42. Equal masses of He and Ne are placed in a sealed container. What is the partial pressure in the container if the total pressure is 6 atm?

(A) 1 atm  
(B) 2 atm  
(C) 3 atm  
(D) 4 atm  
(E) 5 atm  

42. 

51. Under which of the following conditions of temperature and pressure would 1.0 mol of the real gas \( CO_2(g) \) behave most like an ideal gas?

<table>
<thead>
<tr>
<th>Temperature (K)</th>
<th>Pressure (atm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(A) 100</td>
<td>0.1</td>
</tr>
<tr>
<td>(B) 100</td>
<td>100</td>
</tr>
<tr>
<td>(C) 800</td>
<td>0.1</td>
</tr>
<tr>
<td>(D) 800</td>
<td>1</td>
</tr>
<tr>
<td>(E) 800</td>
<td>100</td>
</tr>
</tbody>
</table>

51. 

\[
\begin{align*}
\text{Pressure & Mass Law} & : \\
\frac{P_1}{M_1} & = \frac{P_2}{M_2} \\
\text{where} & \\
M & = \text{molar mass} \\
P & = \text{pressure} \\
V & = \text{volume} \\
T & = \text{temperature} \\
\text{Number of moles} & = \frac{nM}{\text{molar mass}} \\
\text{Ideal Gas Law} & : \\
P & = \frac{nRT}{V} \\
\end{align*}
\]
8. The graph above shows the speed distribution of molecules in a sample of a gas at a certain temperature. Which of the following graphs shows the speed distribution of the same molecules at a lower temperature (as a dashed curve)?

(A) 

(B) 

(C) 

(D) 

(2013 Practice Exam)
26. The figure above represents three sealed 1.0 L vessels, each containing a different inert gas at 298 K. The pressure of Ar in the first vessel is 2.0 atm. The ratio of the numbers of Ar, Ne, and He atoms in the vessels is 2:1:6, respectively. After all the gases are combined in a previously evacuated 2.0 L vessel, what is the total pressure of the gases at 298 K?

(A) 3.0 atm  
(B) 4.5 atm  
(C) 9.0 atm  
(D) 18 atm

Add Pressures
2.0 atm + 1.0 atm + 6.0 atm = 9.0 atm

(2013 Practice Exam)

39. The experimental apparatus represented above is used to demonstrate the rates at which gases diffuse. When the cotton balls are placed in the ends of a tube at the same time, the gases diffuse from each end and meet somewhere in between, where they react to form a white solid. Which of the following combinations will produce a solid closest to the center of the tube?

(A) HCl and CH₃NH₂  
(B) HCl and NH₃  
(C) HBr and CH₃NH₂  
(D) HBr and NH₃

If want gases to react in center, diffusivity must be traveling at same velocity (um/s)

\[ \text{UMS} = \sqrt{\frac{\text{MM}}{\text{MM}}} \]

Choose gases with similar MM values.

(2013 Practice Exam)
25. The pressure, in atm, exerted by 1.85 mol of an ideal gas placed in a 3.00 L container at 35.0°C is given by which of the following expressions?

(A) \( \frac{1.85 \times (0.0821)(308)}{3.00} \) atm

(B) \( \frac{1.85 \times 3.00}{(0.0821)(308)} \) atm

(C) \( \frac{3.00}{1.85 \times (0.0821)(308)} \) atm

(D) \( \frac{1.85 \times 8.314 \times (308)}{3.00} \) atm

(E) \( \frac{3.00 \times 1.85}{(0.0821)(35.0)} \) atm

\[ PV = nRT \]
\[ P = \frac{nRT}{V} = \frac{(1.85 \text{ mol}) \times 0.08206 \text{ atm L/mol K} \times 308 \text{ K}}{3.00 \text{ L}} \]

2008 Released Exam

51. Under which of the following conditions of temperature and pressure would 1.0 mol of the real gas \( \text{CO}_2(g) \) behave most like an ideal gas?

<table>
<thead>
<tr>
<th>Temperature (K)</th>
<th>Pressure (atm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(A) 100</td>
<td>0.1</td>
</tr>
<tr>
<td>(B) 100</td>
<td>100</td>
</tr>
<tr>
<td>(C) 800</td>
<td>0.1</td>
</tr>
<tr>
<td>(D) 800</td>
<td>1</td>
</tr>
<tr>
<td>(E) 800</td>
<td>100</td>
</tr>
</tbody>
</table>

High \( T \), low \( P \) → most ideal behavior
(helps to ignore \( TA + Part. \ Volume \))

2008 Released Exam
65. In a laboratory experiment, \( \text{H}_2(g) \) is collected over water in a gas-collection tube as shown in the diagram above. The temperature of the water is 21°C and the atmospheric pressure in the laboratory is measured to be 772 torr. Before measuring the volume of gas collected in the tube, what step, if any, must be taken to make it possible to determine the total gas pressure inside the tube?

(A) Tilt the tube to the side enough to let some air in to break the partial vacuum in the tube.
(B) Lift the tube upward until it is just barely immersed in the water.
(C) Move the tube downward until the water level is the same inside and outside the tube.
(D) Adjust the temperature of the water to 25°C.
(E) No further steps need to be taken as long as the temperature of the water is known.

