact zero point energy
    d) the force constant (Reduced mass of $^{14}N^{16}O$ is 1.24 x 10^{-26} kg)

(60 marks)

End.