



Passage VI

For gas atoms in a state of random motion, the *mean free path*, λ , is the average distance a gas atom will travel between collisions with other gas atoms. This distance depends upon the diameter of the gas atom, d , the volume of the gas, V , and the number of atoms of the gas, N . Table 1 lists the name, symbol, and value of d (in nanometers, nm) for each of 4 gases. Figure 1 shows, for each gas, at 293 kelvins (K), how λ (in nm) varies with V (in liters, L) in a sample with $N = 6 \times 10^{23}$ atoms of the gas. Figure 2 shows, for each gas, at 293 K, how λ varies with N in a sample with $V = 25$ L.

Table 1		
Gas	Symbol	d (nm)
Neon	Ne	0.076
Argon	Ar	0.142
Krypton	Kr	0.176
Xenon	Xe	0.216

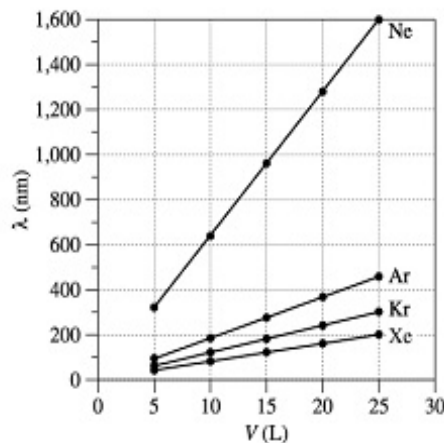


Figure 1

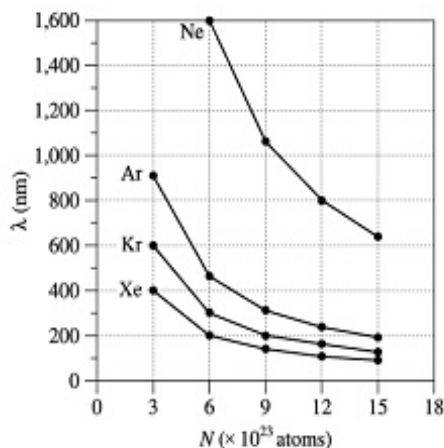


Figure 2

35. According to Figure 2, what is the order of gas samples from shortest λ to longest λ for $N = 15 \times 10^{23}$ atoms?

A. Ne, Ar, Kr, Xe
 B. Ne, Kr, Ar, Xe
 C. Xe, Ar, Kr, Ne
 D. Xe, Kr, Ar, Ne

36. According to Figure 2, doubling the Ne sample size from 6×10^{23} atoms to 12×10^{23} atoms effectively multiplies λ for Ne by a factor of:

F. $\frac{1}{4}$
 G. $\frac{1}{2}$
 H. 2
 J. 4



37. Consider 2 Kr samples at 293 K, each with $N = 6 \times 10^{23}$ atoms, but one with $V = 25$ L and the other with $V = 50$ L. Based on Figure 1, λ for the 50 L sample would most likely be how many times as great as λ for the 25 L sample?
- $\frac{1}{4}$
 - $\frac{1}{2}$
 - 2
 - 4
38. Based on Figure 1, for the Xe and Ar gas samples with $V = 20$ L, compared to λ for Xe, approximately how much longer is λ for Ar?
- 50 nm
 - 100 nm
 - 150 nm
 - 200 nm
39. The *collision frequency* is defined as the number of collisions between gas atoms per second. Consider the 5 L and 25 L Xe samples represented in Figure 1. Assuming the Xe atoms have the same average speed in both samples, in which sample would the collision frequency more likely be higher?
- In the 5 L sample; Xe atoms in the 5 L sample travel, on average, shorter distances between collisions and therefore collide more often.
 - In the 5 L sample; Xe atoms in the 5 L sample travel, on average, longer distances between collisions and therefore collide more often.
 - In the 25 L sample; Xe atoms in the 25 L sample travel, on average, shorter distances between collisions and therefore collide more often.
 - In the 25 L sample; Xe atoms in the 25 L sample travel, on average, longer distances between collisions and therefore collide more often.
40. For a particular sample of radon (Rn) gas in a 25 L container at 293 K, λ is approximately 320 nm. If d for Rn is 0.240 nm, then, based on Table 1 and Figure 2, approximately how many Rn atoms are most likely in this sample?
- Less than 6×10^{23}
 - Between 6×10^{23} and 9×10^{23}
 - Between 9×10^{23} and 12×10^{23}
 - More than 12×10^{23}

END OF TEST 4

STOP! DO NOT RETURN TO ANY OTHER TEST.