

# Heat vs Temperature

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IB PHYSICS | THERMAL PHYSICS

# Temperature – What is it?

Measure of how **hot** or **cold** something feels

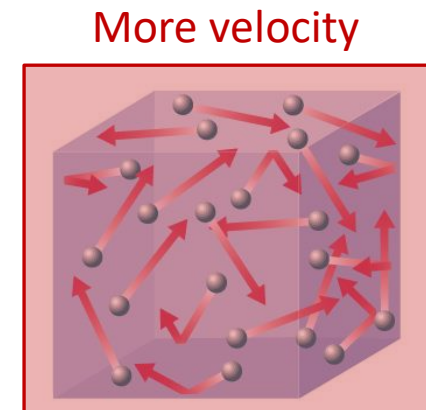
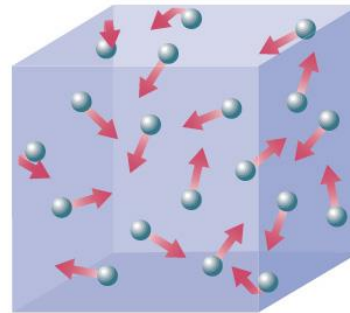
Quantitative  
or Qualitative?

Temperature is the average Kinetic Energy  
of the molecules of a substance

The faster the particles move, the  
more temperature increases

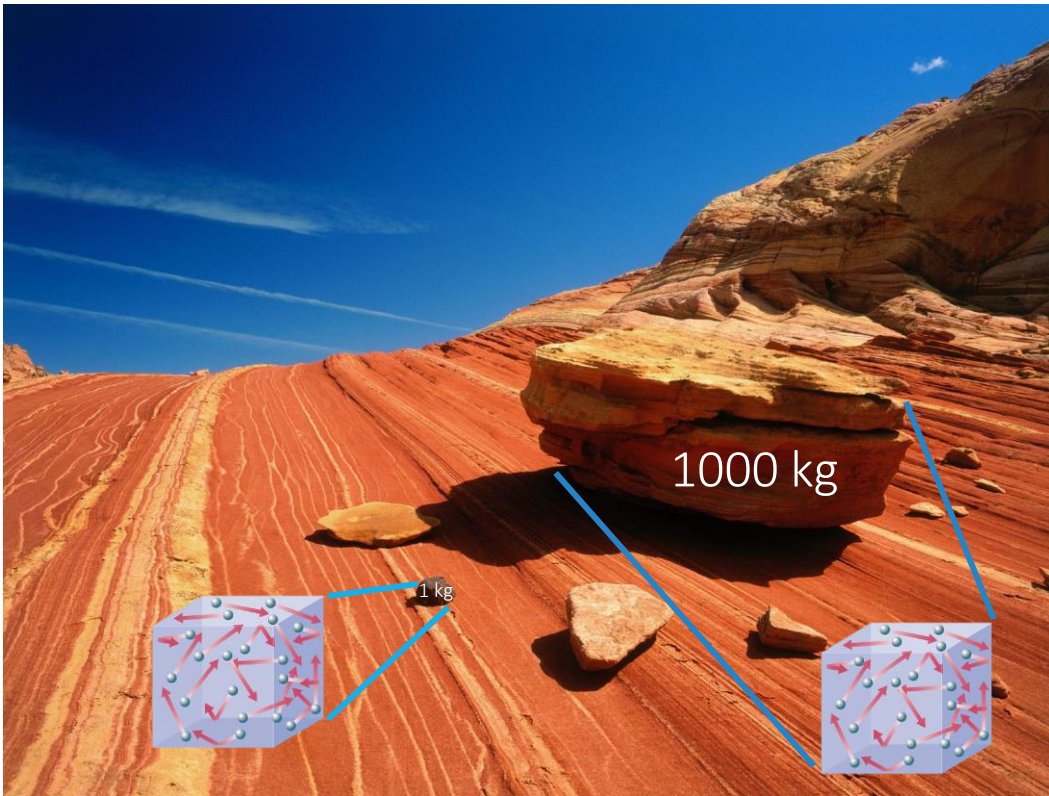
$$E_K = \frac{1}{2}mv^2$$

Circle the container with  
the highest temperature



# Temperature

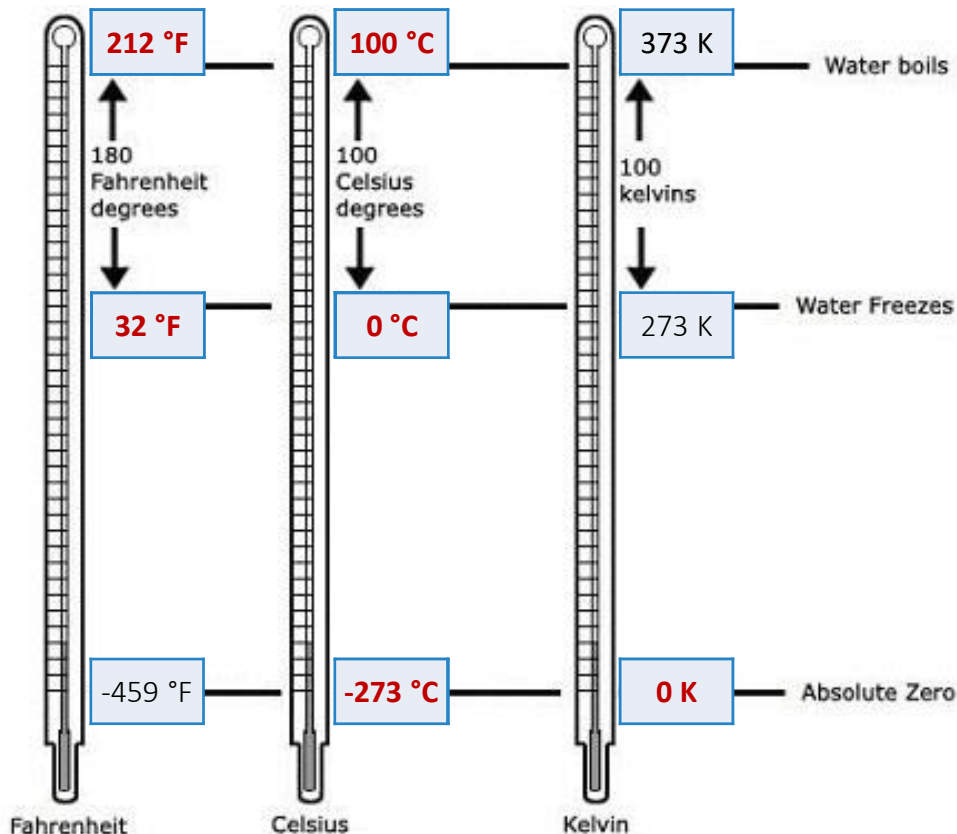
Which rock has a higher temperature (average kinetic energy)?



**Same!**

# Temperature Scales

It is important that we can **quantify** temperature



