

## Student Directions for Understanding KMT using *Gas Properties* and *States of Matter*

phet.colorado.edu

**Learning Goals:** Students will be able to describe matter in terms of particle motion. The description should include

- **Diagrams to support the description.**
- **How the particle mass and temperature affect the image.**
- **How the size and speed of gas particles relate to everyday objects**
- **What are the differences and similarities between solid, liquid and gas particle motion**

1. Open *Gas Properties* and then use the pump to put a little gas into the box.
  - a. Observe gas particles' behavior.
  - b. Pump in some lighter particles and talk about the similarities and differences that you see between heavy and light particles.
  - c. Use the simulation to see how changing the temperature affects the behavior of the gas particles.
  - d. Write a description for a gas based on your observations; include diagrams to help with your description.
2. How fast do you think the air particles in this room are moving compared to a car going 50 mph (about 22m/s)? Put your answer in the form, 'a molecule travels \_\_\_ as fast as a car'
3. Using the simulation, test your idea from question 2 and give evidence to support or revise your thoughts. For evidence, include how you used the simulation to collect data, and any calculations.
4. Determine the size of the heavy particle using the simulation tools and then relate molecule size to something you are familiar with. A common way to relate two things is to say something like: 1000 particles of sand fit in the palm of your hand. Show your calculations with the units clearly labeled.
5. Open *States of Matter*; use the simulation to determine how well liquids and solids match your description of gas particles.
6. Write a paragraph that explains the differences and similarities between solid, liquid and gas particle motion; include drawings to help with your explanations.