

Chapter 10

Heat and Temperature

Temperature

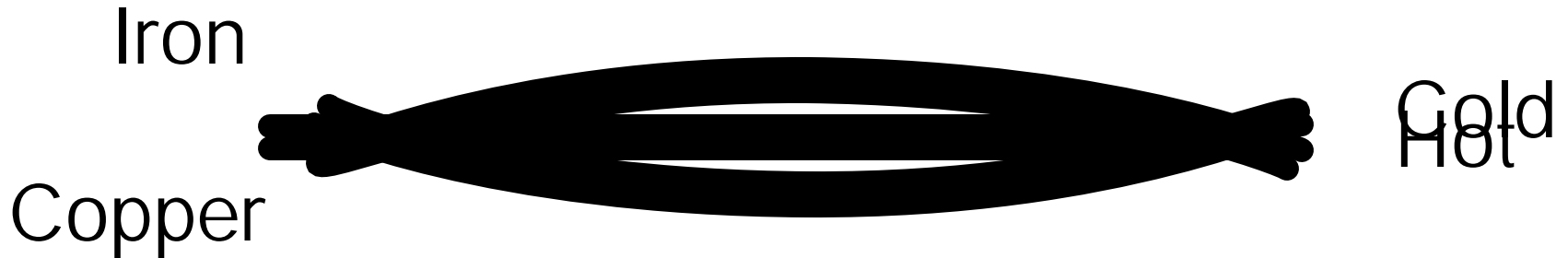
- How hot or cold something is.
- What make something hot?
- Particles that me up matter are in constant motion
- They have kinetic energy
- When you heat something the particles move faster
- Temperature measures average KE

Temperature

- Measured with thermometers
- Most materials expand when heated.
- That is how most thermometers work
- Liquid thermometers have a large bulb hooked to a narrow tube.
- When the liquid expands it rises up the tube.
- Won't work if too hot or cold

Thermometers

- Metals expand when heated
- Different metals expand different amounts
- Hook two metals together to make a thermometer that turns
- Bimetallic Thermometers



Thermometers

- Bimetallic thermometers are used in thermostats
- Digital thermometers use the fact that electricity conducts differently at different temperatures.

