Today:

- Heat and Thermal Motion

Irish Phrasebook

Slainte! *– Cheers!*

(it's really the Gaelic word for 'health')

Final Exam Announcements

- Final exam dates and times are set:
  - Tuesday 15th, 3-5pm
  - Friday 18th, 10am-12pm
- Review session:
  - Thursday 10th, 7pm, C106

Announcements

- Reading Questions for Ch 13 and Ch 14 due tomorrow
- Reading Questions for Ch15 due Sunday
- LON-CAPA Homework for Ch13 and Ch14 due Wednesday 9th

A book slides across the table. It starts with a kinetic energy $KE_{initial}$. Friction does negative work on the book, making it slide to a halt. What happens to that energy?

A. It is used up stopping the book
B. It is turned into potential energy
C. It is converted to heat in the table and book
D. It is converted into a distortion of the table
E. None of the above

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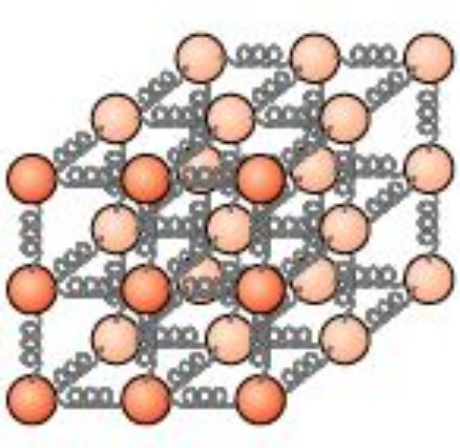
Energy must be conserved in my system and so if I'm thinking about the table and the book as my system the friction must transfer the KE from one form to another – in this case it would be heat energy.



Ch 13 –
Energy at the atomic level: heat and thermal motion

"The kind of motion we call heat"

- We have a natural sense of hot and cold.
- In the 19th century it was learned that the warmth of an object was a measure of a kind of random internal motion of the object's atoms.
- It was found that there was a surprisingly large amount of "hidden" energy that objects possessed as a result of their temperature –
  and that under the right conditions, this energy could be put to work.

Definitions: Heat energy

- Our model of matter as composed of many small moving particles allows us to extend energy conservation to include resistive forces.
- The energy associated with the motion of a macroscopic object is ***coherent***; all parts of the object move in the same way.
  The object has a net momentum associated with its kinetic energy.
- The internal energy of an object is ***incoherent***. The molecules of the object are moving in all directions randomly. Although the individual molecules have kinetic energy and momentum, the net momentum of the object as a result of its thermal energy is zero.
- The key idea in understanding thermal energy is ***equipartition*** – the equal sharing of energy any place it can go.

When gas particles move at a certain temperature, they….

A. All have same velocity, which is fixed
B. All have different, but fixed, velocities
C. All have different velocities, and those velocities fall into discrete energy bins
D. All have different velocities, and those velocities change

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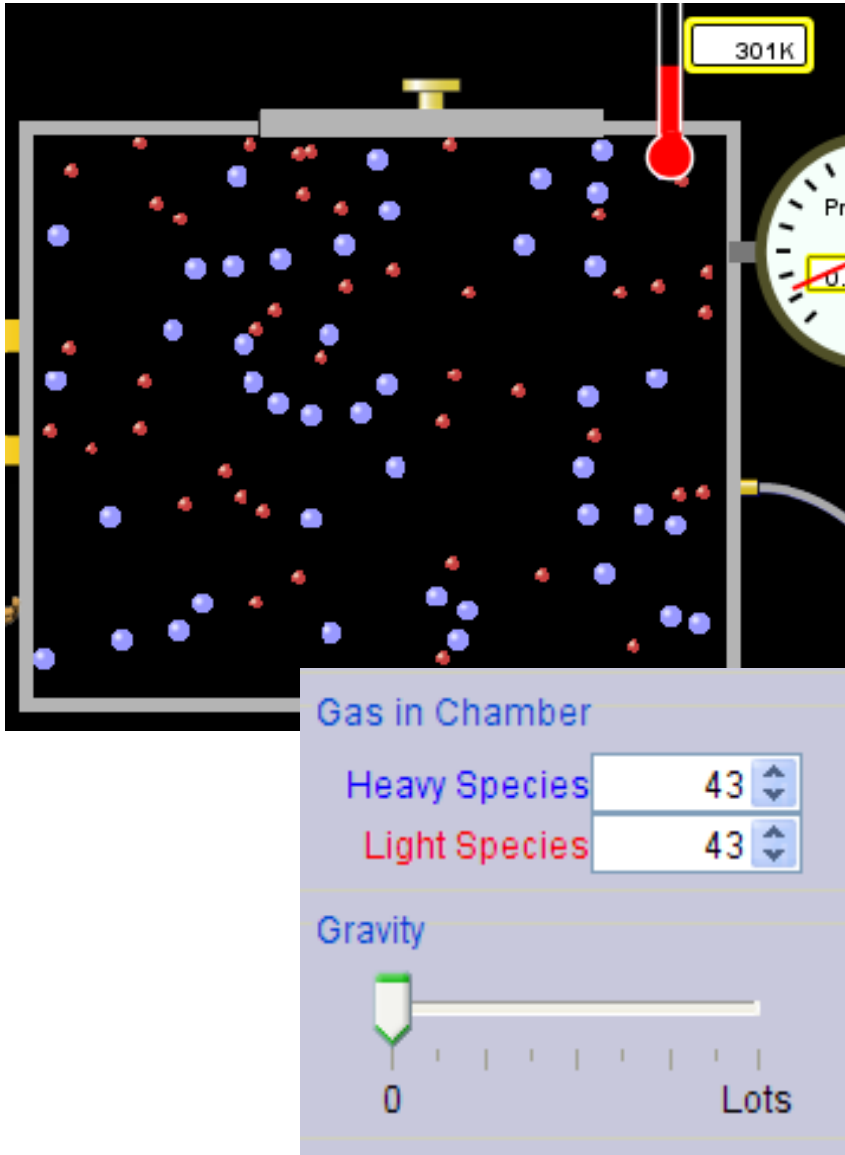
What is important is that the average kinetic energy remains the same. As the particles are moving around they collide with eachother and with the walls, so the velocities are changing, but the average kinetic energy remains the same.

http://phet.colorado.edu/en/simulation/gas-properties

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



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

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Since the temperature is the same, the kinetic energy must be the same. But since the Nitrogen are heavier, to have the same kinetic energy the Helium must be moving faster.