Specific Heat

Review: page 53

How do I quantify how much energy something loses? Calorimetry (physically collect)

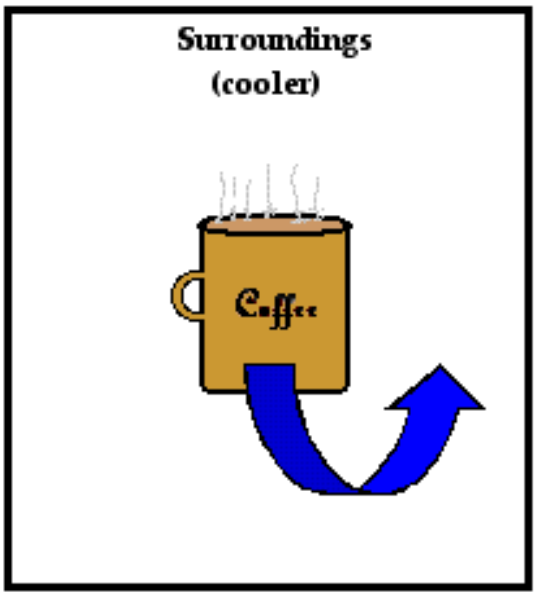
Q: Why would someone last longer when they are trapped outside vs. in water.

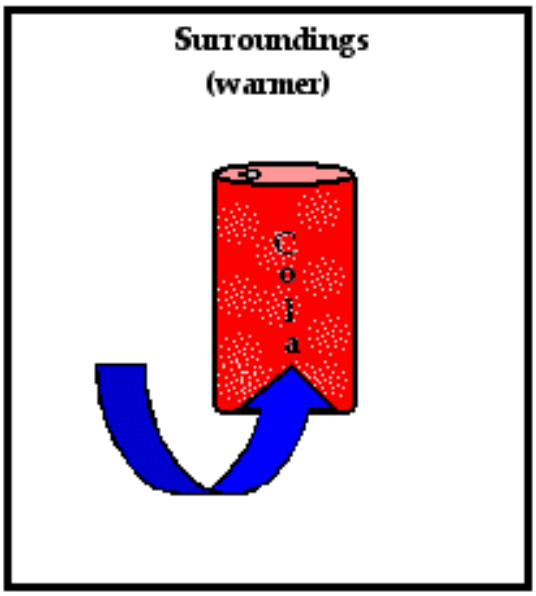
Q: How does one mathematically compare energy exchange vs. Temperature change?

Q: How do the specific heats of various substances differ?

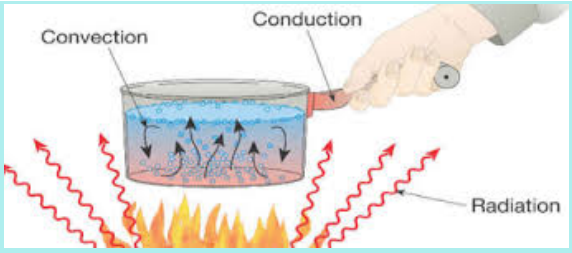
May 14-11:35 AM

What is heat and temperature?



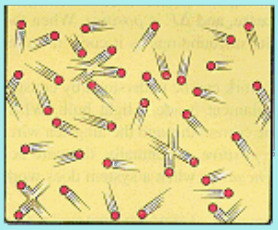


Heat is the flow of energy from area of high temperature to area of low temperature.

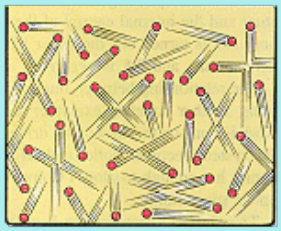


Temperature--velocity of the particles

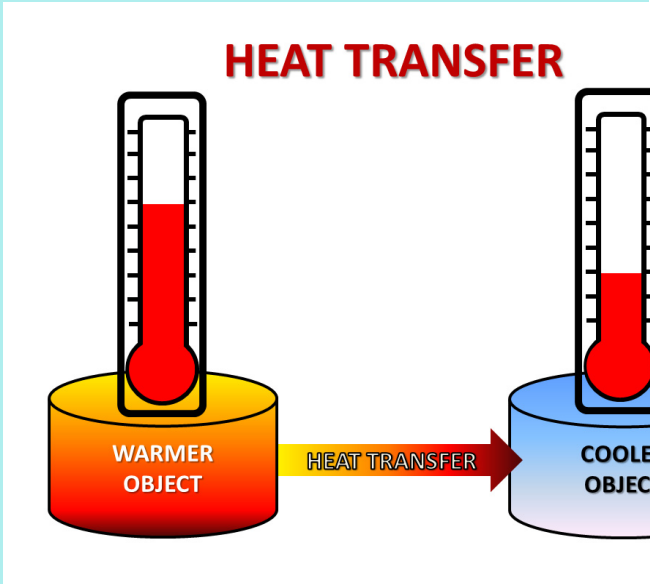
- is a measure of heat in ^{0}F, ^{0}C or K
- is the average kinetic energy of particles