Which temperature scale is the most precise?

**Fahrenheit** (smallest increments)

On which temperature scale(s) would an increase of one degree be largest?

**Celsius or Kelvin**

# Absolute Zero

At absolute zero, all molecules stop moving



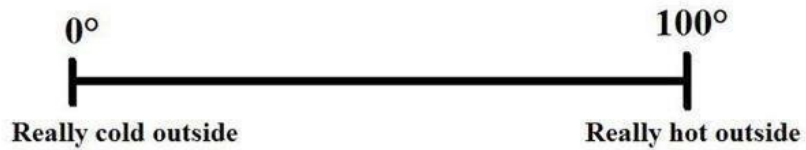
# Celsius and Kelvin

$$T (\text{K}) = T (^\circ\text{C}) + 273$$

-40°C	233 K
0°C	273 K
22°C	295 K
100°C	373 K

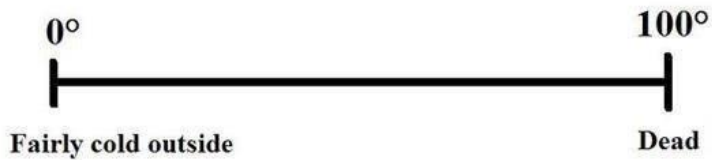
# Temperature Scales

## Fahrenheit



**VS**

## Celsius



**VS**

## Kelvin



[...] [the\\_breadlord](#) 2067 points 2 days ago\* (last edited 1 day ago) (3946|1881)  
Did you hear about the man who got cooled to absolute zero?  
He's OK now.



# Temperature

Which has a higher temperature?