Temperature

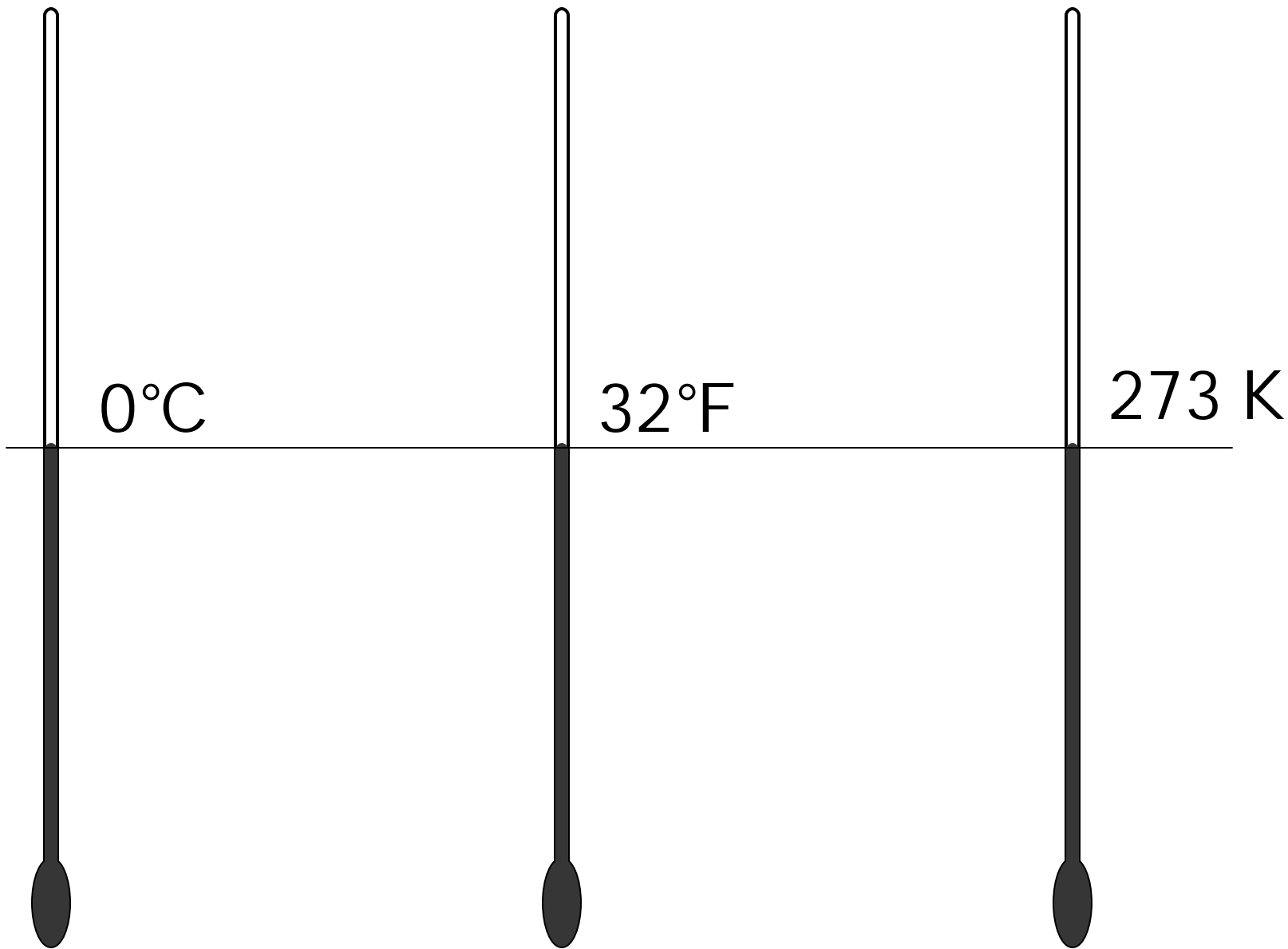
- As the temperature get lower the molecules move slower
- Kinetic energy goes down
- Lowest possible temperature would be when molecules stop moving
- Absolute zero

