

Lecture 9 CH102 A2 (MWF 11:15 am) Spring 2018 Copyright © 2018 Dan Dill dan@bu.edu

[TP] Predict the effect of intermolecular attraction on the pressure exerted by a gaseous molecule in a collision with the wall of its container. The stronger the attraction, the ...

20% 1. greater the pressure
20% 2. smaller the pressure
20% 3. The pressure will not be affected
20% 4. Cannot answer without knowing the temperature
20% 5. Cannot answer without knowing the polarity of the molecule

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Wednesday, February 7, 2018

- Molecular speeds and their distribution; CDF <https://goo.gl/gzgjQE>
- Real gases: Effect of molecular attraction

Next: Real gases: Effect of molecular size; van der Waals equation; Phase diagrams

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u_{rms} versus temperature

The rms speed of O_2 at 300 K is 500 m/s and the rms speed of O_2 at 1200 K is 1000 m/s. Sketch the distribution of speeds for O_2 at these two temperatures on the same axes, marking the position of the two rms speeds on the x axis.

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The rms speed of O_2 at 300 K is 500 m/s and the rms speed of O_2 at 1200 K is 1000 m/s. Sketch the distribution of speeds for O_2 at these two temperatures on the same axes, marking the position of the two rms speeds on the x axis.

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u_{rms} versus temperature

Add to your sketch the distribution of speeds of H_2 at 300 K

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u_{rms} versus temperature

Add to your sketch the distribution of speeds of H_2 at 300 K

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Distribution of molecular speeds

The resulting distribution, known as the Maxwell-Boltzmann (MB) distribution.

For a given u_{rms} it is always the same.

CDF <https://goo.gl/gzgjQE>

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Effect of intermolecular attraction

Gas particles **attract one another**: van der Waals a

- # hitting wall $\propto \frac{n}{V}$
- # pulling back $\propto \frac{n}{V}$
- combined effect $\propto \left(\frac{n}{V}\right)^2$
- $p_{observed} = p_{empty} - a \left(\frac{n}{V}\right)^2$

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[TP] Equal amounts of gases A and C are in a single container. The molar masses of the gases are **identical**, but gas C has **stronger intermolecular forces**. The container is pierced with a hole **0.003 mm** in diameter. After 5 minutes, the container will contain ...

- 33% 1. more A than C
 33% 2. the same amount of A and C
 33% 3. more C than A



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[Quiz] Which of the following is the correct order of species for increasing value of **van der Waals a**?

- 20% 1. $H_2 < Kr < CO_2 < H_2O$
 20% 2. $H_2 < Kr < H_2O < CO_2$
 20% 3. $Kr < H_2 < CO_2 < H_2O$
 20% 4. $Kr < H_2 < H_2O < CO_2$
 20% 5. $H_2 < H_2O < Kr < CO_2$



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Contributions to van der Waals a

Van der Waals a reflects intermolecular attractions present when gas particles **encounter one another**.

Therefore, hydrogen bonding **can** make a contribution.



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