

# Temperature and Thermometer

## Thermal Physics

Instructor: Ben Huang

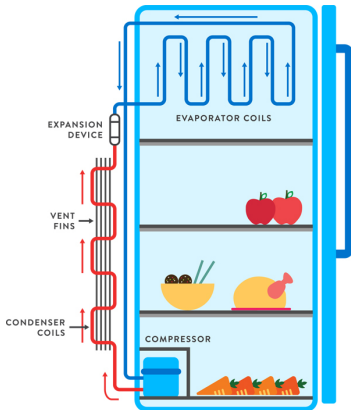


**BROOKLYN SCHOOL  
OF EXCELLENCE**

# Where do we apply thermal physics?

Temperature and  
Thermometer

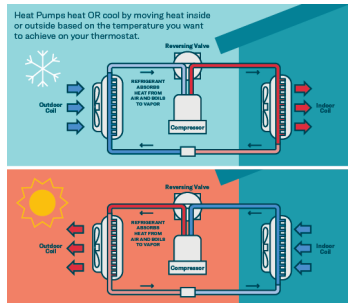
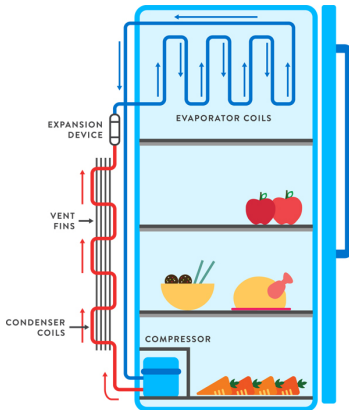
B.H.



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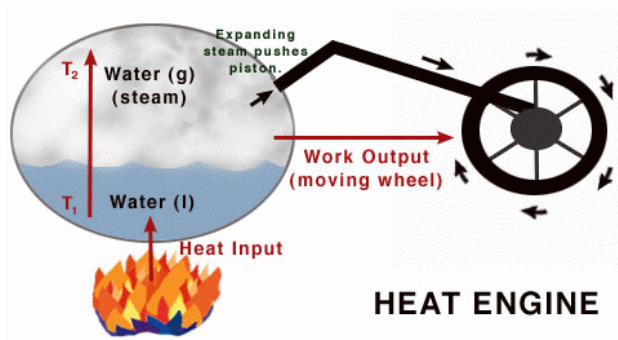
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# Thermal Energy

Temperature and  
Thermometer

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## THERMAL ENERGY

**Thermal Energy:**  
The total of all kinetic and  
potential energy of the  
atoms in an object



When the Thermal Energy of a  
substance increases,  
its particles **move faster**



HEAT SOURCE

A change in Thermal  
energy can lead to a  
change in phase

LIQUID → GAS



HEAT SOURCE

# Temperature

Temperature and  
Thermometer

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What is temperature?

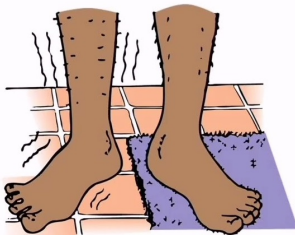
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Temperature and  
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What is temperature?  
Mental Experiments:

1. How do you feel?



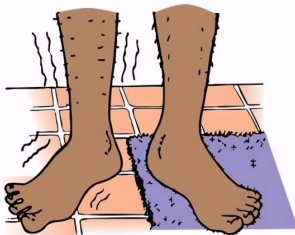
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Temperature and  
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What is temperature?  
Mental Experiments:

1. How do you feel?





# Temperature

Temperature and  
Thermometer

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What is temperature?

Mental Experiments:

2. Which one will boil quicker?



# Temperature

Temperature and  
Thermometer

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What is temperature?  
Mental Experiments:

3. What will happen to the water?



# Temperature

Temperature and  
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In summary:

Temperature is the property that determines whether or not energy will transfer between two objects when they are in thermal contact.

# Temperature

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In summary:

Temperature is the property that determines whether or not energy will transfer between two objects when they are in thermal contact.

For a single object, the higher its temperature is, the more thermal energy it has.

# Temperature Scales: Celsius, Fahrenheit, and Kelvin

Temperature and  
Thermometer

B.H.

What is the ice point and the steam point of water at atmospheric pressure?

	Celsius	Fahrenheit
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ice point		
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steam point		
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# Temperature Scales: Celsius, Fahrenheit, and Kelvin

Temperature and  
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B.H.

What is the ice point and the steam point of water at atmospheric pressure?

	Celsius	Fahrenheit
ice point		$32^{\circ}F$
steam point		$212^{\circ}F$

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# Temperature Scales: Celsius, Fahrenheit, and Kelvin

## Temperature and Thermometer

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**Exercise.** Convert the following temperatures to their values on the Fahrenheit scale: (a) the sublimation point of dry ice,  $-78.5^{\circ}C$ ; (b) human body temperature,  $37.0^{\circ}C$ .

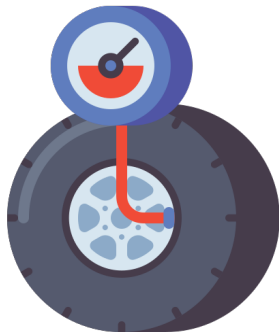


# Temperature Scales: Celsius, Fahrenheit, and Kelvin

Temperature and  
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Pressure v.s. Temperature



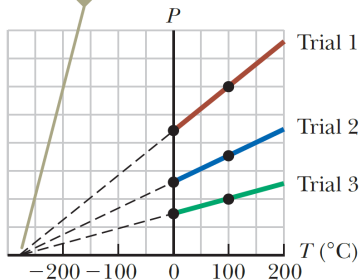
# Temperature Scales: Celsius, Fahrenheit, and Kelvin

## Temperature and Thermometer

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### The Kelvin Scale

For all three trials, the pressure extrapolates to zero at the temperature  $-273.15^{\circ}\text{C}$ .



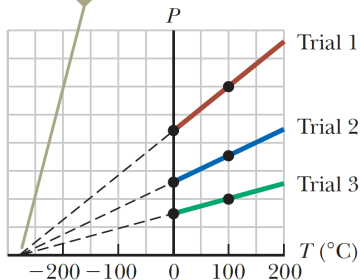
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$$\text{Kelvin} = \text{Celsius} + 273.15$$

# Temperature Scales: Celsius, Fahrenheit, and Kelvin

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Examine the following report, extrapolate the temperature when the pressure is zero, and express the result in Kelvin scale.

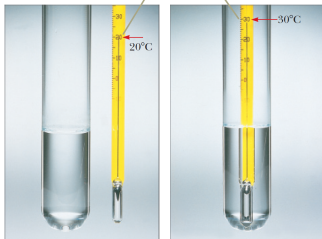
Report: [Pressure-Volume-Temperature Data for Oxygen](#)

# Thermometer

## Temperature and Thermometer

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The level of the mercury in the thermometer rises  
as the mercury is heated by water in the test tube.



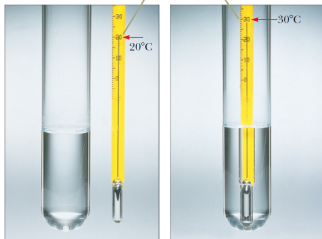
Charles D. Winters

# Thermometer

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The volume of gas in the flask is kept constant by raising or lowering reservoir *B* to keep the mercury level in column *A* constant.

