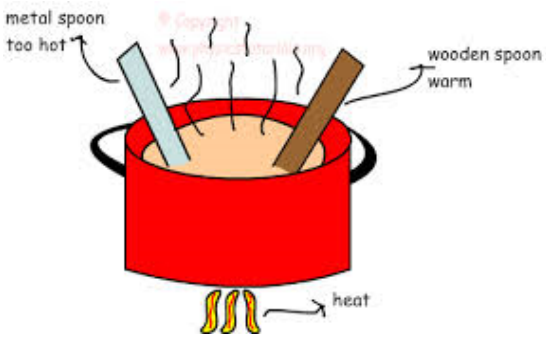
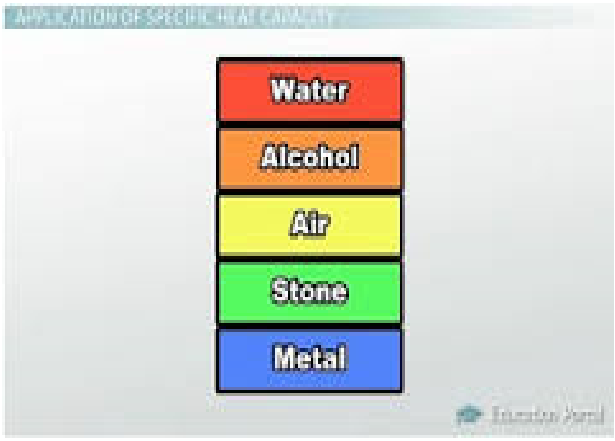
Specific Heat

Def: The amount of heat required to raise the temperature of 1 g of a substance by 1°C.

Specific heat is a characteristic property. The higher SH a substance has, the longer it takes to get hot, but the more heat it absorbed so it will take longer to lose the heat.





Formula $Q = mc\Delta T$

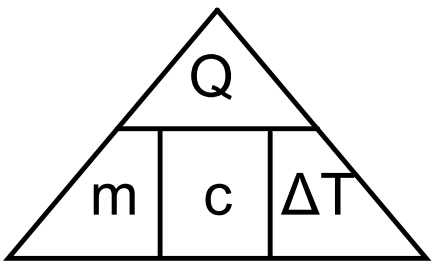
Variables	Stands for	Unit
Q	heat energy	J
m	mass	g
c	specific heat	J/g.℃
T	Temperature	℃
ΔT	Change in temperature	℃

Temperature formulas: must memorize

- To get ΔT: final temperature - initial temp
- To get initial temperature: FT -ΔT
- To get final temperature: IT + ΔT

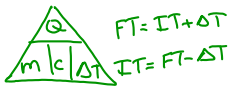
- Conversion kg-g x 1 000
- Specific heat of water 4.19 J/g℃

Using triangle to isolate:



***Electrical energy can be converted to heat energy. In a closed system 4 000 J of electrical energy = to 4 000 J of heat energy.**

Practice questions:



1. The mass of water is 210 g, its initial temperature was 15°C. After heating it for 22 minutes, the water's temperature was 65°C. Calculate the heat energy absorbed. $Q = mc\Delta T$

$210g \times 4.19 J/g \cdot °C \times (65 - 15)°C$

$43995 J = 44000 J$

2. There was 200 g of water with an initial temperature of 15°C. The water had absorbed 24 000 J of energy. What was the water's final temperature?

$FT = IT + \Delta T$

$15°C + 30°C$

$45 = 50°C$

$\Delta T = \frac{Q}{mc}$ $\frac{24000 J}{(200g \times 4.19 J/g \cdot °C)}$

$28.63... °C = 30°C$

3. Oil absorbed 55 000 J of heat and has a specific heat of 2.0 J/g°C. What was oil's temperature if 2.2 kg had a final temperature of 70.0°C?

$IT = FT - \Delta T$

$70.0°C - 13°C$

$57°C$

$\Delta T = \frac{Q}{mc}$ $\frac{55000}{(2200 \times 2.0)}$

$12.5°C = 13°C$

4. What was the mass of water if it absorbed 31 000 J of heat and had an initial temperature of 20.0 °C and a final temperature of 54°C?

$m = \frac{Q}{c\Delta T}$ $\frac{31000 J}{(4.19 J/g \cdot °C \times (54 - 20.0)°C)}$

$217.60... = 220 g$

5. What is vinegar's specific heat if 30.0 g is heated for 18 minutes and has a temperature change of 26°C to produce 50 500 J of heat?

$c = \frac{Q}{m\Delta T}$ $\frac{50\,500 J}{(30.0g \times 26°C)}$

$64.74... J/g \cdot °C = 65 J/g \cdot °C$

Past exam question

Amelia is preparing a pizza on an aluminum baking pan. She places the pizza in the oven. Ten minutes later she realizes that she forgot to add the cheese. She must take the pizza out of the oven to add the cheese.

The baking pan, which weighs 375 grams, was at room temperature (22.0°C) before it was placed in the oven. It absorbed 9450 J of energy during the ten minutes it was in the oven.
The specific heat capacity of aluminum is 0.900 J/g°C.

What is the temperature of the baking pan when it is removed from the oven?

A) 6.00°C
B) 28.0°C
C) 50.0°C
D) 66.0°C

$FT = IT + \Delta T$

$22.0°C + 28°C$

$= 50°C$

$\Delta T = \frac{Q}{mc}$

$\frac{9450}{(375 \times .900)}$

$= 28.0°C$

Past exam questions

1. Amelia is preparing a pizza on an aluminum baking pan. She places the pizza in the oven. Ten minutes later she realizes that she forgot to add the cheese. She must take the pizza out of the oven to add the cheese.

The baking pan, which weighs 375 grams, was at room temperature (22.0°C) before it was placed in the oven. It absorbed 9450 J of energy during the ten minutes it was in the oven.
The specific heat capacity of aluminum is 0.900 J/g °C.

What is the temperature of the baking pan when it is removed from the oven?

A) 6.00°C B) 28.0°C C) 50.0°C D) 66.0°C