Refrigeration Fundamentals

Part 1

Heat and Heat Transfer

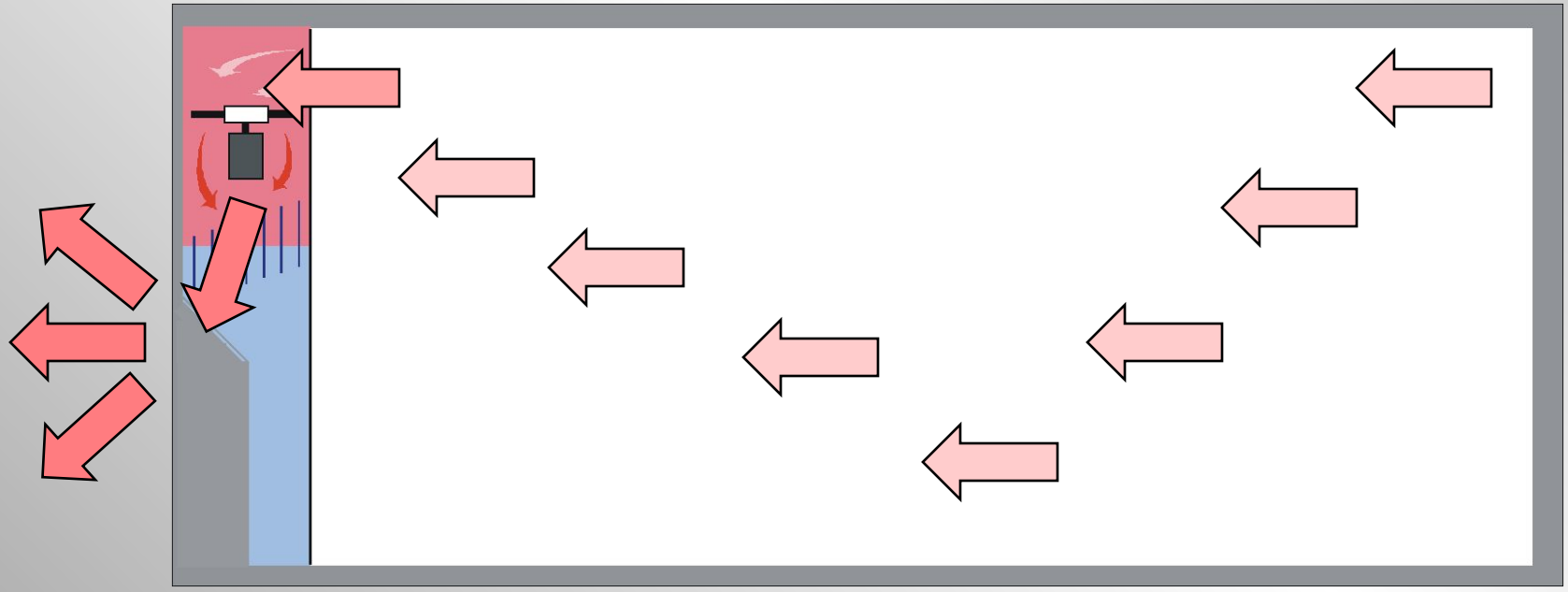
What is Refrigeration?

DEFINITION

'**Refrigeration**'…

…is the transfer of heat from a place where it is 'not wanted'…

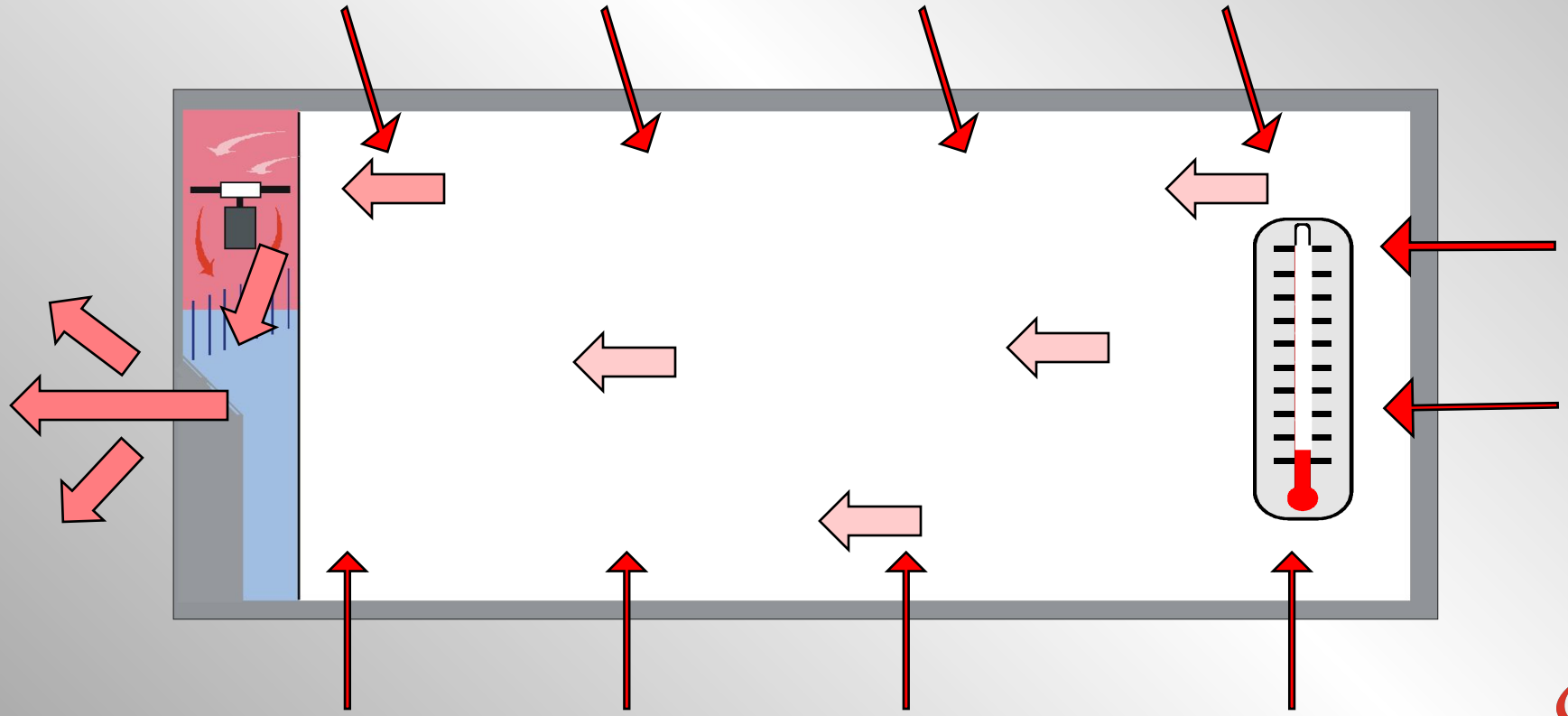
… to a place where it is 'unobjectionable'.



