



M Sc. (4th Semester) (Mid term)

Max. Marks: 30

Course Title: Statistical Thermodynamics and Colloidal Chemistry(PCH-CC-402)

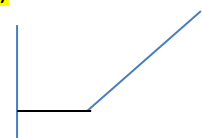
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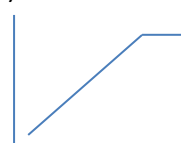
- The ΔG_m^0 for a surfactant whose CMC is $8.7 \times 10^{-5} \text{ mol dm}^{-3}$ at 25°C is:
 - $-33.1 \text{ kJ mol}^{-1}$
 - $-23.2 \text{ kJ mol}^{-1}$
 - $-21.2 \text{ kJ mol}^{-1}$
 - $-30.2 \text{ kJ mol}^{-1}$
- A plot of $\frac{1}{k_0 - k_p}$ versus $\frac{1}{C - \text{CMC}}$ which should be straight line with slope = ? and intercept = ?
 - $\frac{N}{K(k_0 - k_m)}$ and $\frac{1}{k_0 - k_m}$
 - $\frac{1}{k_0 - k_m}$ and $\frac{N}{K(k_0 - k_m)}$
 - None of the above is correct
 - Both (a) & (b) are correct
- For micellar catalysis to occur, it is necessary that:
 - the substrate be solubilized by the micelle
 - the locus of solubilization be such that the reactive site of the substrate is accessible to the attacking reagent
 - Hydrophobic interactions must occur
 - All are correct
 - (i) and (ii) are correct
 - (ii) and (iii) are correct
 - (i) and (iii) are correct
- If post-micellar slope = 1.002 and pre-micellar slope = 2.0. The degrees of ionization and binding are:
 - 0.501 and 0.499
 - 0.499 and 0.501
 - 0.400 and 0.500
 - None

- The correct form of the graph between amounts of material solubilized vs concentration of surfactant is:

a) a)



b)



c)



d)



- If value of packing parameter lies in the range 0.5 to 1, the structure of micelle is:
 - Lamellar in aqueous media
 - Spheroidal in aqueous media
 - Cylindrical in aqueous media
 - Inverse (reversed) micelles in nonpolar media
- The solubilization of hydrocarbons in the interior of the micelle:
 - increases the value of V_H
 - decreases the value of V_H
 - remains same
 - None
- The phase separation model has been questioned for

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- (i) a clear discontinuity in the physical property of a surfactant solution
(ii) if two phases actually exist at the c.m.c., then equating the chemical potential of the surfactant molecule in the two phases would imply that the activity of the surfactant in the aqueous phase would be constant above the c.m.c.
- a) Only (i) is true
b) Only (ii) is true
c) Both (i) and (ii) are true
d) None is correct
9. Using Mass Action Model, if $[S_n] = 4 \text{ mM}$ and $[S] = 2 \text{ mM}$ and $n=2$. The equilibrium constant K_m is given by:
a) 1000
b) 2000
c) 3000
d) 4000
10. Solubilization is believed to occur at a number of different sites in the micelle:
(i) On the surface of the micelle, at the micelle-solvent interface;
(ii) between the hydrophilic head groups
(iii) in the so-called palisade layer of the micelle between the hydrophilic groups and the first few carbon atoms of the hydrophobic groups that comprise the outer core of the micellar interior;
(iv) more deeply in the palisade layer; and
(v) in the inner core of the micelle
a) (i) and (v) are correct
b) (ii) and (iv) are correct
c) Only (iii) is correct
d) All are correct
11. Three particles with a total energy of 5ε are arranged in a ladder of energy levels having energies $0, \varepsilon, 2\varepsilon, 3\varepsilon, 4\varepsilon, \dots$ etc. The correct number of macrostates possible for the system is:
a) 2
b) 4
c) 3
d) 6
12. A system of 4 particles each with spin $3/2$ are arranged in 6 slots. The possible number of arrangements is:
a) 10
b) 15
c) 20
d) 30
13. The value of $\ln(20!)$ is 42.34. What is the error if we use Stirling's formula to calculate it?
a) 12.5 %
b) -6.03 %
c) 1.9 %
d) -9.1 %
Correct Value = -5.70%
14. The expression: $g_j/n_j = \exp(-\alpha + \beta\varepsilon_j)$ represents:
a) M-B distribution law
b) F-D distribution law
c) B-E distribution law
d) incorrect expression
15. $q_t(O_2)/q_t(He)$ at the same temperature and pressure has the value:
a) 4.2
b) 8
c) 22.6
d) 12.8



16. Which of the partition functions is a function of volume?

- a) q_t
- b) q_r
- c) q_v
- d) q_e

17. The thermal wave lengths of H_2 & O_2 at the same temperature are in the ratio of:

- a) 1: 2
- b) 2: 1
- c) 1: 4
- d) 1: 16

18. The correct rotational symmetry numbers of the molecules $CHCl_3$ & CCl_4 are:

- a) 3 & 4
- b) 2 & 6
- c) 4 & 6
- d) 3 & 12

19. The vibrational temperature of $^{35}Cl_2$ is 805 K. The population of the $v = 1$ level at 1000K is expected to be:

- a) Zero
- b) very small (<1%)
- c) large (> 40 %)
- d) between (b) & (c)

20. One of the vibrational modes of H_2O occurs at 1594.8 cm^{-1} . The vibrational temperature corresponding to this mode is:

- a) 229 K
- b) 971.6 K
- c) 2297.2 K
- d) 4291 K