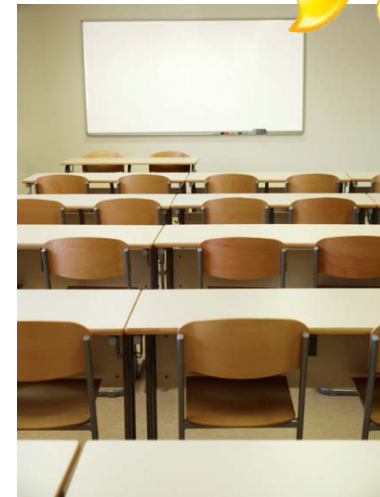
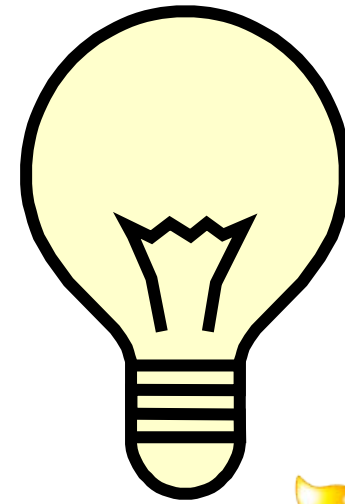


# **Beating the Motion Sensor**

**An Activity to Explore Material  
Properties and Lighting  
Controls**

# Lighting Controls

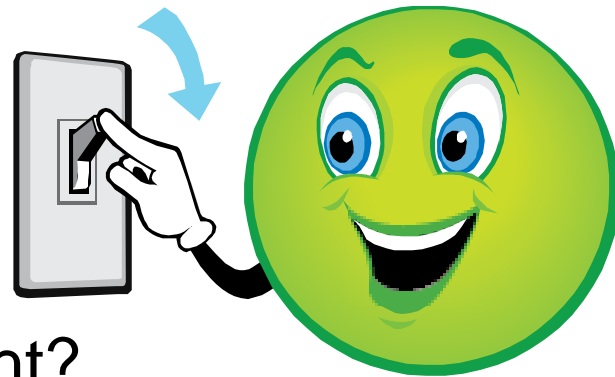
- Lighting in buildings = **1/3** of our electricity.
- How can we save energy for lighting?
- Turn the electrical lights OFF when there's enough light from the sun.
- Turn the lights OFF when there's no one in the room.



# Lighting Controls

- What is the best way to control the lights?

**YOU!**



- But we're not all perfect, right?
  - Install automatic controls to help with lighting control



# Motion Sensors

- Detect when a room is OCCUPIED or EMPTY
- Two types of technology:
  - Passive Infrared (PIR)
  - Ultrasonic
- Both types detect when something (or someone) is MOVING