HEAT REMOVAL

- If heat is removed from inside the container ‘faster’ than it enters...

…The internal temperature becomes colder.



WHAT IS HEAT?

- A Form of Energy
- It Exists ‘Everywhere’
- It Exists at ‘All Temperatures’…Except…
  - **Absolute Zero (-459º F / -273º C)**
- It can be Moved from ‘Place to Place’

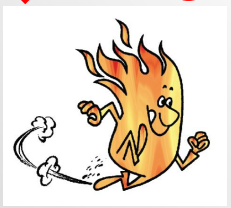
WHAT ARE REEFERS?

Machines that '<u>Move Heat</u>'

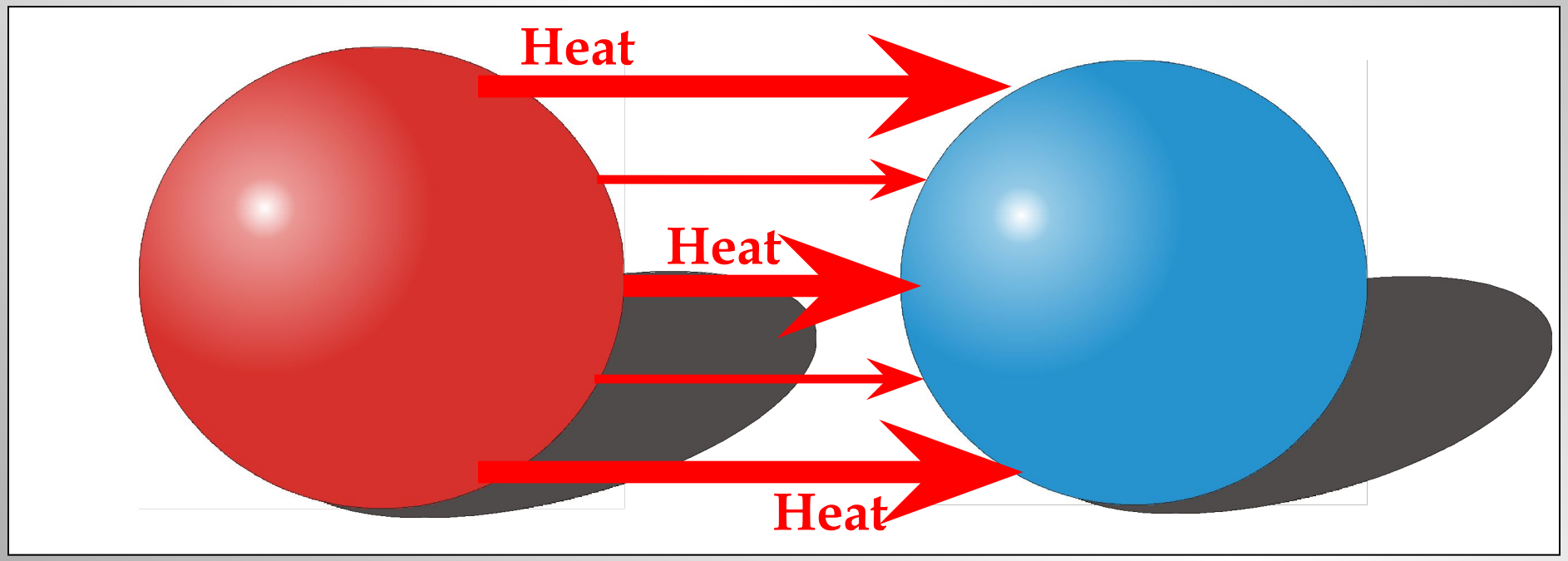
Ingersoll-Rand

‘HOW’ DOES HEAT MOVE?

- Warmer ⇒ Colder - ***ALWAYS!!!!!!!***



Faster’ with Large Temp. Difference

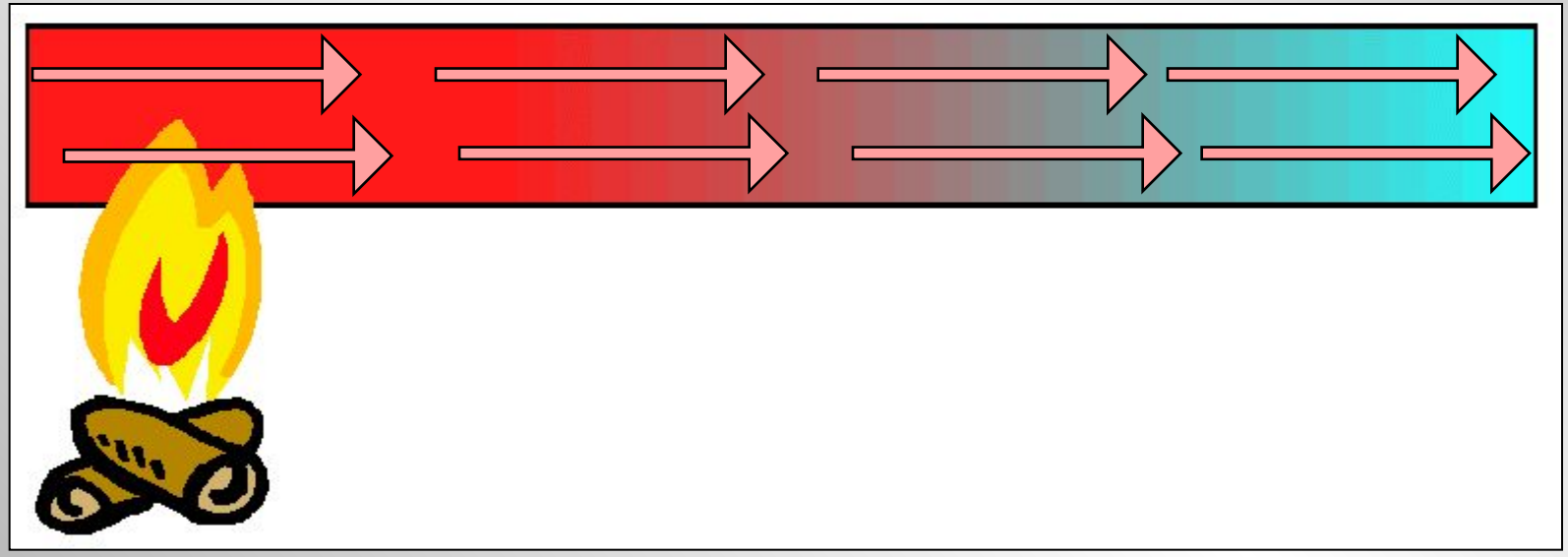


‘HOW’ DOES IT MOVE?