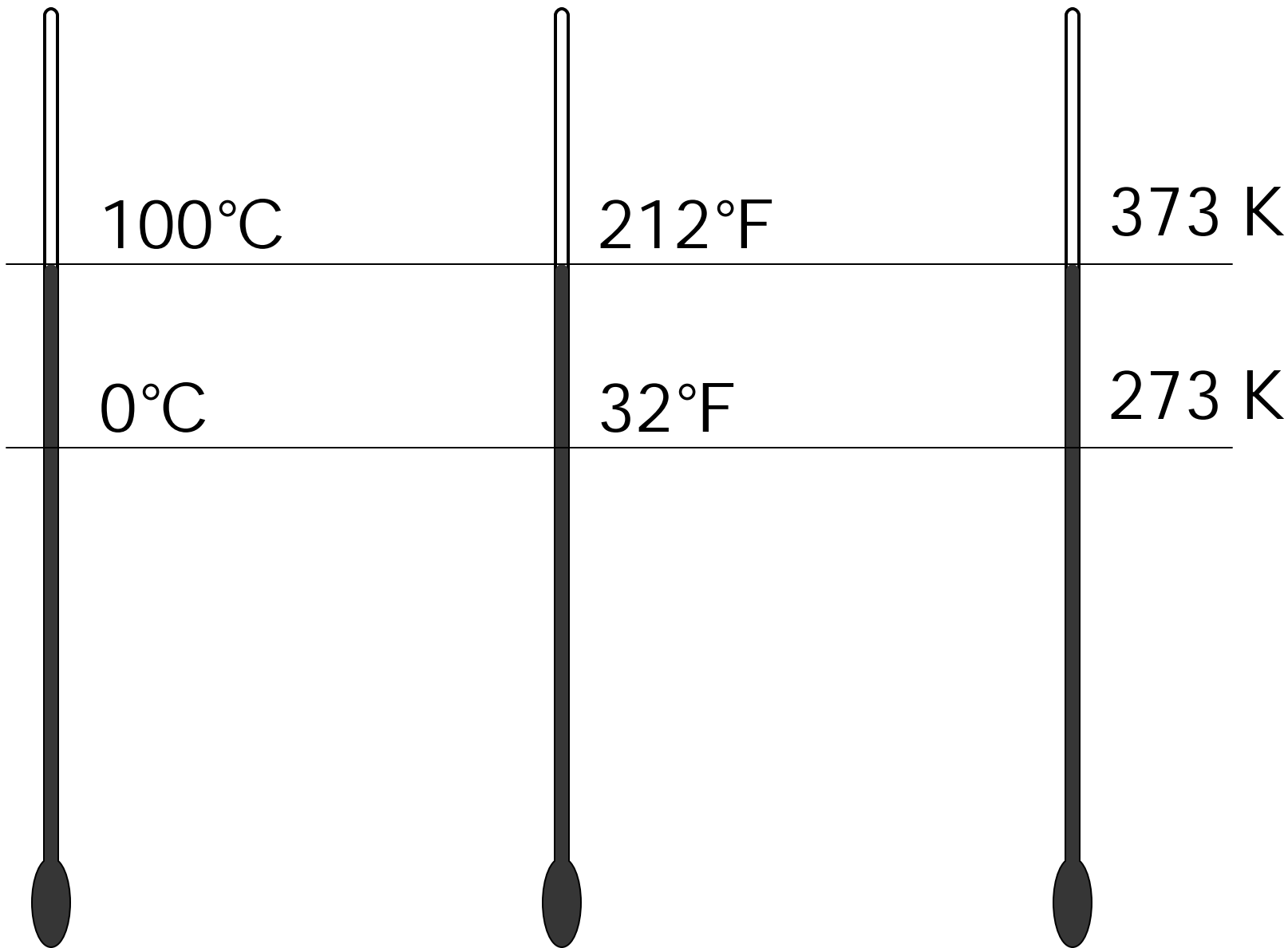
Temperature Scales

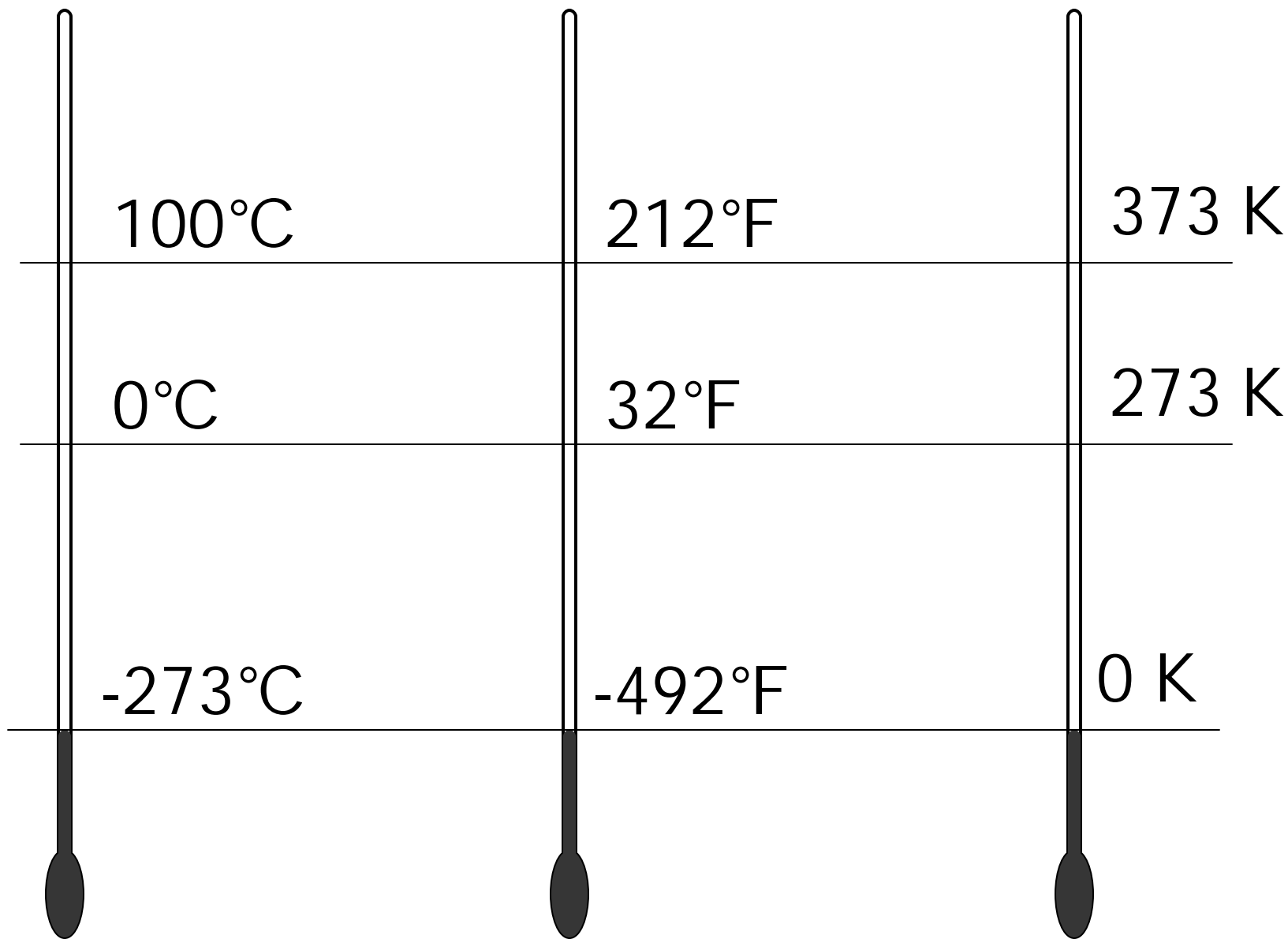
- Three different ones get used
- Fahrenheit- the one we use
- Celsius- metric standard
- Kelvin- starts at absolute zero but same degree size as Celsius

Converting Temperature

- $F = \frac{9}{5} C + 32$
- $K = C + 273$
- Water freezes at 32°F, what is this in Celsius?
- In Kelvin?
- Water boils at 100°C. What is this in Fahrenheit?
- In Kelvin?







Conversion Practice

- Body temperature is 98.6°F , what is this in Celsius? In Kelvin?
- Methanol boils at 75°C , what is this in Fahrenheit?, in Kelvin?
- Lead melts at 600 K , what is this in Celsius? In Fahrenheit?

Temperature tells you direction

- That energy will move.
- Always moves from high temperature to low temperature.
- Faster molecules (high temperature) hit slower molecules (low temperature) and speed them up

Energy Transfer

- Heat can be transferred 3 different ways
- Conduction- transferred by direct contact
- Molecules of high temperature object move faster, hit slower molecules so they speed up
- Doesn't work well in gases, too far apart
- Works better in liquids, but still not well
- Works well in some solids

