Hot Molecules

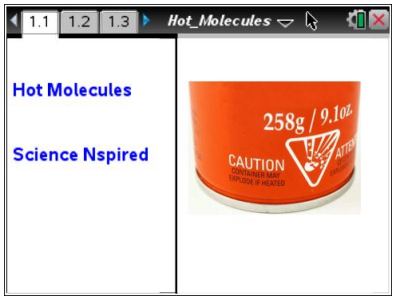
Student Activity

Name _____

Class _____

Open the TI-Nspire document *Hot_Molecules.tns.*

Have you ever wondered why you feel hot on a hot day and cold on a cold day? What causes an aerosol can to explode if placed in a fire? We'll explore this through a simulation in this activity.



Discussion

The Kinetic Molecular Theory of Gases explains the motion of ideal gases. This theory states:

- Gases consist of tiny particles (atoms or molecules).
- These particles are small, compared to the distance between them, and therefore, their volume can be considered to be negligible.
- The particles are in constant random motion, colliding with each other and with the walls of the container causing pressure on the container.
- The particles are assumed to have negligible attraction or repulsion for each other.
- The average kinetic energy of the gas particles is directly proportional to the Kelvin temperature.

In this simulation, you will observe the changes that occur in the motion of the molecules in a rigid container with a constant volume. You will also observe the relationship between the pressure and temperature of the gas in the container.

Move to pages 1.2 – 1.6. Answer the following questions here or in the .tns file.

Q1. What theory governs the motion of molecules in a gas?

A. Atomic
B. Molecular
C. Heat
D. Kinetic Molecular

Q2. Gas particles are considered to have _____ attraction or repulsion for other gas molecules.

A. great
B. zero
C. negligible
D. infinite

Q3. Particles of a gas are in _____ motion.

A. constant, random
B. constant, uniform
C. stop–and-go, random
D. stop-and–go, accelerated

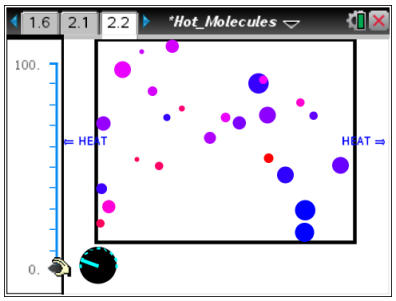
Q4. Based on the Kinetic Molecular Theory, predict what will happen to the pressure of a gas in a closed container as the temperature rises?

A. remains the same
B. decreases
C. increases
D. approaches zero

Q5. Based on the Kinetic Molecular Theory, predict what will happen to the average motion of the particles of gas in a closed container as the temperature is increased.

A. All motion will stop.
B. The particles will slow down.
C. The particles will speed up.
D. The particle motion will not change.

Move to pages 2.1 and 2.2.



1. On page 2.2, the temperature slider on the left side of the screen should read 0 K. If it does not, grab and move the slider down to 0.

   NOTE: Just like in real life, it will take a little time for the temperature to cool down and the molecules to adjust. Wait for the molecules to change before making any observations.

   NOTE: The simulation uses color to represent particle energy. If your handheld does not support color, you may skip questions related to observations of simulation colors.
2. At 0 K, observe the motion of the particles inside the container. Observe the pressure of the gas in the container at this same point.
3. Increase the temperature by moving slider to the first mark above 0 and observations the color, motion, and pressure. Continue to move the slider up one mark and observe the color, motion, and pressure.
4. After moving the slider to 100 K and making observations, move the temperature slider down one step at a time and observe the changes.

Move to pages 3.1 – 3.9. Answer the following questions here or in the .tns file.

Q6. At a temperature of 100 K, the color of most of the molecules changes to _____.

A. darker blue
B. pink
C. purple
D. red

Q7. The color change observed in Question 6 indicates that the molecules have _____ average kinetic energy at a higher temperature.

A. zero
B. increased
C. decreased
D. negative

Q8. As the temperature of the gas decreases, what slowly happens to the pressure?

A. It decreases.
B. It remains the same.
C. It increases.
D. It doubles.

Q9. At a temperature of 0 K, most of the particles are _____.

A. red
B. purple
C. pink
D. blue

Q10. From the observation in Question 9, the kinetic energy of the particles at 0 K is _____.

A. a theoretical minimum
B. a theoretical maximum
C. very high
D. nonexistent

Q11. When the molecules hit the walls of the container, they _____.

A. stick to the walls of the container
B. break into pieces
C. pass through the walls
D. bounce off the walls

Q12. Observe the size of the molecules in the simulation carefully. Which would best describe the composition of the gas in the container? The gas is made up of _____ substance(s).

A. one
B. two
C. three
D. four

Q13. Move the temperature slider one third of the way toward 100 degrees. Sometimes when molecules collide with each other there is a color change for one or both molecules. Explain the meaning of this observation in terms of the energy of the molecules.

Q14. Why do aerosol cans have a warning that the container may explode if heated?