# PIR Sensors

- See something moving if it is hotter than its background



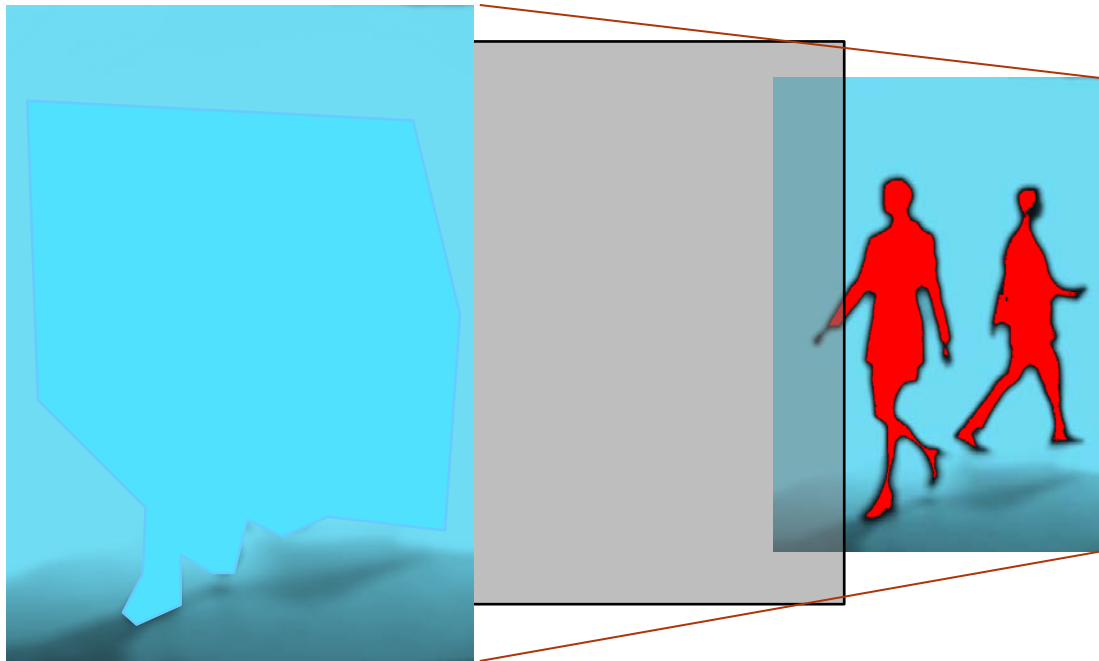
# Ultrasonic Sensors

- See something moving if it changes the way sound is reflected back (Doppler Effect)



