Assignment 11

The due date for submitting this assignment has passed.

Due on 2021-04-07, 23:59 IST.

As per our records you have not submitted this assignment.

1) A spheroidal surface P is given parametrically by the position vector $r\,(\theta,\phi)$ as *1 point*

$$r\,(\theta,\phi) = (b\cos\theta\sin\phi, b\sin\theta\sin\phi, c\cos\phi)$$

where $-\pi < \theta \leq \pi$, and $0 \leq \phi \leq \pi$ and the constant b is the minor semi-axis length and c is the major semi=axis length.Which of the following expresses the scalar surface element dA for P ?

where $\epsilon^2 = 1 - \frac{c^2}{b^2}$

- $dA = b^2\sin\phi\left(1+\epsilon^2\sin^2\phi\right)^{\frac{1}{2}}d\theta d\phi$
- $dA = b^2\sin\phi\left(1-\epsilon^2\sin\phi\right)^{\frac{1}{2}}d\theta d\phi$
- $dA = b^2\sin\phi\left(1-\epsilon^2\sin^2\phi\right)^{\frac{1}{2}}d\theta d\phi$
- $dA = b^2\sin\phi\left(1+\epsilon^2\sin\phi\right)^{\frac{1}{2}}d\theta d\phi$
- $dA = b^2\sin^2\phi\left(1-\epsilon^2\sin^2\phi\right)^{\frac{1}{2}}d\theta d\phi$
- $dA = b^2\sin^2\phi\left(1+\epsilon^2\sin\phi\right)^{\frac{1}{2}}d\theta d\phi$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$dA = b^2\sin\phi\left(1-\epsilon^2\sin^2\phi\right)^{\frac{1}{2}}d\theta d\phi$

2) Consider calculating the Lennard-Jones interaction energy E_s of a spherical surface S with radius a and atomic density η_s with some point a distance δ (assuming δ > a) from the centre of the sphere , assuming the continuum approximation and Lennard-Jones constants of A and B . After adoting an appropriate parameterisation , which of the following is/are the integral form the interaction energy E_s *1 point*

- $E_s = \eta_s\int_0^{\pi}\int_{-\pi}^{\pi}\left(-A\rho^{-6}+B\rho^{-12}\right)a^2\cos\phi d\theta d\phi$
- $E_s = \eta_s\int_0^{\pi}\int_0^{\pi}\left(-A\rho^{-6}+B\rho^{-12}\right)a^2\cos\phi d\theta d\phi$
- $E_s = \eta_s\int_0^{\pi}\int_0^{\pi}\left(-A\rho^{-6}+B\rho^{-12}\right)a^2\sin\phi d\theta d\phi$
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- $E_s = \eta_s\int_0^{\pi}\int_{-\pi}^{\pi}\left(-A\rho^{-6}+B\rho^{-12}\right)a\cos\phi d\theta d\phi$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$E_s = \eta_s\int_0^{\pi}\int_{-\pi}^{\pi}\left(-A\rho^{-6}+B\rho^{-12}\right)a^2\sin\phi d\theta d\phi$

3) By treating E_s from the question (2) above , as a hypergeometric integral ,integrate the expression and express the result in terms of in terms of hypergeometric functions *1 point*

- $E_s = 2\pi a^2\eta_s\left[-\frac{A}{(\delta-a)^6}F\left(3,1;2;-\frac{4a\delta}{(\delta-a)^2}\right)+\frac{B}{(\delta-a)^{12}}F\left(6,1;2;-\frac{4a\delta}{(\delta-a)^2}\right)\right]$
- $E_s = 2\pi a^2\eta_s\left[\frac{A}{(\delta-a)^6}F\left(3,1;2;-\frac{4a\delta}{(\delta-a)^2}\right)+\frac{B}{(\delta-a)^{12}}F\left(6,1;2;-\frac{4a\delta}{(\delta-a)^2}\right)\right]$
- $E_s = 2\pi a^2\eta_s\left[-\frac{A}{(\delta-a)^6}F\left(3,1;2;-\frac{4a\delta}{(\delta-a)^2}\right)-\frac{B}{(\delta-a)^{12}}F\left(6,1;2;-\frac{4a\delta}{(\delta-a)^2}\right)\right]$
- $E_s = 2\pi a\eta_s\left[-\frac{A}{(\delta-a)^6}F\left(3,1;2;-\frac{4a\delta}{(\delta-a)^2}\right)+\frac{B}{(\delta-a)^{12}}F\left(6,1;2;-\frac{4a\delta}{(\delta-a)^2}\right)\right]$
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No, the answer is incorrect.
Score: 0
Accepted Answers:
$E_s = 2\pi a^2\eta_s\left[-\frac{A}{(\delta-a)^6}F\left(3,1;2;-\frac{4a\delta}{(\delta-a)^2}\right)+\frac{B}{(\delta-a)^{12}}F\left(6,1;2;-\frac{4a\delta}{(\delta-a)^2}\right)\right]$