- **Heat can move three (3) ways….**
  1. **Conduction**
  2. **Convection**
  3. **Radiation**

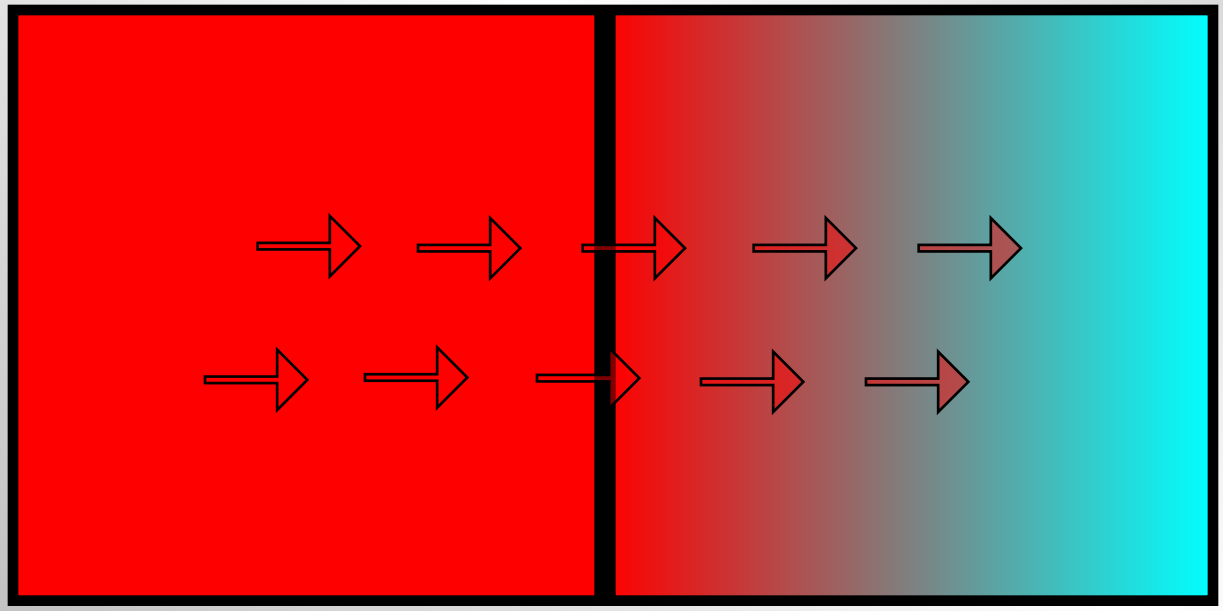
CONDUCTION

- Heat moves through Solids & Liquids

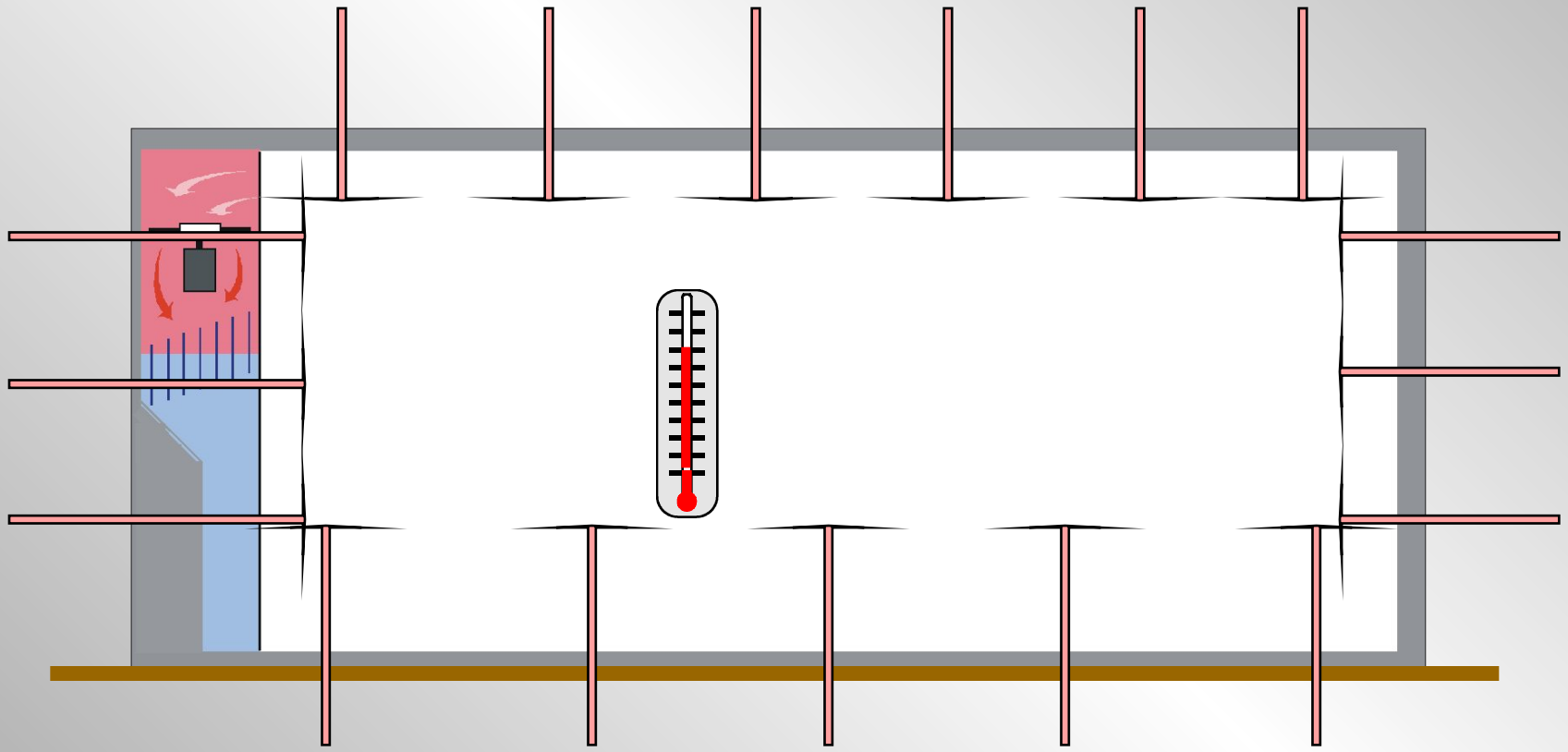


CONDUCTION

- Heat will move B**etween Solids and / or Fluids** in direct contact with one another



CONDUCTION



Any other Examples of Conduction?