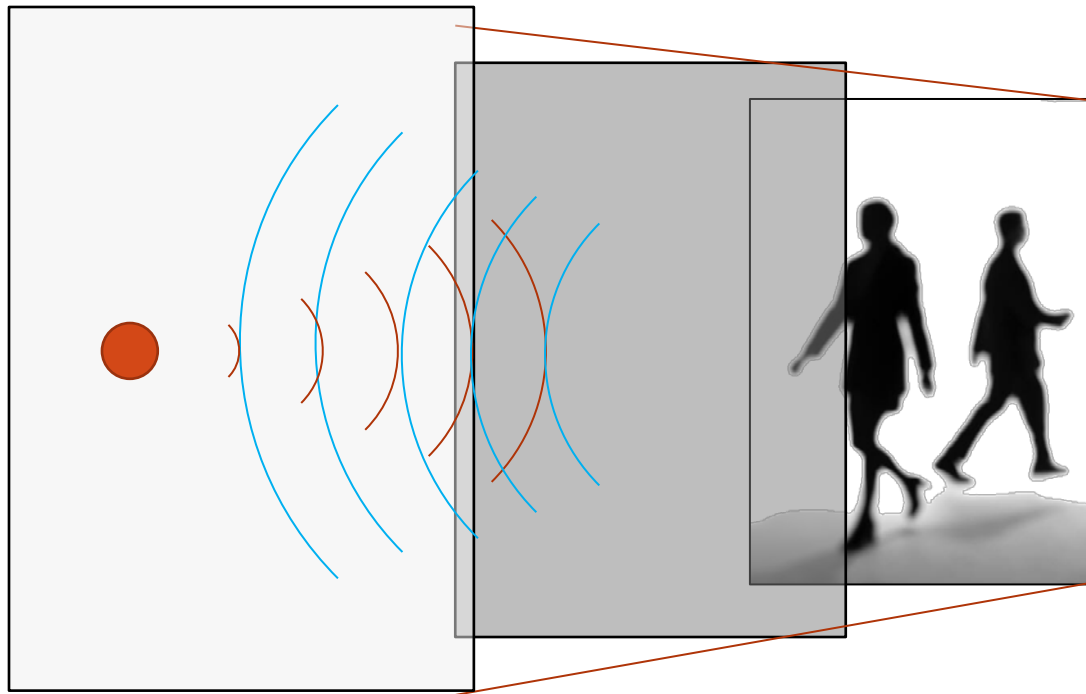
# PIR Sensors

- Won't "see" the motion if there is a material that blocks the heat



# Ultrasonic Sensors

- Won't "see" the motion if there is a material that reflects the sound

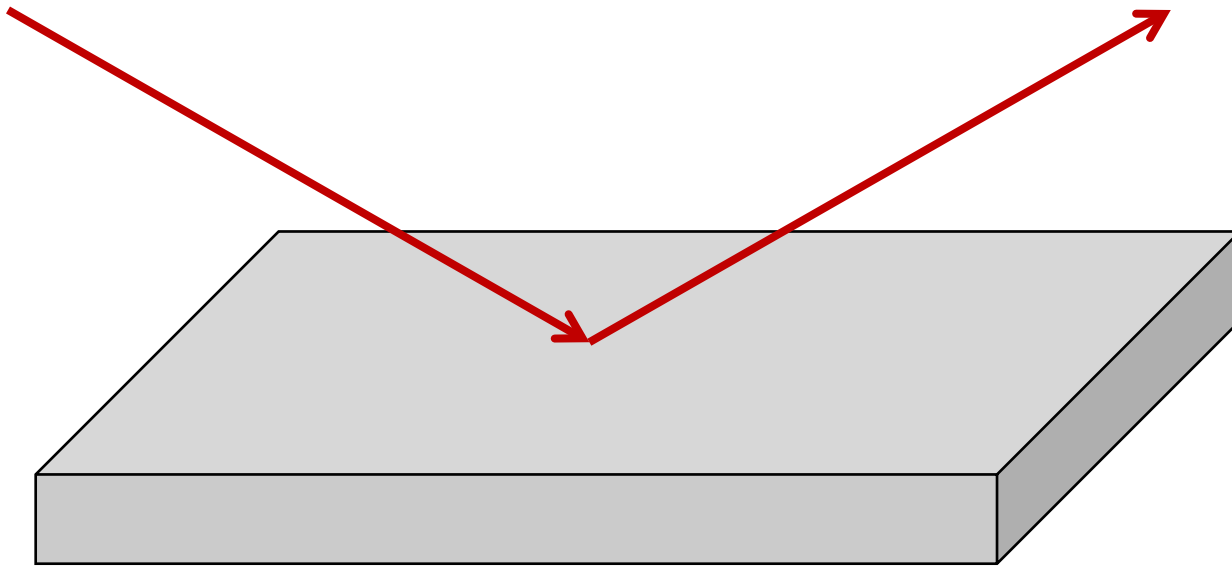




# Important Interactions

- How do materials interact with energy?

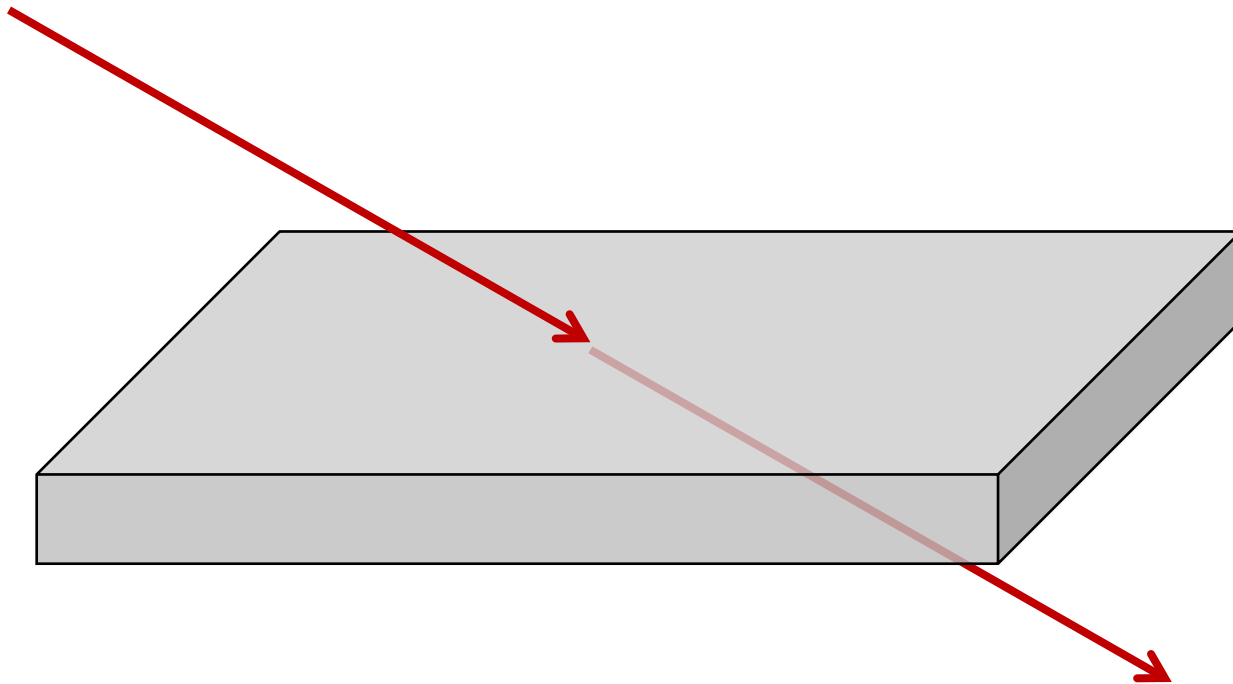
## REFLECTION



# Important Interactions

- How do materials interact with energy?