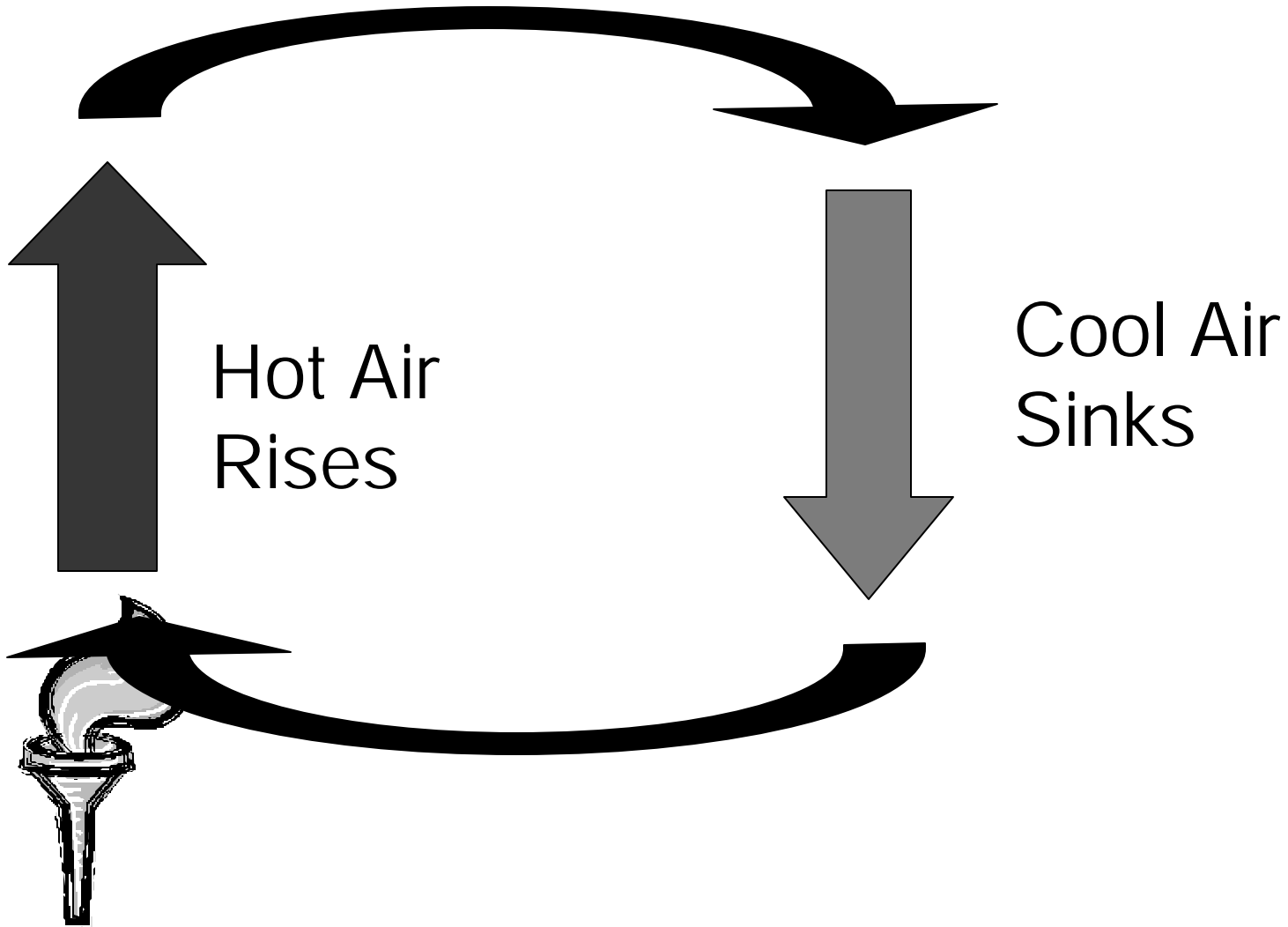
Energy Transfer

- Conductors- materials that allow heat to pass through them
- Most metals
- Insulators- materials that don't let heat through them well
- Rubber, plastics, glass
- Insulation traps air in pockets.
- Still air makes a good insulator.

Energy Transfer

- Convections- transferring energy by moving fluids
- Liquids and gases are fluids
- When heated they expand, become less dense
- They rise, replaced by cooler denser fluids
- Make a circular flow called a convection current

Convection Current



Energy Transfer

- Radiation- Energy transferred by electromagnetic waves
- Can travel through empty space
- When wave hit object they make the molecules move faster.

Specific Heat

- Some materials heat up easily
- Others require a large amount of energy to change their temperature
- Specific heat measures the amount of energy required to raise the temperature 1 kg of a substance by 1 degree Kelvin
- Table on page 336
- Water has a high specific heat
- 4186 J/kg K

Specific Heat

- Metals have a low specific heat
- Iron 449 J/kg K
- Heat = Specific heat x mass x change in temp
- How much heat does it take to change the temperature of 3 kg of water by 75 K?
- How much heat to change the heat of 5 kg of iron by 75 K?