CONVECTION

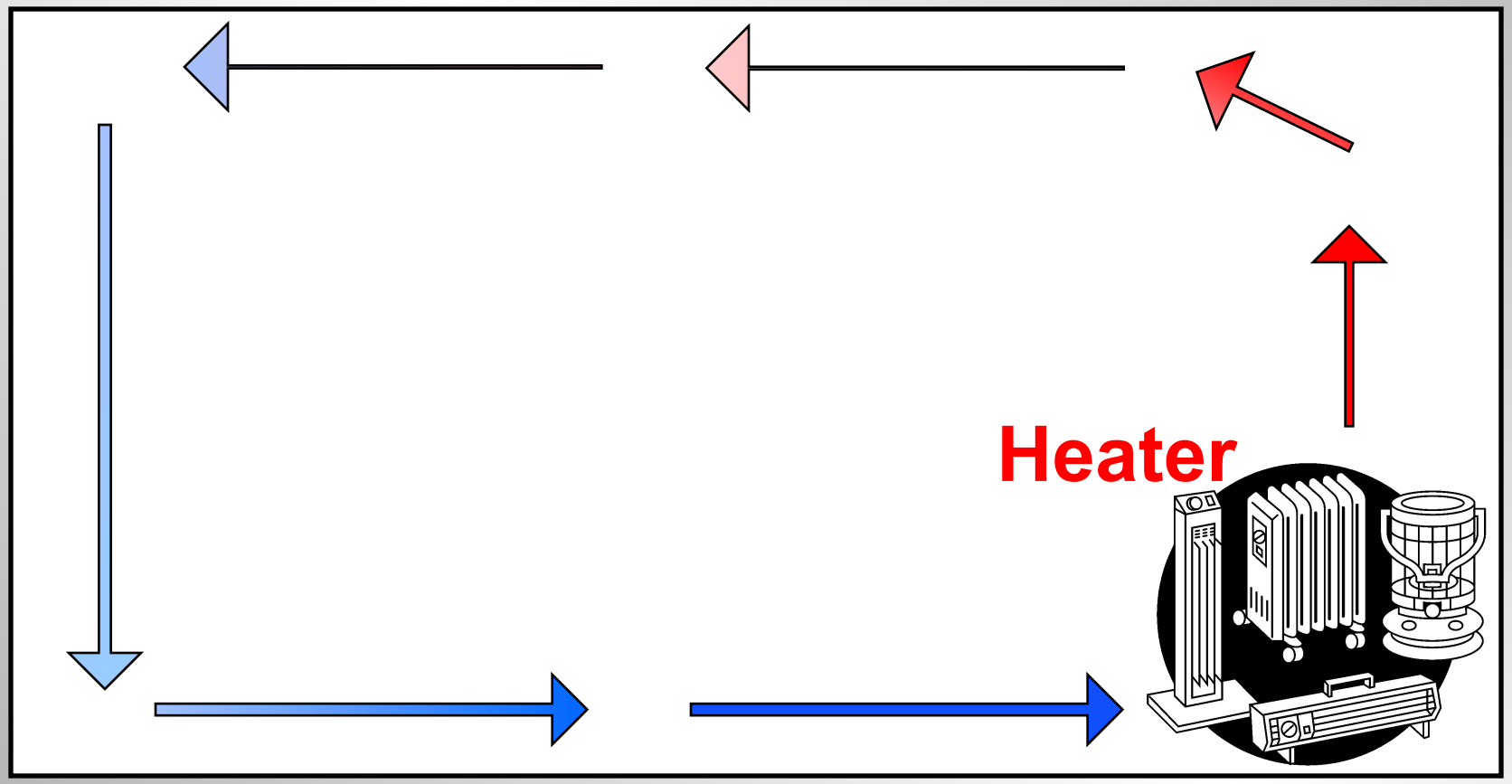
Definition - Heat transfers via the circulation (movement) of a fluid. i.e…..

- ***Air*** is a fluid
- ***Refrigerant*** Liquid & Vapor are fluids

Types

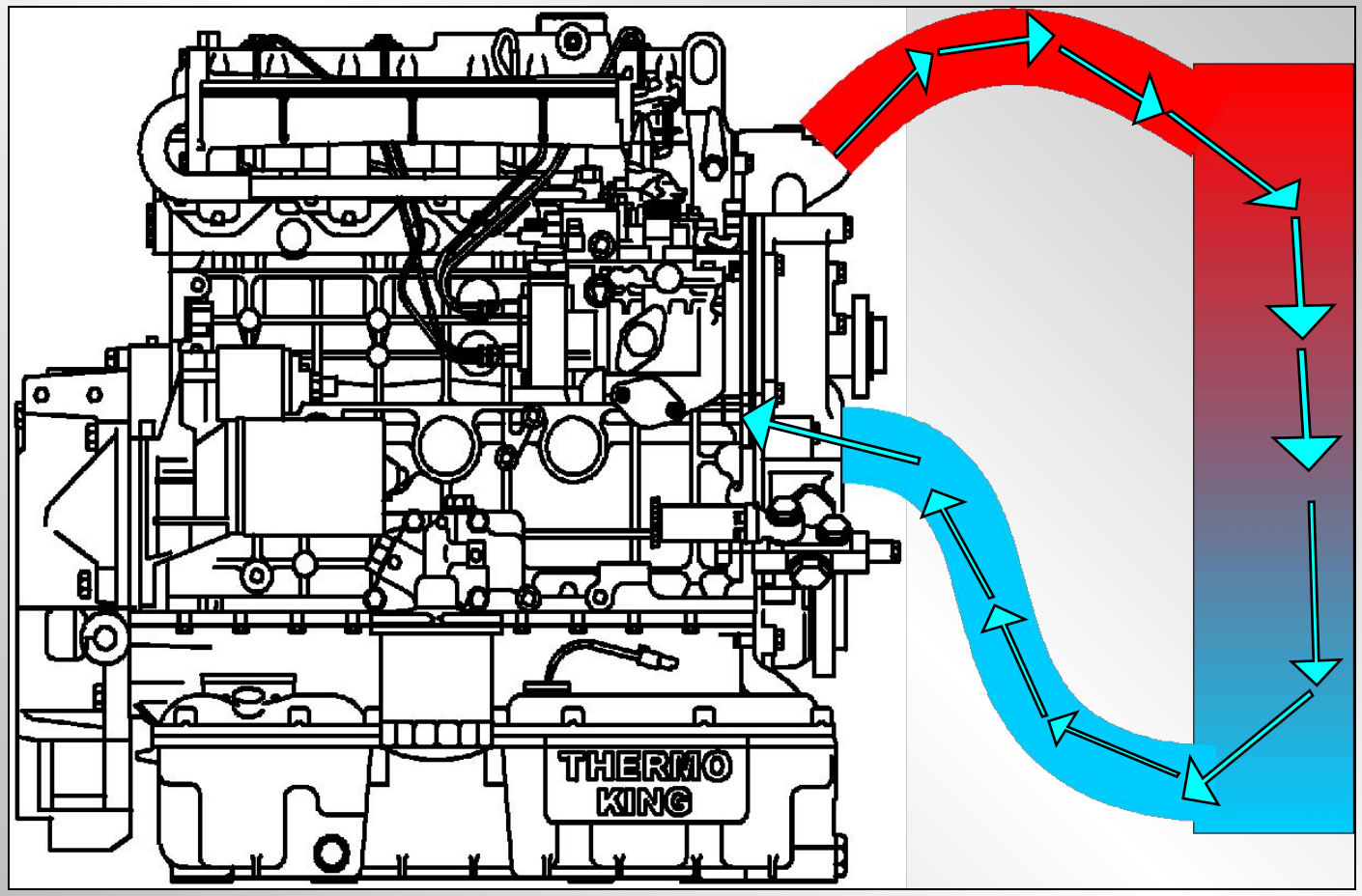
- ***'Natural'*** Convection
- ***'Forced'*** Convection

