Unit 6 - Week 5

Assignment 5

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

Due on 2020-10-21, 23:59 IST.

The ionization of surface groups is one of the mechanism by which surfaces acquire electric charge. Consider a polystyrene particle functionalized by carboxyl group. When such particles are brought in contact with water and the conditions are appropriate for the dissociation of carboxyl group:

1) What is the surface charge that the particle acquires? *1 point*

- Positive
- Negative
- Neutral

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

2) Identify the charged group on the particle surface? *1 point*

- CO^-
- H^+
- COO^-
- COOH

No, the answer is incorrect.
Score: 0
Accepted Answers:
COO^-

3) Identify the counter-ions in the solution? *1 point*

- CO^-
- H^+
- COO^-
- COOH

No, the answer is incorrect.
Score: 0
Accepted Answers:
H^+

The adsorption surfactant is yet another mechanism by which surfaces acquire electric charge. Consider a dispersion containing neutral particle to which a surfactant with a general formula $R\text{-}NH_3Cl$ is added, where R represents a linear chain hydrocarbon. Assume that there is adsorption of surfactant molecules on the neutral particles when they come in contact.

4) What is the surface charge that the particle acquires? *1 point*

- Positive
- Negative
- Neutral

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

5) Identify the charged group on the particle surface? *1 point*

- $R\text{-}NH_3^+$
- $R\text{-}NH_2^{2+}$
- $R\text{-}NH^-$
- Cl^-
- $R\text{-}NH_3Cl$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$R\text{-}NH_3^+$

6) Identify the counter-ions in the solution? *1 point*

- $R\text{-}NH_3^-$
- $R\text{-}NH_2^{2-}$
- $R\text{-}NH^-$
- Cl^-
- $R\text{-}NH_3Cl$

No, the answer is incorrect.
Score: 0
Accepted Answers:
Cl^-

Surfactant free sulfate latex (polystyrene) particles are purchased from a supplier to study electrostatic interactions in solution. Following are the data as supplied by the manufacturer.

Mean Diameter:	3.1 µm
Percent Solids w/v:	8.1 % (8.1 grams in 100 ml of dispersion)
Specific Surface Area:	1.8×10^4 cm^2/g
Density of Polystyrene at 20°C:	1.055 g/cm^3

Given that the number of surfate groups on the surface of a single particle is 1.3×10^7. The electric charge on an electron is 1.6×10^{-19} Coulomb. Calculate

7) Surface charge density in $\mu C/cm^2$

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 6.8,7.0

3 points

8) Area per Sulfate Group in A^{o2} (square Angstorms)

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 222,242

3 points

Consider a charged surface with a surface charge density of 6.9×10^{-2} C/m^2. This surface is immersed in water at 25 °C. Assume the relative permittivity of water at this temperature to be 80. The permittivity of free space to be 8.85×10^{-12} $C^2J^{-1}m^{-1}$. Use the capacitor arrangement to model the electrical double layer.

9) Calculate the strength of the electric field in V/m *3 points*

- 9.3×10^5 - 9.5×10^5
- 9.3×10^7 - 9.5×10^7
- 9.3×10^8 - 9.7×10^8

No, the answer is incorrect.
Score: 0
Accepted Answers:
9.3×10^7 - 9.5×10^7

10) Calculate the gradient of the surface potential if the thickness of the double layer is 4.4 nm. Express your answer in mV.

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 40,45

3 points

11) Figure 1 shows scaled depletion potential as a function of separation distance estimated by the Asakura-Oosawa model a system of a pair of A-A, B-B and C-C particle immersed in a fluid containing non-adsorbing polymers. The corresponding depletion potential is represented by the plots labeled A, B and C *2 points*

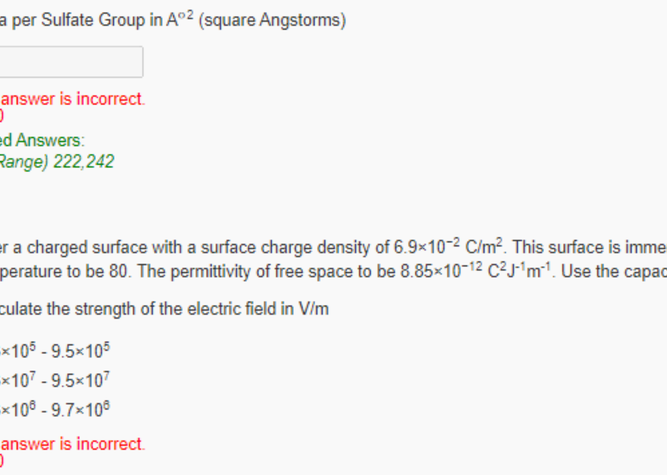

Figure 1: Scaled depletion potential as a function of separation distance estimated by the Asakura-Oosawa model a system of three particles A-A, B-B and C-C immersed in a fluid containing non-adsorbing polymers.

If V_{dep} refers to depletion volume, which of the following statements is true?

- $V_{dep,\,A} > V_{dep,\,B} > V_{dep,\,C}$
- $V_{dep,\,A} < V_{dep,\,B} < V_{dep,\,C}$
- $V_{dep,\,A} = V_{dep,\,B} = V_{dep,\,C}$
- $V_{dep,\,A} > V_{dep,\,B} < V_{dep,\,C}$
- $V_{dep,\,A} < V_{dep,\,B} > V_{dep,\,C}$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$V_{dep,\,A} < V_{dep,\,B} < V_{dep,\,C}$