**Chapter 18**

1. An airplane mechanic notices that the sound from a twin-engine aircraft rapidly varies in loudness when both engines are running. What could be causing this variation from loud to soft?

Answer:

2. 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:

3. 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:

4. A liquid has a density $ρ$. (a) Show that the fractional change in density for a change in temperature $∆$T is $∆ρ/ρ$ = -$β∆T$ . (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 $β$ for water over this temperature interval? (d) At 0oC, the density of water is 0.999 9 g/cm3. What is the value for $β$ over the temperature range 0oC to 4.00oC?

Solution:

**Solutions for Chapter 18**

1. An airplane mechanic notices that the sound from a twin-engine aircraft rapidly varies in loudness when both engines are running. What could be causing this variation from loud to soft?

Answer:

The loudness varies because of beats. The propellers are rotating at slightly different frequencies.

2. 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,

 

3. 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

4. A liquid has a density $ρ$. (a) Show that the fractional change in density for a change in temperature $∆$T is $∆ρ/ρ$ = -$β∆T$ . (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 $β$ for water over this temperature interval? (d) At 0oC, the density of water is 0.999 9 g/cm3. What is the value for $β$ 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) 