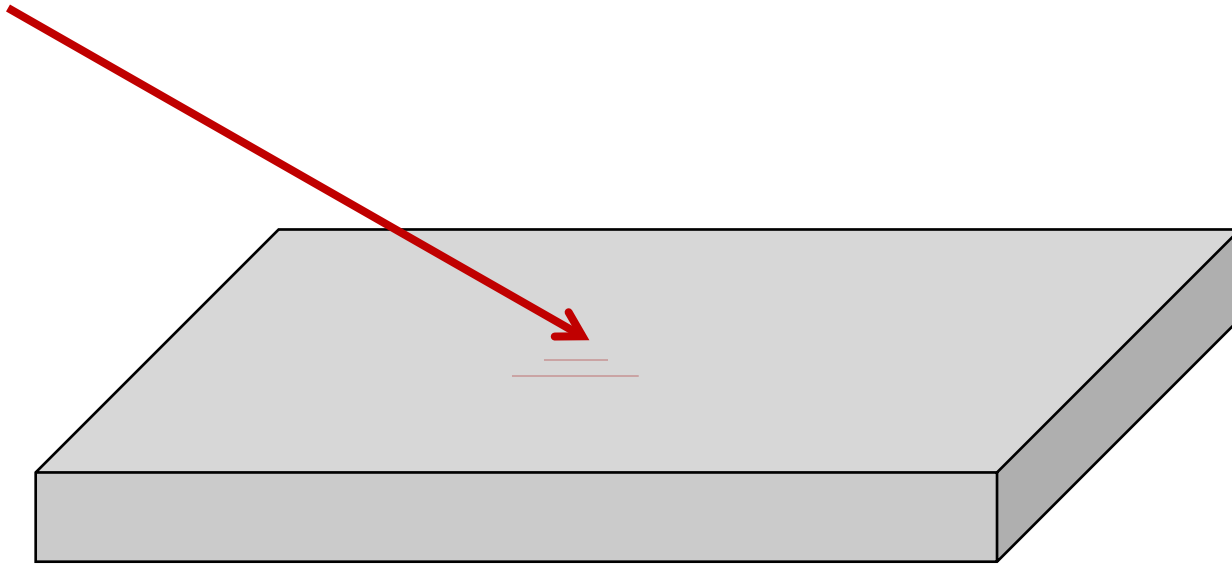
## TRANSMISSION



# Important Interactions

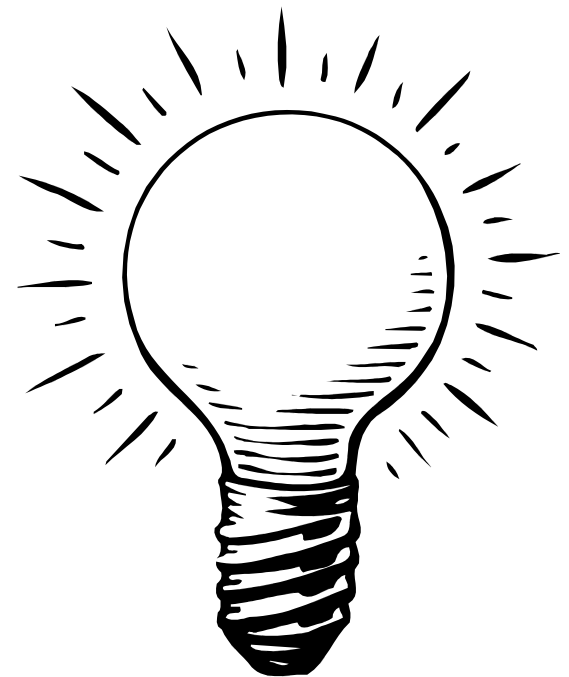
- How do materials interact with energy?

## A B S O R P T I O N



# Activity

- Let's BEAT the motion sensor!
  - BEATING THE SENSOR = If you can move your object in front of the sensor without the light coming on, you beat it.
- How do materials used in buildings interact with these sensors?
  - Wood
  - Metal
  - Glass
  - Fabric
  - Acrylic
  - ... others?
- Heat & sound energy



# As an Architectural Engineer...

- You are asked to select occupancy sensors to be used in different types of rooms that have different materials (see below).
  - What type of sensor would you select and why? (Using BOTH types together, known as “Dual-Technology” is also an option.)
  - *Office: Fabric-covered metal cubicle walls*
  - *Warehouse: Metal shelves with wooden crates*
  - *Bathroom: Ceramic tile stall walls with metal doors*
  - *Airport Security: Glass interior walls*