Low Temperature



High Temperature



May 7-5:25 AM

specific heat capacity(C)-the amount of heat required to cause a unit of mass to change its temperature by 1°C.

Substance	C in J/gm*°C
Aluminum	0.900
Copper	0.386
Gold	0.126
Silver	0.233
Tungsten	0.134
Zinc	0.387
Mercury	0.140
Alcohol(ethyl)	2.4
Water	4.18
Ice	2.09
steam	2.09
Glass	.84

Heating up solid, liquid or gas

$Q = m \cdot C \cdot \Delta T$ (this is not for phase changes)

Quantity of Heat **(Q)** = mass **(m)** x specific heat capacity **(C)** x temp change **(ΔT)**

What quantity of heat is necessary to raise the temperature of 100g of water from 10°C to 90°C?

m= 100g

C= 4.18 J/g* °C

ΔT = 10°C to 90°C = 80°C

q=100g * 4.18 J/g*°C * 80°C = 33440J

How much thermal energy is needed to heat up 5 grams of silver from 25°C to 35°C?

q= 5g * 0.233 J/g°C* 10°C = 11.65J

Substance	C in J/gm*°C
Aluminum	0.900
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Gold	0.126
Silver	0.233
Tungsten	0.134
Zinc	0.387
Mercury	0.140
Alcohol(ethyl)	2.4
Water	4.18
Ice	2.09
steam	2.09
Glass	.84

May 7-5:36 AM

$$Q = m \bullet C \bullet \Delta T$$

Substance	C in J/gm*°C
Aluminum	0.900
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Gold	0.126
Silver	0.233
Tungsten	0.134
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p.54

$Q = m \cdot C \cdot \Delta T$

$= 100g \cdot 0.386 \frac{J}{g°C} \cdot 25°C$

$= 965\ J$

(2.) $965J = 100g \cdot 0.9 \frac{J}{g°C} \cdot \Delta T$

$\Delta T = 10.7°C$ $25°C + 10.7 = 35.7°C$

	Known Water	Unknown-Metal
M.	150g	50g
T_i	21°C } 2°C	100°C } 77°C
T_f	23°C	23°C
c	4.18	?
Q	1254J ← same →	1254

$Q = 150g \cdot 4.18 \frac{J}{g°C} \cdot 2°C =$

$1254 = 50g \cdot C \cdot 77$

$(50)(77)$

$C = 0.325$ Cu OR Zn

$Q = m \bullet C \bullet \Delta T.$

1. What quantity of heat is required to raise the temperature of 450 grams of water from 15°C to 85°C?
The specific heat capacity of water is 4.18 J/g*°C.
Given:
m =
C =
$T_{initial}$ =
T_{final} =

$Q = m \bullet C \bullet \Delta T = (450\ g) \bullet (4.18\ J/g/°C) \bullet (70.°C)$
$Q =$ **131,670 J**

Substance	C in J/gm*°C
Aluminum	0.900
Copper	0.386
Gold	0.126
Silver	0.233
Tungsten	0.134
Zinc	0.387
Mercury	0.140
Alcohol(ethyl)	2.4
Water	4.18
Ice	2.09
steam	2.09
Glass	.84

2. How much thermal energy is needed to heat up 5 grams of glass from 25ºC to 35ºC?

$Q = 5g * 0.84 * 10 = 42\ J$

3. If you have 25 grams of a material that gives off 167.5J of heat when the temperature raises from 25°C to 75°C, what is the specific heat of the material and what is the probable material?

$167.5\ J = 25g * C * 50^0C$

$$\frac{167.5\ J}{(25g)(50^0C)} = \frac{\cancel{25g} * C * \cancel{50^0C}}{\cancel{(25g)}\cancel{(50^0C)}}$$

$C = 0.134 J/g^0C$ Look at data chart
- material must be **Tungsten**