‘NATURAL’ CONVECTION

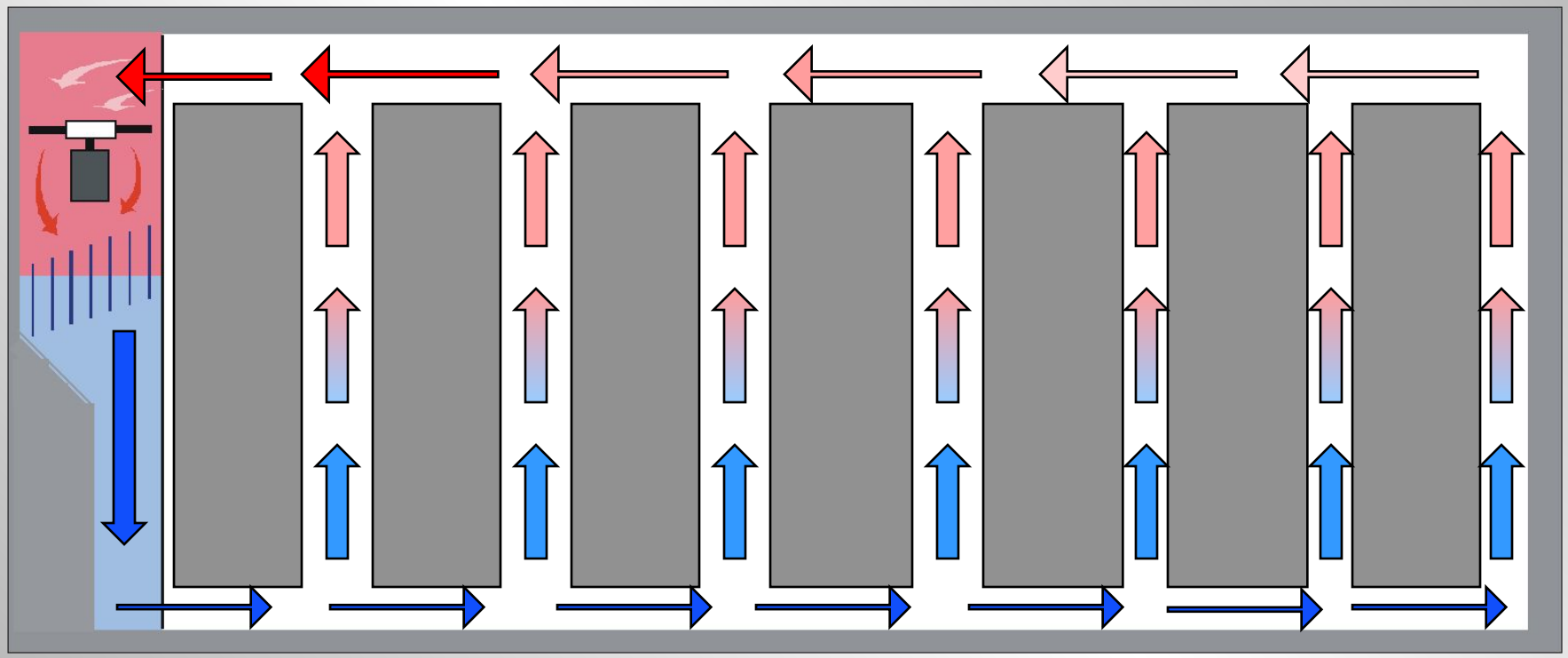


‘NATURAL’ CONVECTION

‘FORCED’ CONVECTION



‘FORCED’ CONVECTION

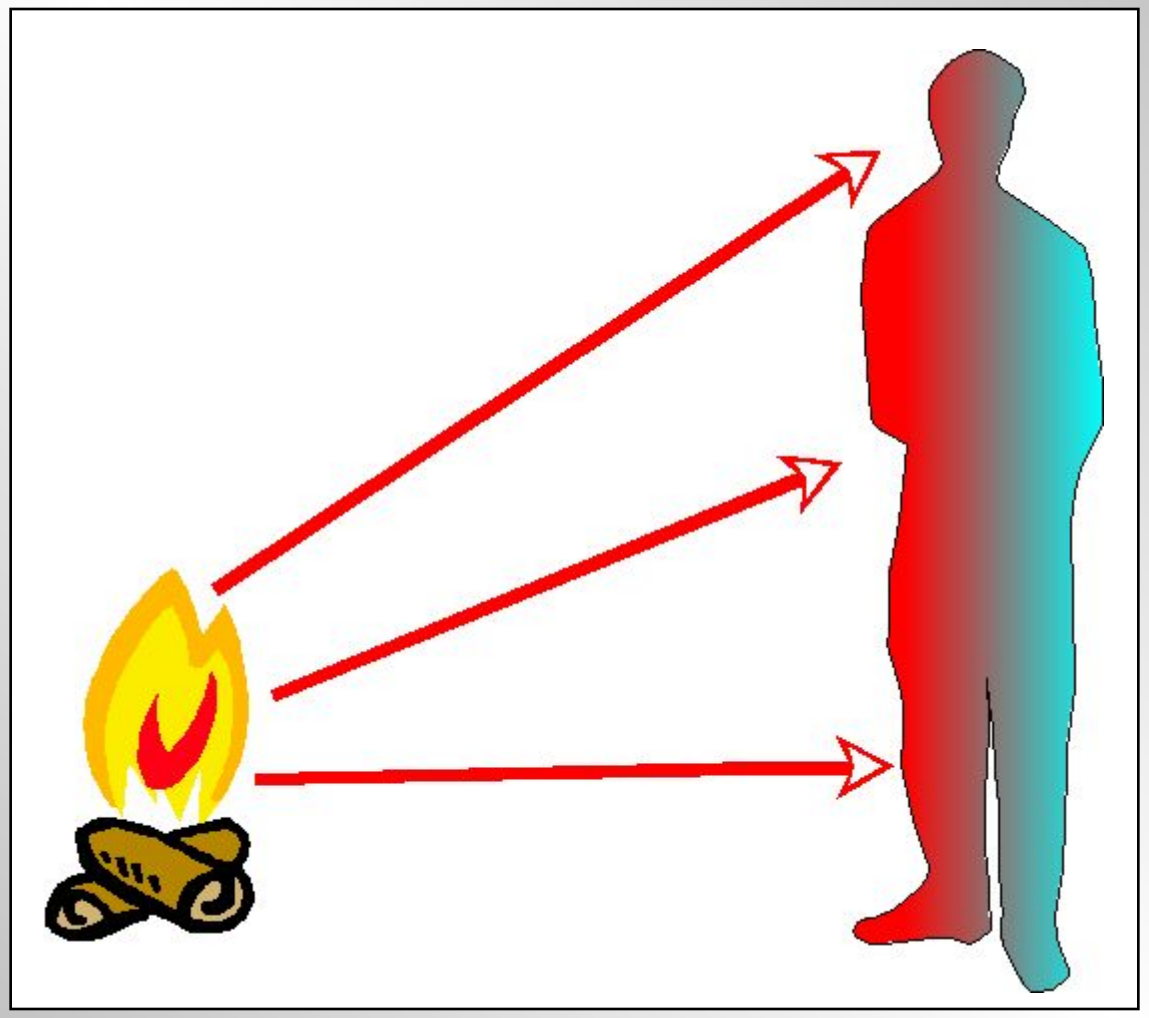


Any other Examples of Convection?

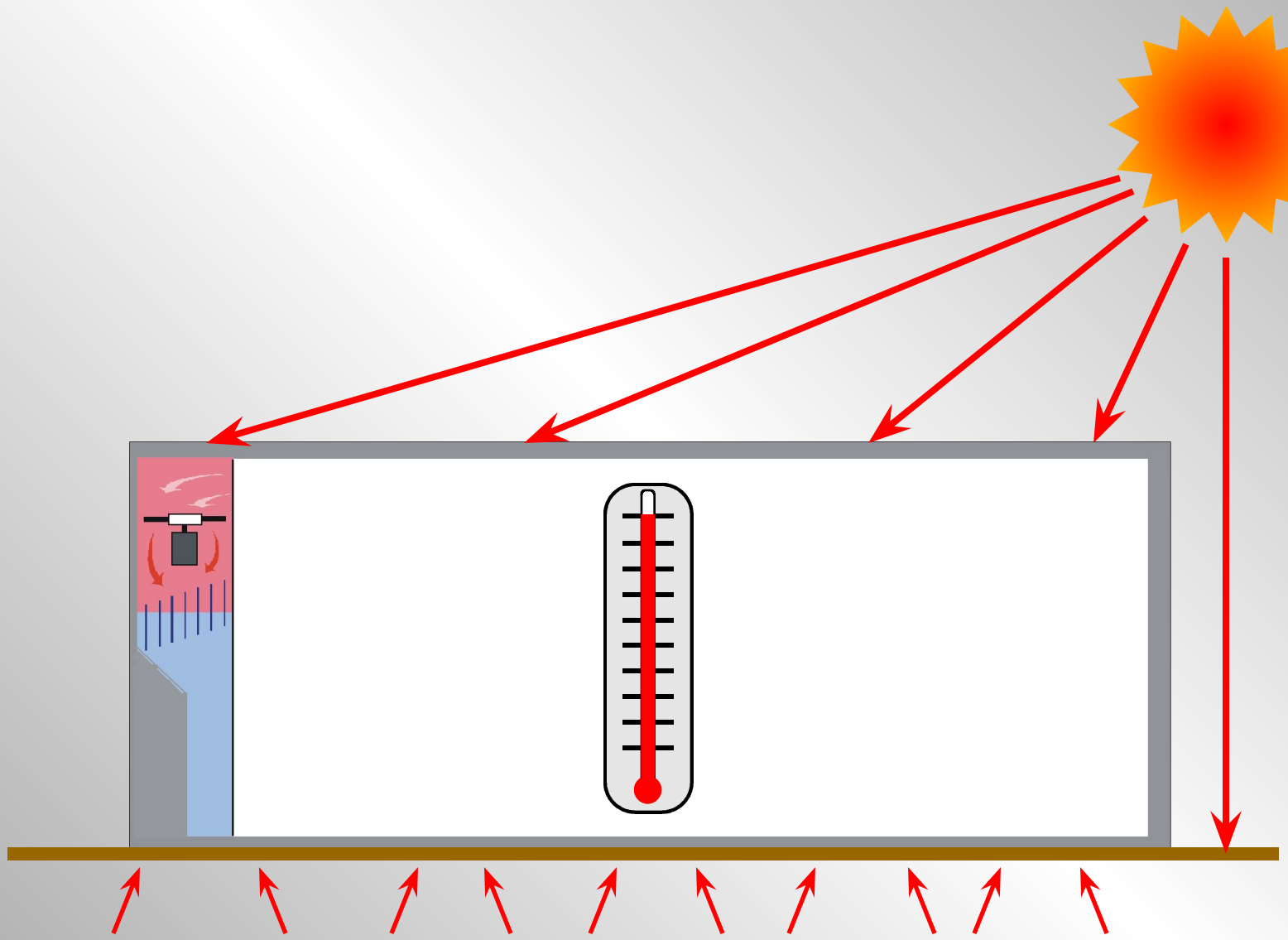
RADIATION

- Moves in Straight Lines… like light
- Does not heat the air it passes through
- Raises temperature of the substance that absorbs it
- Dark colors absorb ‘more’ heat…
- Light colors absorb ‘less’ heat

