Assignment 5

Due on 2020-03-10 23:59:59

1. Consider a container divided into two chambers, one chamber of volume V1 having 3N molecules of monatomic ideal gas at temperature T1 and the other chamber of volume V2 having 2N molecules of monatomic ideal gas at temperature T2. If the partition between the two chambers is now removed, what is the overall change in the internal energy of the gas?

\( \Delta U = \text{?} \) point

2. The chemical potential function for a molecule with fundamental frequency \( \nu \) is given by

\[ \mu(\nu) = a_0 \nu \left( \frac{\nu}{\nu_0} \right)^{1/2} \exp \left( - \frac{\nu}{\nu_0} \right) \]

\( a_0 = \text{?} \nu_0^{\frac{1}{3}} \) point

3. A classical gas of molecules, each of mass \( m \), is in thermal equilibrium at temperature T. The velocity components of the molecules along the Cartesian coordinates \( x, y, \) and \( z \). The average values of \( v_x, v_y, v_z \) are

\[ v_x = \text{?} \] point

4. Consider a gas occupying two distinct parts of a container, one part with volume \( V_1 \) at temperature \( T_1 \) and the other part with volume \( V_2 \) at temperature \( T_2 \). The molecules of the gas are monatomic ideal gas. If the partition between the two parts is removed, what is the overall change in the internal energy of the gas?

\( \Delta U = \text{?} \) point

5. A system of two harmonic oscillators, each of mass \( m \) and stiffness \( k \), are placed in a container of volume \( V \). The oscillators are in thermal equilibrium at temperature T. The kinetic energy of the oscillators is given by

\[ \frac{1}{2} m \omega^2 \left( x^2 + y^2 + z^2 \right) \]

\( \omega = \text{?} \) point

6. Through the reduction of an improper fraction to simplest form, the same value of m, in the equation \( m \), is found. The total time taken to wash the clothes is 15 minutes. The total cost of washing the clothes is 30 dollars. The price of washing per minute is\( \text{?} \) point

7. A classical gas of molecules, each of mass \( m \), is in thermal equilibrium at temperature T. The velocity components of the molecules along the Cartesian coordinates \( x, y, \) and \( z \). The average values of \( v_x, v_y, v_z \) are

\[ v_x = \text{?} \] point

8. A classical gas of molecules, each of mass \( m \), is in thermal equilibrium at temperature T. The velocity components of the molecules along the Cartesian coordinates \( x, y, \) and \( z \). The average values of \( v_x, v_y, v_z \) are

\[ v_x = \text{?} \] point

9. A classical gas of molecules, each of mass \( m \), is in thermal equilibrium at temperature T. The velocity components of the molecules along the Cartesian coordinates \( x, y, \) and \( z \). The average values of \( v_x, v_y, v_z \) are

\[ v_x = \text{?} \] point

10. A classical gas of molecules, each of mass \( m \), is in thermal equilibrium at temperature T. The velocity components of the molecules along the Cartesian coordinates \( x, y, \) and \( z \). The average values of \( v_x, v_y, v_z \) are

\[ v_x = \text{?} \] point

11. A classical gas of molecules, each of mass \( m \), is in thermal equilibrium at temperature T. The velocity components of the molecules along the Cartesian coordinates \( x, y, \) and \( z \). The average values of \( v_x, v_y, v_z \) are

\[ v_x = \text{?} \] point