THE OPEN UNIVERSITY OF SRI LANKA
B.Sc Degree Programme
Assignment - I (Test) on Vol 1 *(Surface, ---)*
CHU 3124 Physical Chemistry 2006/2007

(1.5 hours)

23rd Decemeber 2006 **1.00 p.m - 2.30 p.m**

This question paper consists of **five (5)** structured type questions for which **answers are to be written in the space provided.**

*The use of a **non-programmable** electronic calculator is permitted.
*Logarithm tables will be provided.

Gas constant	$= 8.314\ J\ K^{-1}mol^{-1}$
Avogadro constant	$= 6.023 \times 10^{23}\ mol^{-1}$
Faraday constant (F)	$= 96{,}500\ C\ mol^{-1}$
Plancks constant (h)	$= 6.63 \times 10^{-34}\ J\ s$
Velocity of light (c)	$= 3.0 \times 10^{8}\ m\ s^{-1}$
Standard Atmospheric pressure	$= 10^{5}\ Pa\ (N\ m^{-2})$

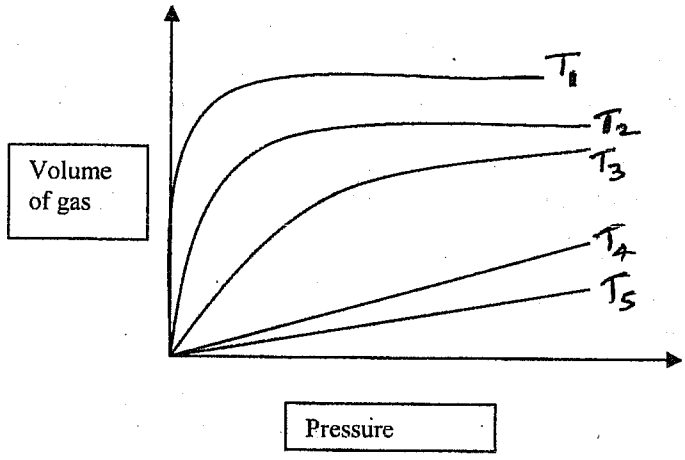
1(a) A spherical droplet of liquid (relative molecular mass =**B**, Density = **C**) with radius **X** at temperature **D** exhibits a vapour pressure **M** outside the droplet. The Vapour pressure outside a plane surface of the liquid equals **N**, Gas constant equals **R**, surface tension of liquid equals **T.** Using the symbols given in the above passage but **no other,** complete the Kelvin equation given below.

$$\ln\frac{M}{N} = \text{----------}$$

(b) The Kelvin equation expresses how the ration $\left(\frac{M}{N}\right)$ changes with radius, **X**. What is the most important conclusion that you can make from the Kelvin equation?

(18 marks)

2. Typical adsorption isotherms obtained for a certain system at various temperatures, T_1, T_2, T_3, T_4 ----- are given below.



(a) (i) Is the adsorption more likely to be chemisorption OR physical adsorption?

(ii) Is $T_1 > T_2 > T_3 > T_4 > T_5$?

(b) Briefly give adequate reasons in support of your answers to the questions in (a) above.

(c) The type of adsorption illustrated in the diagram above is in accordance with the theory put forward by which pioneer scientist?

(18 marks)

3. An amount of work, **W**, has to be done on a surface system at temperature **D** to extend its area by an amount **E**. The molar concentration of this aqueous system is **C**. Gas constant = **R**; surface tension of pure water = **T**
Using the symbols given but **no other,** write down for the system an expression for

(i) the surface tension

(ii) the surface pressure

(iii) the surface excess concentration using the Gibbs adsorption isotherm.

(18 marks)

4. The monolayer volume(V_m) for the adsorption of gaseous krypton on 1 kg carbon measured at 27 °C and 1 standard atmospheric pressure is 500 cm^3. A single krypton molecule has a molecular area of 22 x 10^{-20} m^2. Calculate the specific surface area of the carbon adsorbent.

(10 marks)

5. The adsorption of nitrogen gas on charcoal amounted to 0.925 cm^3 g^{-1} of adsorbent under the following equilibrium conditions of pressure and temperature.

P/bar	11.2	35.8
T/K	196	273

(i) Calculate the temperature at which the same quantity of gas would be adsorbed under an equilibrium pressure of 25 bar.

(ii) What is the name given to the equation you used to make the above calculation?

(iii) Give two important assumptions that you are making in using this equation.

(20 marks)

6. The table below refers to colloidal dispersions. Complete it by filling the blank boxes appropriately.

Dispersion Medium	Dispersed Phase	General Name given to dispersion system	One typical example	A second example
Solid	Gas			
		Solid emulsion		
Liquid				
	Solid		AgCl in Colloidal Dimension	

(16 marks)