RADIATION



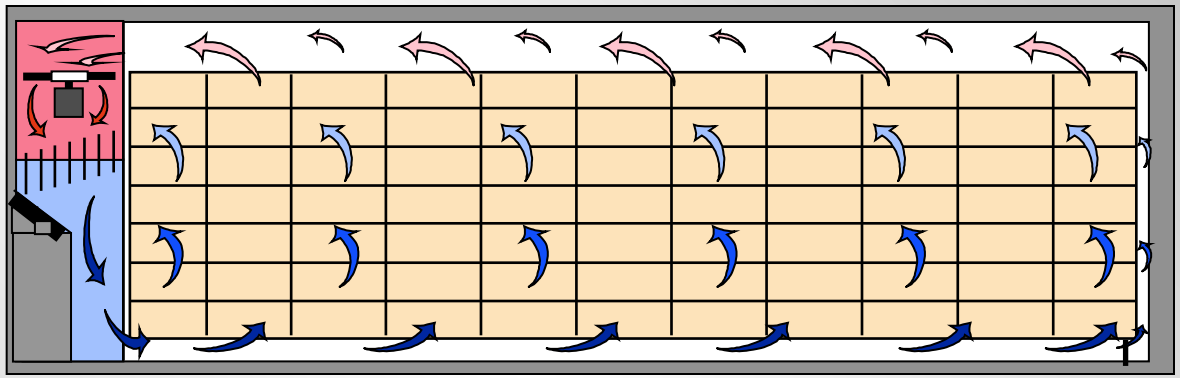
RADIATION

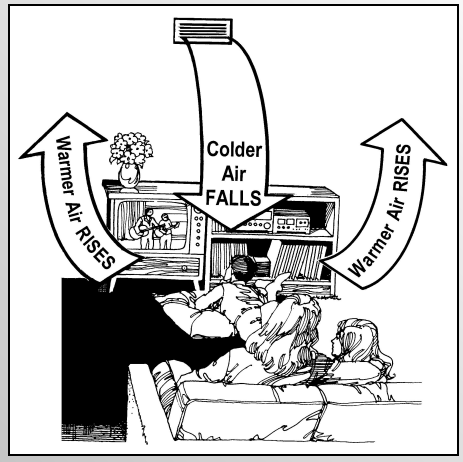


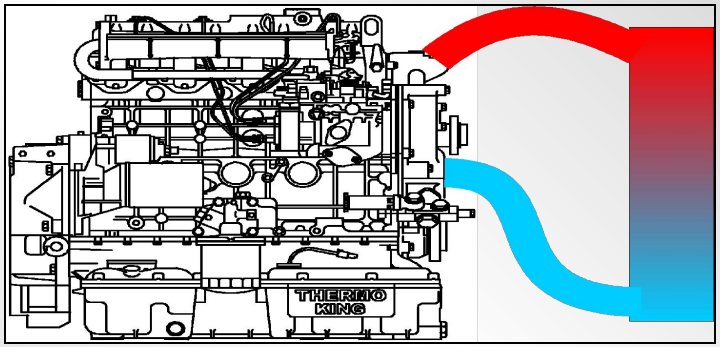
Any other Examples of Radiation?

HEAT TRANSFER SYSTEMS

- Usually combine ***'Conduction'*** AND ***'Convection'*** to move heat. i.e….







Ingersoll Rand

TERMS TO REMEMBER

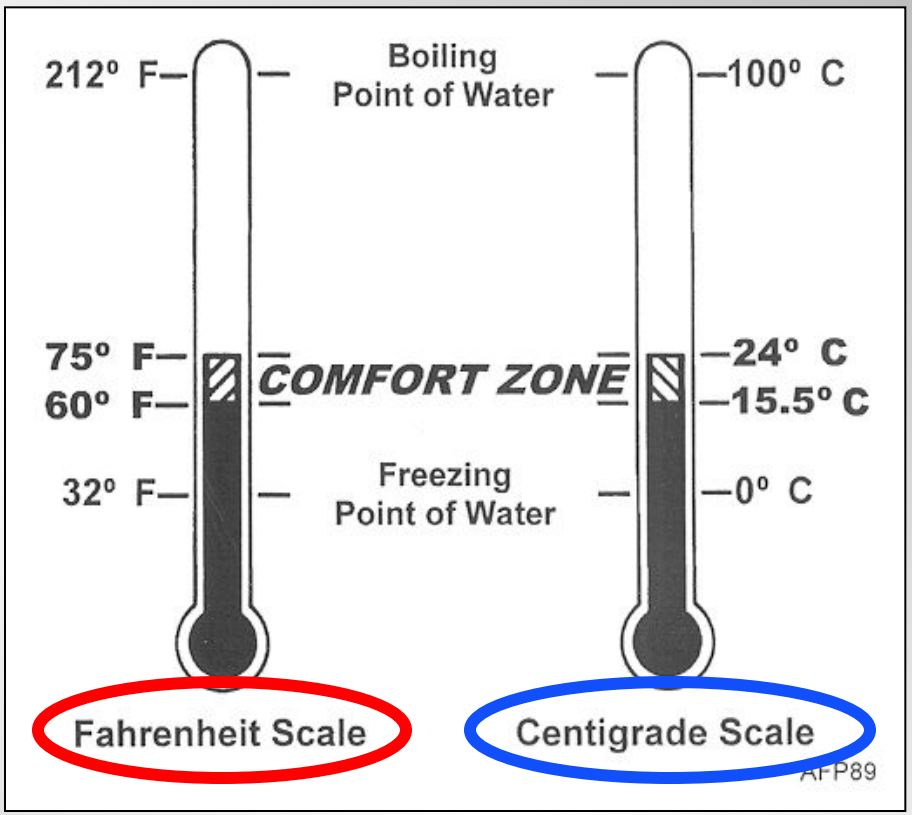
- Refrigeration
- Heat
- Box
- Conduction
- Convection
- Radiation

HOW IS HEAT ‘MEASURED’?

