

- Take Home Exam is Optional
- Clickers turned in on Wednesday 4/30/14 after class.

4/25/14

Which type of heat transfer can happen through empty space?

- A. conduction
- B. evaporation
- C. convection
- D. radiation

If you get a cup of coffee in a paper cup, you may be given a corrugated paper sleeve to put around it to make it comfortable to hold. Explain the purpose of the paper sleeve, and how it accomplishes this. Why is the paper sleeve corrugated?

Which form of Heat transfer does it insulate against?

- A. Conduction
- B. Convection
- C. Radiation
- D. Evaporation

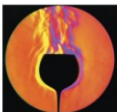


### Heat Transfer



When two objects are in direct physical contact, such as the soldering iron and the circuit board, heat is transferred by *conduction*. Energy is transferred by direct contact.

Conduction



This special photograph shows air currents near a warm glass of water. Air near the glass is warmed and rises, taking thermal energy with it in a process known as *convection*. Energy is transferred by the bulk motion of molecules with high thermal energy.

Convection



The lamp shines on the lambs huddled below, warming them. The energy is transferred by *infrared radiation*, a form of electromagnetic waves. Energy is transferred by electromagnetic waves.

Radiation



As we saw in an earlier section the *evaporation* of liquid can carry away significant quantities of thermal energy. When you blow on a cup of cocoa, this increases the rate of evaporation, rapidly cooling it. Energy is transferred by the removal of molecules with high thermal energy.

Evaporation

Suppose you place an ice cube in a cup of room-temperature water and then seal it in a well-insulated container. No energy can enter or leave the container.



If the result were a larger ice cube and some 100°C steam would it violate energy conservation?

Energy is conserved yet we never see a process like this. Why not?

## Gambling

Why do you think you might roll Snake Eyes (1/36) but you never expect the water to get hotter and the ice cube to get larger?

It's like saying after a year of gambling, the casino will lose.



## How Big is Mole?

4 grams of Helium  
16 grams of sulfur  
29 grams Copper  
80 grams of mercury

18 grams or 18 cubic centimeters of water

$6.022 \times 10^{23}$  molecules



## How Big is Mole?

More than the number of throws of craps in Las Vegas in

- A. 1 day
- B. 1 year
- C. Your lifetime
- D. Human's existence
- E. > age of the earth

Which of the following changes would allow your refrigerator to use less energy to run? (1) Increasing the temperature inside the refrigerator; (2) increasing the temperature of the kitchen; (3) decreasing the temperature inside the refrigerator; (4) decreasing the temperature of the kitchen.

- A. All of the above
- B. 1 only
- C. 1 and 4
- D. 2 and 3