**Chapter – 18**

1. **An auditorium has dimensions 10.0 m x 20.0 m x 30.0 m. How many molecules of air fill the auditorium at 20.0oC and a pressure of 101 kPa (1.00 atm)?**

**Solution:**

The equation of state of an ideal gas is *PV* = *nRT,* so we need to solve for the number of moles to find *N*.



Then,



1. **A container in the shape of a cube 10.0 cm on each edge contains air (with equivalent molar mass 28.9 g/mol) at atmospheric pressure and temperature 300 K. Find (a) the mass of the gas, (b) the gravitational force exerted on it, and (c) the force it exerts on each face of the cube. (d) Why does such a small sample exert such a great force**

**Solution:**

(a) From *PV* = *nRT*, we obtain . Then

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(b) 

(c) 

(d) The  to hit the walls hard

1. **A steel beam being used in the construction of a skyscraper has a length of 35.000 m when delivered on a cold day at a temperature of 15.000oF. What is the length of the beam when it is being installed later on a warm day when the temperature is 90.000oF?**

**Solution:**

We must first convert both the initial and final temperatures to Celsius:



Thus, 



The length of the steel beam after heating is *Lf* , and the linear expansion of the beam follows the equation: 

Thus,



1. **A liquid has a density . (a) Show that the fractional change in density for a change in temperature T is = - . (b) What does the negative sign signify? (c) Fresh water has a maximum density of 1.000 0 g/cm3 at 4.0oC. At 10.0oC, its density is 0.999 7 g/cm3. What is for water over this temperature interval? (d) At 0oC, the density of water is 0.999 9 g/cm3. What is the value for over the temperature range 0oC to 4.00oC?**

**Solution:**

(a)  and 

For very small changes in *V* and *ρ*, this can be expressed as



(b) 

(c) For water we have 

(d) 