2008 Released Exam

69. At standard temperature and pressure, a 0.50 mol sample of \( \text{H}_2 \) gas and a separate 1.0 mol sample of \( \text{O}_2 \) gas have the same

(A) average molecular kinetic energy
(B) average molecular speed
(C) volume
(D) effusion rate
(E) density

\[ \text{Take KE} \]
\[ \text{Same T} \rightarrow \text{same KE} \]

2008 Released Exam
Questions 8–10 refer to the following gases at 0°C and 1 atm.

(A) Ne (B) Xe (C) O₂ (D) CO₂ (E) NO₃

8. Has an average atomic or molecular speed closest to that of N₂ molecules at 0°C and 1 atm \( \text{D} \)
9. Has the greatest density \( \text{B} \)
10. Has the greatest rate of effusion through a pinhole \( \text{A} \)

\[
\text{Rate of Effusion} = \frac{1}{\sqrt{\text{MM}}} \\
\text{Lowest MM} = \uparrow \text{Rate}
\]

Choose closest MM to N₂ at STP, greatest d = greatest MM → \( \frac{9}{\text{mol}} \left( \frac{22.441 \text{L}}{\text{mol}} \right) \)

66. A 2 L container will hold about 4 g of which of the following gases at 0°C and 1 atm?
(A) SO₂ (B) N₂ (C) CO₂ (D) C₄H₈ (E) NH₃

\[
\frac{4 \text{g}}{2 \text{L}} \left( \frac{22.441 \text{L}}{\text{mol}} \right) = \frac{11.22}{\text{mol}}
\]

Questions 8–10 refer to three gases in identical rigid containers under the conditions given in the table below.

<table>
<thead>
<tr>
<th>Container</th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gas</td>
<td>Methane</td>
<td>Ethane</td>
<td>Butane</td>
</tr>
<tr>
<td>Formula</td>
<td>CH₄</td>
<td>C₂H₆</td>
<td>C₃H₈</td>
</tr>
<tr>
<td>Molar mass (g/mol)</td>
<td>16</td>
<td>30</td>
<td>58</td>
</tr>
<tr>
<td>Temperature (°C)</td>
<td>27</td>
<td>27</td>
<td>27</td>
</tr>
<tr>
<td>Pressure (atm)</td>
<td>2.0</td>
<td>4.0</td>
<td>2.0</td>
</tr>
</tbody>
</table>

8. The average kinetic energy of the gas molecules is
(A) greatest in container A
(B) greatest in container B
(C) greatest in container C
(D) greatest in container C

(\( \text{D} \)) the same in all three containers
9. The density of the gas, in g/L, is
   
   (A) greatest in container A
   (B) greatest in container B
   (C) greatest in container C
   (D) the same in all three containers

\[
\text{Density} = \frac{\text{mass}}{\text{volume}} = \frac{m}{V}
\]

10. If the pressure of each gas is increased at constant temperature until condensation occurs, which gas will condense at the lowest pressure?

   (A) Methane \( \text{CH}_4 \)
   (B) Ethane \( \text{CH}_3\text{CH}_3 \)
   (C) Butane \( \text{CH}_3\text{CH}_2\text{CH}_3 \)
   (D) All the gases will condense at the same pressure.

6. Under which of the following conditions of temperature and pressure will \( \text{H}_2 \) gas be expected to behave most like an ideal gas?

   (A) 50 K and 0.10 atm
   (B) 50 K and 5.0 atm
   (C) 500 K and 0.10 atm
   (D) 500 K and 50 atm

\[\text{High } T \text{ low } P\]

Course Descrip 2018

2014 International Practice Exam
7. The volume of a sample of air in a cylinder with a movable piston is 2.0 L at a pressure $P_1$, as shown in the diagram above. The volume is increased to 5.0 L as the temperature is held constant. The pressure of the air in the cylinder is now $P_2$. What effect do the volume and pressure changes have on the average kinetic energy of the molecules in the sample?

(A) The average kinetic energy increases.
(B) The average kinetic energy decreases.
(C) The average kinetic energy stays the same.
(D) It cannot be determined how the kinetic energy is affected without knowing $P_1$ and $P_2$.

2014 International Practice Exam
Questions 14-16 refer to the following.

The table below contains information about samples of four different gases at 273 K. The samples are in four identical rigid containers numbered 1 through 4.

<table>
<thead>
<tr>
<th>Container</th>
<th>Gas</th>
<th>Pressure (atm)</th>
<th>Mass of Sample (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>He</td>
<td>2.00</td>
<td>?</td>
</tr>
<tr>
<td>2</td>
<td>Ne</td>
<td>2.00</td>
<td>?</td>
</tr>
<tr>
<td>3</td>
<td>?</td>
<td>2.00</td>
<td>16.0</td>
</tr>
<tr>
<td>4</td>
<td>SO₂</td>
<td>1.96</td>
<td>64.1</td>
</tr>
</tbody>
</table>

14. On the basis of the data provided above, the gas in container 3 could be
(A) CH₄
(B) O₂
(C) Ar
(D) CO₂

15. Under the conditions given, consider containers 1, 2, and 4 only. The average speed of the gas particles is
(A) greatest in container 1
(B) greatest in container 2
(C) greatest in container 4
(D) the same in containers 1, 2, and 4

16. The best explanation for the lower pressure in container 4 is that SO₂ molecules
(A) have a larger average speed than the other three gases
(B) occupy a larger portion of the container volume than the other three gases
(C) have stronger intermolecular attractions than the other three gases
(D) contain π bonds, while the other gases contain only σ bonds

2014 International Practice Exam

2015 Released Exam
44. A rigid metal tank contains oxygen gas. Which of the following applies to the gas in the tank when additional oxygen is added at constant temperature?

(A) The volume of the gas increases.
(B) The pressure of the gas decreases.
(C) The average speed of the gas molecules remains the same.
(D) The total number of gas molecules remains the same.
(E) The average distance between the gas molecules increases.

1999 Exam

74. Which of the following gases deviates most from ideal behavior?

(A) SO₂
(B) Ne
(C) CH₄
(D) N₂
(E) H₂

1999 Exam