Unit 8 - Week 7

Course outline

How does an NPTEL online course work?

Week 1

Week 2

Week 3

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Week 6

Week 7

- Models of electrical double layer: Gouy Chapman Theory - I
- Models of electrical double layer: Gouy Chapman Theory - II
- Structure of Electrical double layer
- Force of Repulsion between interacting surfaces
- Potential Energy of repulsion between Planar double layers and DLVO Theory
- Weekly Feedback 7 : Colloids and Surfaces
- Quiz : Assignment 7

Week 8

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Assignment 7

The due date for submitting this assignment has passed.
As per our records you have not submitted this assignment.

Due on 2020-11-04, 23:59 IST.

An approximate expression for the repulsive potential energy due to electrical double layer overlap, (V_{EDL}) versus the surface to surface separation distance (s) between two spherical particles of diameter (D) with the same surface charge is given by:

$$V_{EDL} = \pi\epsilon_0\epsilon_r d\Psi_0^2 exp(-\kappa s)$$

where ϵ_0 = 8.85 × $10^{-12} C^2 N^{-1} m^2$ is the permittivity of the free space, ϵ_0 =74.5 is the relative dielectric constant of water, Ψ_0 is the surface potential (created by the surface charge) and κ is the inverse Debye screening length. The particles have a surface potential of 25 mV and are immersed in water containing 1 mM NaCl solution. Assume that the presence of salt does not affect the dielectric constant of the medium. The diameter of the spherical particles in 100 nm. Calculate:

1) the inverse Debye screening length _____ x 10^8. Report your answer in SI units

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 0.94,1.14

3 points

The strength of the electrical double layer potential at (i) 3 nm, (ii) 6 nm and (iii) 9 nm surface to surface separation distance. Express your answers in units of thermal energy, k_BT , where k_B is the Boltzmann constant is 1.3807 × 10^{-23} J/K and T is the absolute temperature. T can be taken as 300 K.

2) 3 nm _____?

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 20,25

2 points

3) 6 nm _____ ?

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 14,18

2 points

4) 9 nm _____ ?

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 10,14

2 points

A colloidal particle has a 40 mV surface potential in an aqueous 1:1 electrolyte solution (0.0001 M concentration).

5) Calculate the electrical double layer thickness in nm

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 28,32

3 points

Calculate the potential at (i) 30 nm, (ii) 20 nm, (iii) 10 nm and (iv) 1 nm distance from the particle surface according to the Debye–Hückel double layer model. Assume that the particle-fluid combination is maintained at 300 K temperature. Report your answers in mV.

6) 30 nm _____ ?

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 14,16

1 point

7) 20 nm _____ ?

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 19,22

1 point

8) 10 nm _____ ?

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 27,30

1 point

9) 1 nm _____ ?

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 38,39.5

1 point

10) Calculate the potential energy of interaction between Na^+ and Cl^- that are 1 nm apart in vacuum. The permittivity of vacuum is 8.85 × 10^{-12} $C^2 N^{-1} m^{-2}$. Express your answer in units of Joules_____ x 10^{-19}.

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 2.0,2.6

3 points

11) Is the interaction attractive or repulsive? ***1 point***

- attractive
- repulsive

No, the answer is incorrect.
Score: 0
Accepted Answers:
attractive