- **Four (4) Ways….**
  1. **Temperature**
  2. **Sensible Heat**
  3. **British Thermal Unit (BTU)**
  4. **Specific Heat**

TEMPERATURE

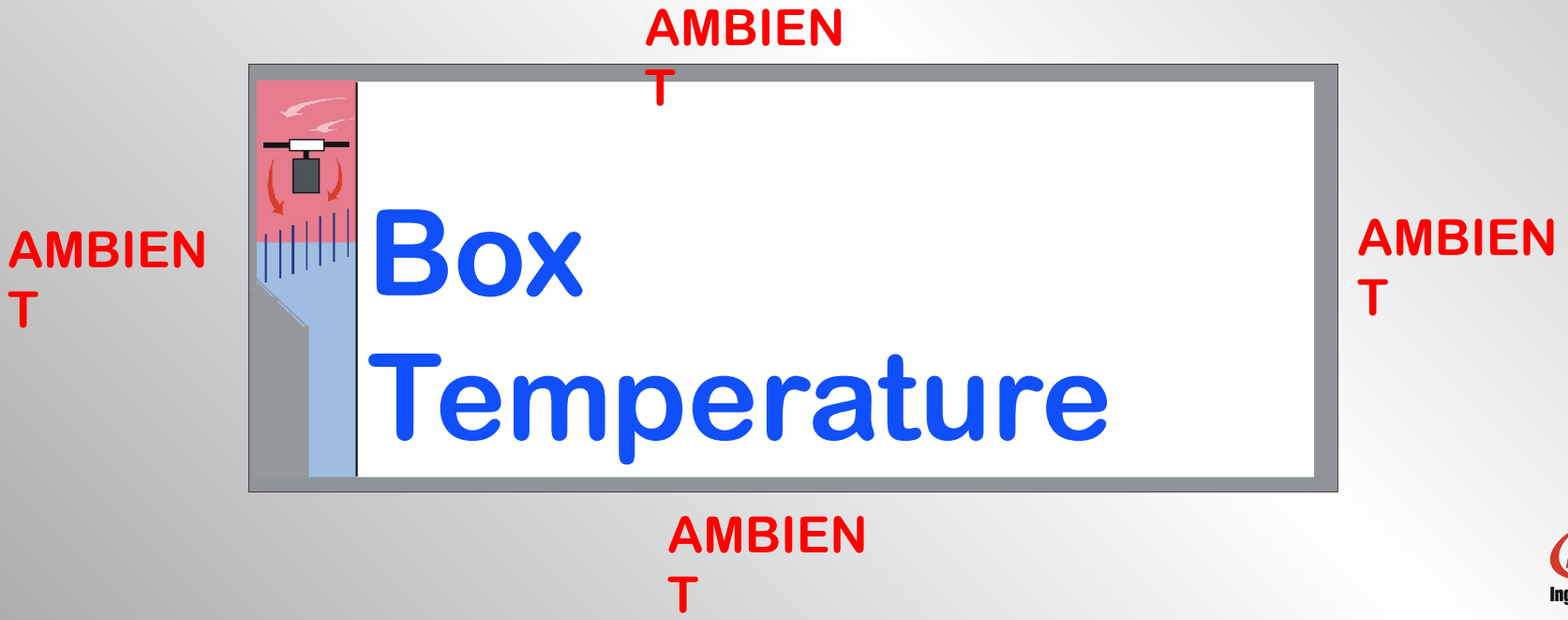
- Is the Level or Intensity of heat energy
- Is measured in degrees Fahrenheit or Centigrade
- Can be 'Felt' or 'Sensed'



TEMPERATURE

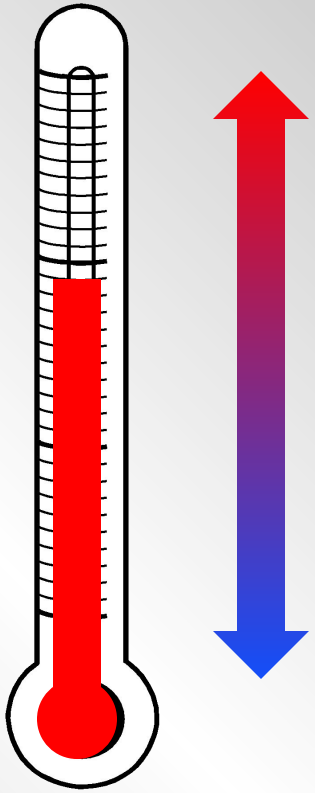
- The temperature inside the controlled space (container) is called….

- The temperature surrounding the Container is called…



SENSIBLE HEAT

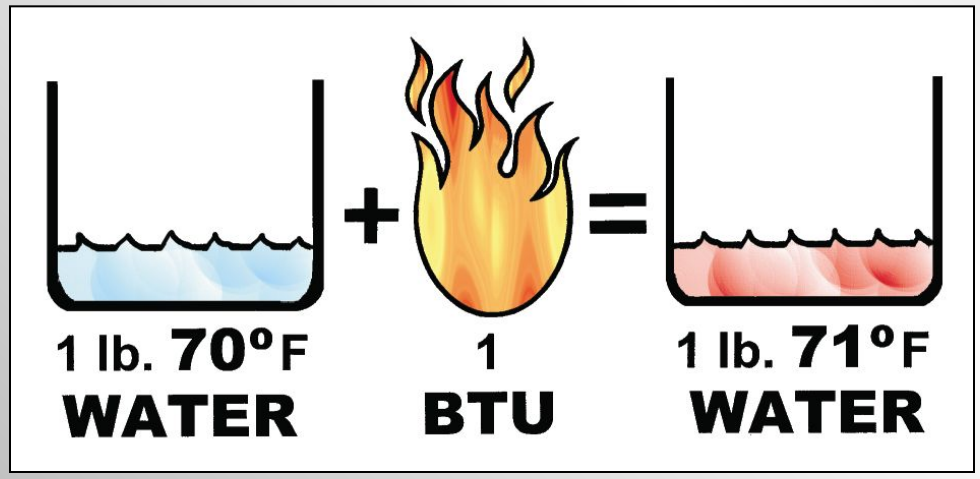
- **Is Heat you 'Can Feel'**
- Is measured with a Thermometer
- Causes a change in Temperature



BRITISH THERMAL UNIT

- Measure of the quantity (amount) of heat energy

Definition: A Btu is the amount of heat required to raise the temperature of one (1) pound of water one (1) degree F



SPECIFIC HEAT

- Amount of heat required to raise the temperature of one (1) pound of a 'Specific Substance' one (1) degree F. **i.e. 0.75**

- Compared to Water (1.0)
- The less heat required to change substance temp., the lower the Specific Heat
- The more heat required to change substance temp., the higher the Specific Heat

SPECIFIC HEAT EXAMPLES

- Water - 1.0
- Aluminum - .22
- Honey - .35
- Cheese - .50
- Fresh Beef - .75
- Vegetables - .90
- Cucumbers & Watermelon - .97

TERMS TO REMEMBER

- Temperature
- Box Temperature
- Ambient Temperature
- Sensible Heat
- Btu
- Specific Heat

Questions?