

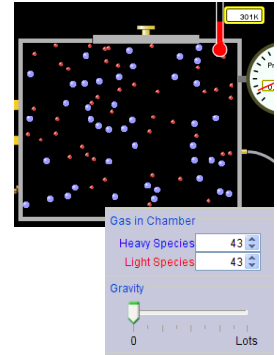
Understanding KMT using Gas Properties and States of Matter

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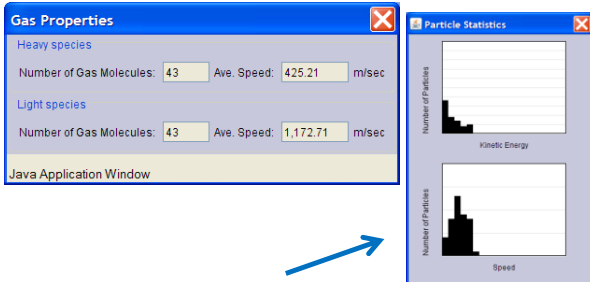
- Learning Goals: Students will be able to describe matter in terms of particle motion. The description should include
- Diagrams to support the description.
 - How the particle mass and temperature affect the image.
 - How the size and speed of gas particles relate to everyday objects
 - What are the differences and similarities between solid, liquid and gas particle motion

If you have a bottle with Helium & Nitrogen at room temperature, how do the speed of the particles compare?

- A. All have same speed
- B. The average speeds are the same
- C. Helium particles have greater average speed
- D. Nitrogen particles have greater average speed



Light and heavy gas at same temperature 300K

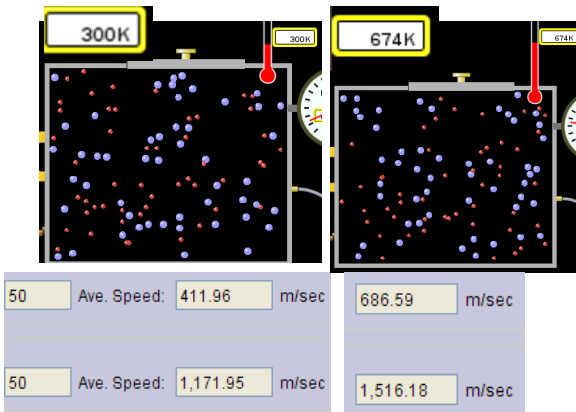


Speed of each particle varies!!

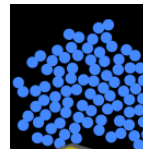
What happens if you add energy using the heater?



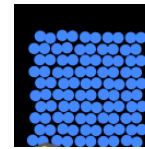
- A. All atoms speed up
- B. All atoms speed up about the same
- C. The lighter ones speed up more
- D. The heavier ones speed up more



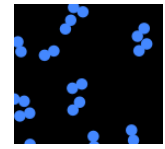
Which is most likely oxygen gas?



A

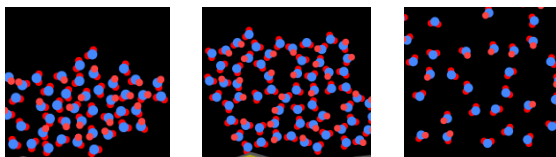


B



C

Which is most likely liquid water?



A

B

C

How many water molecules are in a raindrop (.5 cm diameter). *The molecules are about .1nm*

If we just look at how many are across $.005\text{m}/.1\text{E-}9\text{m} = 5\text{E}7$ or 50 million.

To show vibration

- <http://chemeddl.org/collections/molecules/index.php>
- Check **Spin Molecule** to see 3D rotation
- Show vibration under **Normal modes of vibration** (toggle down to see bond length changing)

KMT summary:

- Matter is made up of particles having negligible mass are in constant random motion (vibrate, rotate, translate)
- The particles are separated by great distances
- The particles collide perfectly elastically (there are no forces acting except during the collision)
- The temperature of a substance is related to the molecular velocity.