Burning Match

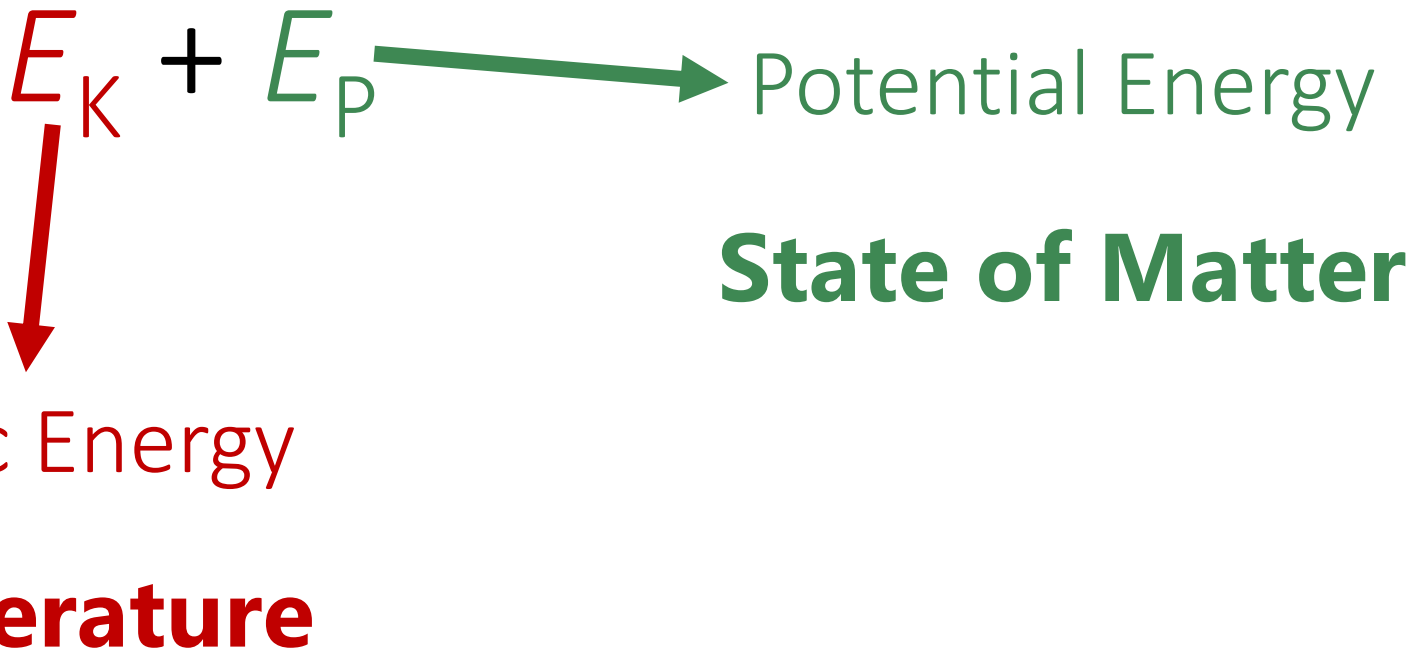


Ice Sculpture



# Total Internal Energy

$$E_{\text{INT}} = E_{\text{K}} + E_{\text{P}}$$



Kinetic Energy

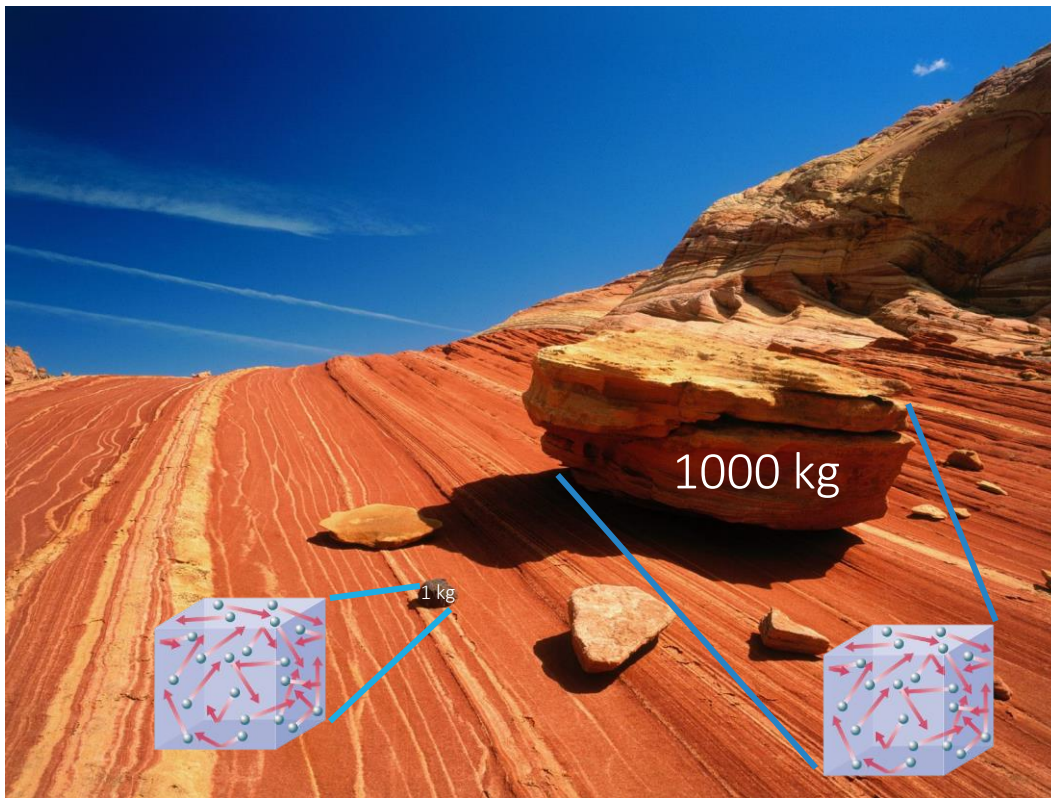
Potential Energy

**Temperature**

**State of Matter**

# Internal Energy

Which rock has a higher internal energy?



**Larger Rock**  
More mass means  
larger total energy

# Internal Energy

Which has more internal energy?



Burning Match



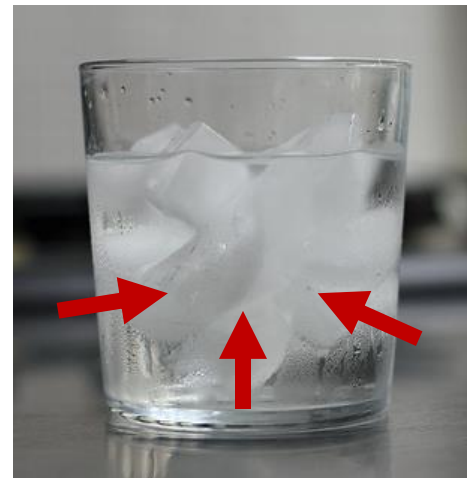
Ice Sculpture

**More Mass = Larger Total Energy**

# Heat

Heat is the transfer of thermal energy

Always flows from hot to cold



# Heat Flow

Which is correct?



Heat flows from the hand to the ice cube

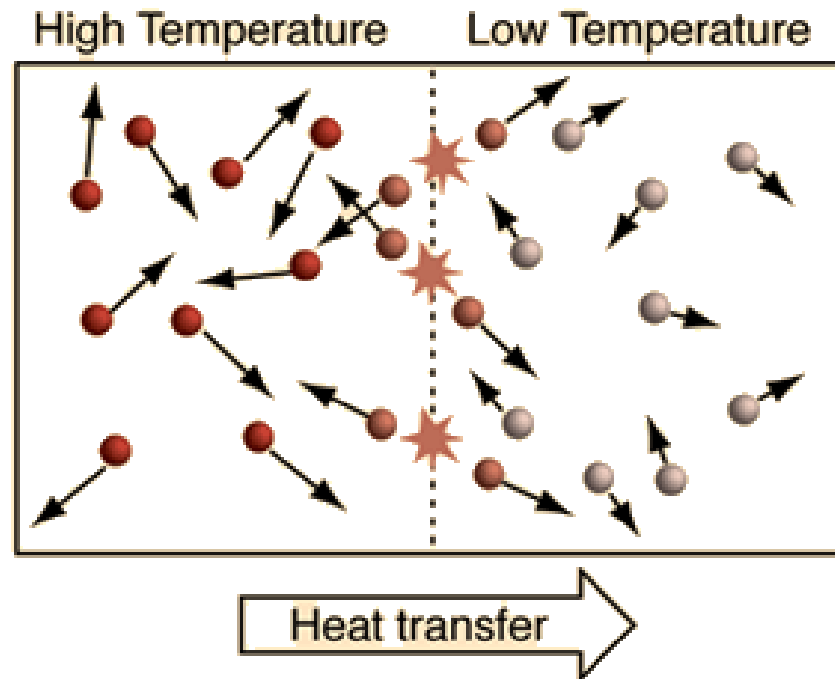


Heat flows from the ice cube to the hand

# Heat Flow

Why does heat flow?

Fast moving particles collide with slow moving particles and increase their velocity, kinetic energy, and temperature



# Energy is Energy



r/NoStupidQuestions

MrWaterplant 3.0k points 6 days ago

**If kinetic energy is converted into thermal energy, how hard do I have to slap a chicken to cook it?**

# Lesson Takeaways

- I can explain the relationship between temperature and molecular kinetic energy
- I can describe the energies present in an object's total internal energy
- I can convert between Celsius and Kelvin
- I can describe the nature of molecules when at a temperature of absolute zero
- I can explain the difference between temperature, internal energy, and heat