Unit 9 - Week 8

Assignment 8

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

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

Optical microscopy was used to measure the electrophoretic moility of a dilute aqueous suspension containing 1.84 μm diameter amidine latex particles. The mobility data was converted to zeta potentials using appropriate formulae. The zeta potential of amidine latex particles as a function of pH obtained through such a measurement is shown in Figure 2

Concentration of monolavent chemical species used to adjust pH is 10^{-4} M. ε_0 =8.8542x10^{-12} C^2 N^{-1} m^{-2} and ε_r =80. The relation $q = 4\pi\varepsilon\zeta R_S(1+\kappa R_S)$, where q is the charge on the particle, is known to apply for the case of spherical particles with when the surface potential is low. Rs is the radius of the particle. The Elementary charge is 1.6022x10^{-19} C

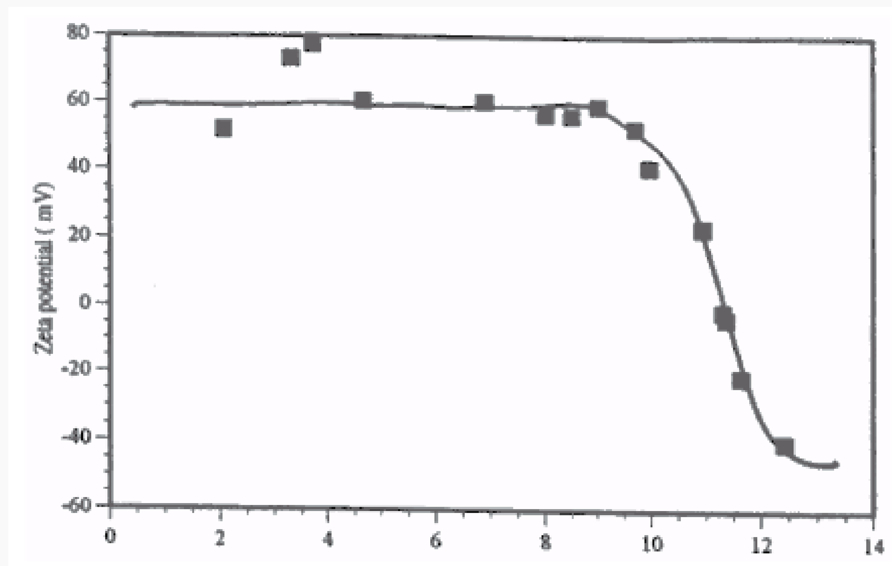

Figure 2: zeta potential of amidine latex particles as a function of pH (data from - Somasundaran, P., Sudhir Shrotri, and K. P. Ananthapadmanabhan. "Deposition of latex particles: Theoretical and Experimental aspects." *Mineral Processing: Recent Advances and Future Trends: Proceedings of a Conference Honouring Professor PC Kapur on His 60th Birthday, Indian Institute of Technology, Kanpur, December 11-15, 1995.* Allied Publishers, 1995.)

1) Identify the pH above which the particles are negatively charged

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 11,12

2 points

2) Determine the iso-electric point from the plot shown in Figure 2

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 11,12

2 points

3) Calculate the surface charge q at pH = 11. From the figure, it appears that the zeta potential of the particles at pH = 11 is 20 mV. ___________ x 10^{-15}

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 4,6

6 points

4) Estimate the surface charge density at pH = 11. Report your answer in $\mu C/m^2$

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 460,500

3 points

5) If the valency of the charge on the surface is +1, calculate the number of charges on 1 particle.

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 30000,34000

3 points

6) Identify the pH below which the particles are positively charged

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 11,12

2 points

7) What is the zeta potential of a particle that displays a mobility of 10^{-4} cm^2 V^{-1} s^{-1} in a liquid which has a viscosity of 0.001 Pa.s and a relative permittivity of 80.4? Assume that the applicability of Debye-Huckel approximation. ε_0 can be taken as 8.8542x10^{-12} C^2 N^{-1} m^{-2} . Report your answer in mV.

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 20,22

3 points

Consider a cube like particle of 1 micrometer side length. There are two sineraios – a) the particle is located at water-air interface with half of its surface in water and the other half in air b) the particle is located at water-air interface with 3/4 th of its surface in water and the other 1/4 th surface in air. This is schematically represented in a side view image shown in Figure 1. Calculate the energy required to detach the cube from the interface into air for configuration (a) and (b). The water-air surface tension is 72 mN/m. Report your answer in units of k_B T, the thermal energy. T can be taken as 300 K.

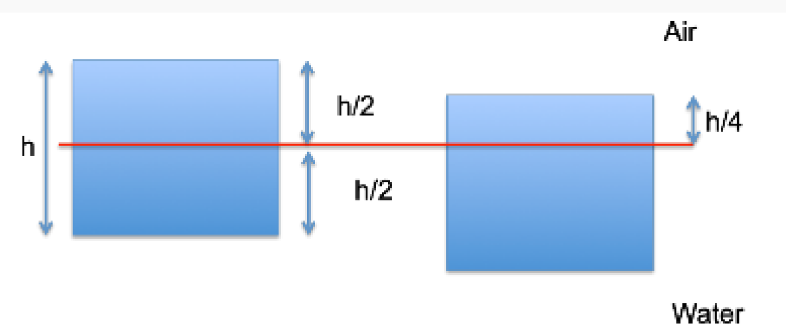

Figure 1: Side view of a cubic particle at water-air interface in two configurations

8) a. ___________?

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 16000000,18000000

2 points

9) b. ___________?

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 16000000,18000000

2 points