

11-1

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# 11-1

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- ❖ Daniel Gabriel Fahrenheit 1724
- ❖ Fahrenheit scale—measures temperature
- ❖ Sets 0 degrees as the coldest Mr. Fahrenheit could find
- ❖ Sets 100 degrees as the hottest air temperature Mr. Fahrenheit could find.
- ❖ 32 degrees is water freezing, 212 is water boiling.

# Celsius scale

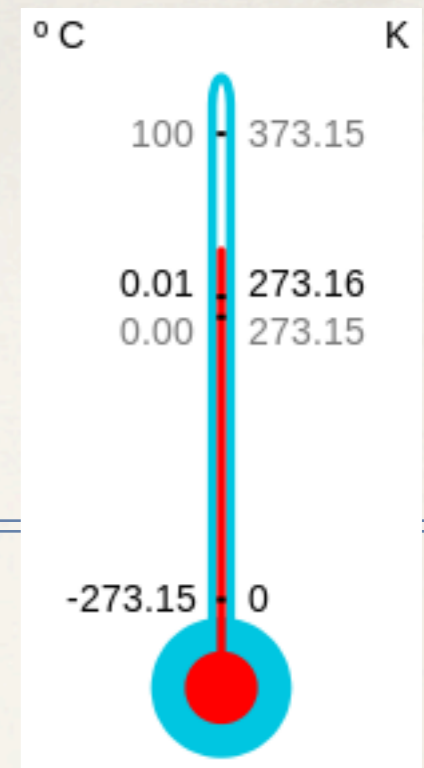
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- ❖ Anders Celsius, Sweden 1701-1744
- ❖ Sets water freezing as:
- ❖ 0 degrees
- ❖ Sets water boiling as:
- ❖ 100 degrees.

# Kelvin scale

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- ❖ Uses the exact same scale as Celsius; 1 degree equals one degree, except 273.1 degrees lower.
- ❖ Sets Absolute Zero as zero. Total stoppage of molecular motion
- ❖ Sets water freezing as:  $0 \text{ degrees} + 273.1 = 273.1 \text{ degrees}$
- ❖ Sets water boiling as:
  - ❖  $100 \text{ degrees} + 273.1 = 373.1 \text{ degrees}$

# Thinker:

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- ❖ Take a minute and think about what the words “temperature” and “heat” mean. How are they different? How would you explain this to your favorite 4th grader?

# 11-1

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- ❖ The difference between heat and temperature
- ❖ **TEMPERATURE** / Heat is “**AVERAGE** / total kinetic energy of the moving atoms and molecules of a substance”

11-1

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❖ *Temperature:*

The **Average** Kinetic Energy of  
the Moving Atoms and Molecules  
of a Substance

or: “the average kinetic energy of  
the particles in an object”

11-1

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✿ Heat: The TRANSFER of thermal energy from a warmer object to a cooler object



11-1

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- ❖ Thermal Energy: The ***Total*** Kinetic Energy of the Moving Atoms and Molecules of a Substance
- ❖ Or: “The total energy of all the particles in an object”

11-2

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# 11-2

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- ❖ Convection: the transfer of heat in liquids and gases as groups of molecules move in **currents**
- ❖ Radiation: the transfer of heat energy by **electromagnetic waves**
- ❖ Conduction: Transfer of Heat energy from one substance to another by **DIRECT CONTACT**
- ❖ Convection Current: Circular motion of air due to its changing temperature

# Three types of heating

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- ❖ Conduction: *A stovetop*
- ❖ Convection: *A mirage, a room heater, an aquarium*
- ❖ Radiation: *Sunlight*

# Three types of Heating

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- ❖ Conduction: DIRECT CONTACT--frying pan
- ❖ Convection: CURRENTS of heat in a fluid--requires a medium--something to move through
- ❖ Radiation: heat in ELECTROMAGNETIC WAVES--can go through empty space

## Nu-Wave Oven Analog

Broils, Bakes, Fries, Roasts, Steams, Dehydrates, and Barbeques all without fats or oils!



model #20201

- **Patented 3 way cooking:** Allows for meats to be moist and succulent but also crisply browned. Convenience Foods cook up crisp and done to perfection.
  - Conduction: Heat transfer by direct contact
  - Convection: Circulates the heat for even cooking
  - Infrared: Safe, radiant heat that penetrates the inside while cooking the outside at the same time.
- **Powerful 1500W Heater:** Saves up to 50% of the cooking time with no pre-heating and no defrosting.
- **Versatile:** Lightweight and compact for easy transportability
- **Easy Cleanup:** Except for the Power Head, all parts are dishwasher safe.
- **Dial Controls:** Dials adjust the time and temperature with a single turn, up to 60 minute maximum. Oven dings to let you know when cooking is complete.
- **Economical:** Uses up to 85% less energy than a conventional oven.

11-3

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# 11-3

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- ❖ Insulators: Materials and substances that limit the amount of heat that passes through them
- ❖ Conductors: Materials and substances that (readily) allow the transfer of heat



# 11-3

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- ❖ Think about coastal areas. Do they experience milder or more extreme weather than inland areas? Why?
- ❖ Specific Heat of Water:
- ❖ Therefore, the specific heat of water is really high—it doesn't change temperature as easily as the air, or the sand, or the mountains.

# 11-3

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- ❖ Specific Heat: The amount of energy required to raise the temperature of 1 kilogram of a material by one degree kelvin. Measured in J/kgK.
- ❖ “To change the temperature of different objects by the same amount, different amounts of thermal energy are needed”.

# 11-3

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- ❖ Thermal Expansion: an increase in the size or volume of a substance due to an increase in the motion of its molecules and atoms
- ❖ OR: “The expanding of matter when it is heated”
- ❖ “As the thermal energy of matter increases its particles usually spread out, causing the substance to expand” p385

Thanks for Watching!

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