**Chapter 20**

1. A spherical balloon of volume 4.00 x 103 cm3 contains helium at a pressure of 1.20 x 105 Pa. How many moles of helium are in the balloon if the average kinetic energy of the helium atoms is 3.60 x 10-22 J?

Solution:

2. Calculate the mass of an atom of (a) helium, (b) iron, and (c) lead. Give your answers in kilograms. The atomic masses of these atoms are 4.00 u, 55.9 u, and 207 u, respectively.

Solution:

3. A 7.00-L vessel contains 3.50 moles of gas at a pressure of 1.60 x 106 Pa. Find (a) the temperature of the gas and (b) the average kinetic energy of the gas molecules in the vessel. (c) What additional information would you need if you were asked to find the average speed of the gas molecules?

Solution:

4. At what temperature would the average speed of helium atoms equal (a) the escape speed from the Earth, 1.12 x 104 m/s, and (b) the escape speed from the Moon, 2.37 x 103 m/s? Note: The mass of a helium atom is 6.64 x 10-27 kg.

**Solutions for Chapter 20**

1. A spherical balloon of volume 4.00 x 103 cm3 contains helium at a pressure of 1.20 x 105 Pa. How many moles of helium are in the balloon if the average kinetic energy of the helium atoms is 3.60 x 10-22 J?

Solution:

The gas temperature must be that implied by  for a monatomic gas like helium. 

Now *PV* = *nRT* gives 

2. Calculate the mass of an atom of (a) helium, (b) iron, and (c) lead. Give your answers in kilograms. The atomic masses of these atoms are 4.00 u, 55.9 u, and 207 u, respectively.

Solution:

We use 1 u = 1.66 × 10−24 g.

(a) For He, 

(b) For Fe, 

(c) For Pb, 

3. A 7.00-L vessel contains 3.50 moles of gas at a pressure of 1.60 x 106 Pa. Find (a) the temperature of the gas and (b) the average kinetic energy of the gas molecules in the vessel. (c) What additional information would you need if you were asked to find the average speed of the gas molecules?

Solution:

(a) The volume occupied by this gas is



Then, the ideal gas law gives



(b) The average kinetic energy per molecule in this gas is



(c) You would need to know the mass of the gas molecule to find its average speed, which in turn requires knowledge of 

4. At what temperature would the average speed of helium atoms equal (a) the escape speed from the Earth, 1.12 x 104 m/s, and (b) the escape speed from the Moon, 2.37 x 103 m/s? Note: The mass of a helium atom is 6.64 x 10-27 kg.

Solution:

(a) From  we find the temperature as

 

(b) 