Unit 4 - Week 3

Assignment 3

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

Due on 2020-10-07, 23:59 IST.

The interaction energy versus separation distance for a pair of Argon molecules is shown in the Figure 1. The interaction energy (y-axis) is scaled with the thermal energy, k_BT and the separation distance; r (x-axis) is in nm.

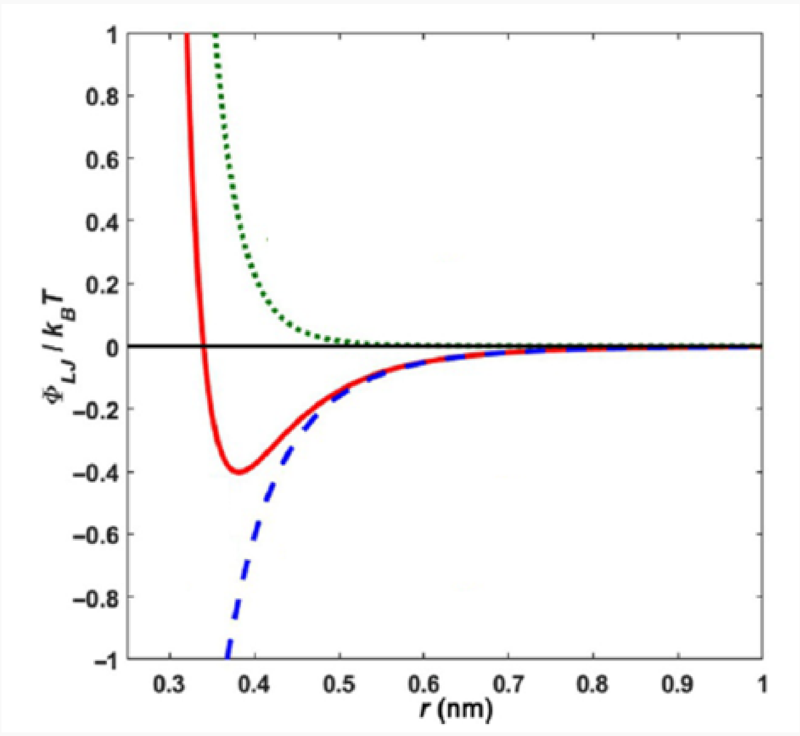

Figure 1: A plot of interaction energy as a function of separation distance

From Figure 1, identify the line that corresponds to attractive, repulsive and total interaction energy:

1) The dotted line corresponds to ---------------

Hint

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: String) repulsive interaction energy

0 points

2) The dashed line corresponds to ---------------

Hint

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: String) attractive interaction energy

0 points

3) The continuous line corresponds to-----------

Hint

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: String) total interaction energy

0 points

For the variation of total interaction, repulsive and attractive interactions shown in the Figure 1, pick the expression best represents the functional variation.

(A) $-\frac{a}{r^{12}} - \frac{a}{r^6}$, (B) $-\frac{a}{r^{12}} + \frac{a}{r^6}$, (C) $\frac{a}{r^{12}} - \frac{a}{r^6}$, (D) $-\frac{a}{r^{12}}$, (E) $-\frac{a}{r^6}$, (F) $\frac{a}{r^{12}}$, (G) $\frac{a}{r^6}$

4) The total interaction ---------------

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: String) C

1 point

5) The repulsive interaction ---------------

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: String) F

1 point

6) The attractive interaction -----------

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: String) E

1 point

7) From Figure 1, find the equilibrium separation distance (in nm)

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 0.35,0.45

2 points

8) From Figure 1, find the energy that the pair of argon molecules experience at this separation (in scaled k_BT units i.e., energy divided by k_BT).

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) -0.45,-0.35

2 points

9) A spherical silica (SiO2) particle hangs on a planar silica surface caused by the van der Waals attraction of $F = AR/6D^2$. The van der Waals attraction increases linearly with the radius of the sphere. The gravitational force, which pulls the sphere down, is $4\Box\pi R^3 \rho g/3$. It increases cubically with the radius. As a consequence, the behavior of small spheres is dominated by van der Waals forces, while for large spheres gravity is more important. At which radius is the gravitational force so strong that the sphere detaches? Report your answer in millimeter (mm).The separation distance can be taken as 0.17 nm.

Use a Hamaker constant, $A = 6 \times 10^{-20} J$, the density (ρ) is $5000\ kg/m^3$.

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 1.2,1.4

5 points

The following table provides parameters that are necessary to calculate the magnitudes of Debye, Keesom and London interactions that contribute to the overall van der waals attraction between toluence molecules.

Compound	μ (debye)	$(\alpha/4\pi\varepsilon_0)\times 10^{30}$ (m^3)	$\beta\times 10^{77}$ (Jm^6)
Toulene	0.43	11.80	5.16

10) Calculate Debye at 0.4 nm separation distance and report your answer in Joules. *2.5 points*

- 1.25E-20 J or 1.25×10^{-20} J
- 1.26E-20 J or 1.26×10^{-20} J
- 1.13E-21 J or 1.13×10^{-22} J
- 1.26E-22 J or 1.26×10^{-23} J

No, the answer is incorrect.
Score: 0
Accepted Answers:
1.13E-21 J or 1.13×10^{-22} J

11) Calculate Keesom at 0.4 nm separation distance and report your answer in Joules. *2.5 points*

- 1.13E-21 J or 1.13×10^{-22} J
- 1.26E-22 J or 1.26×10^{-23} J
- 1.25E-20 J or 1.25×10^{-20} J
- 1.26E-20 J or 1.26×10^{-20} J

No, the answer is incorrect.
Score: 0
Accepted Answers:
1.26E-22 J or 1.26×10^{-23} J

12) Calculate London dispersion 0.4 nm separation distance and report your answer in Joules. *2.5 points*

- 1.25E-20 J or 1.25×10^{-20} J
- 1.26E-20 J or 1.26×10^{-20} J
- 1.13E-21 J or 1.13×10^{-22} J
- 1.26E-22 J or 1.26×10^{-23} J

No, the answer is incorrect.
Score: 0
Accepted Answers:
1.25E-20 J or 1.25×10^{-20} J

13) Calculate van der Waals interaction at 0.4 nm separation distance and report your answer in Joules. *2.5 points*

- 1.25E-20 J or 1.25×10^{-20} J
- 1.26E-20 J or 1.26×10^{-20} J
- 1.13E-21 J or 1.13×10^{-22} J
- 1.26E-22 J or 1.26×10^{-23} J

No, the answer is incorrect.
Score: 0
Accepted Answers:
1.26E-20 J or 1.26×10^{-20} J