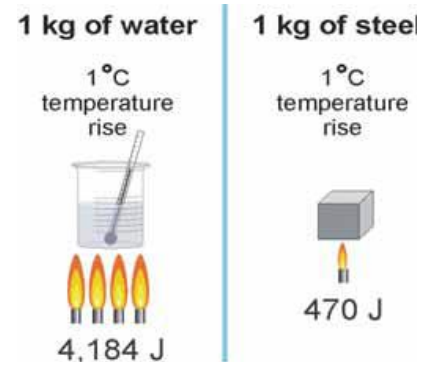


Specific Heat & Temperature

If you add heat to an object, how much will its temperature increase? It depends in part on the mass of the object. If you double the mass of the object you are going to heat, you need twice as much energy to increase the temperature. The amount of temperature increase also depends on the kind of material you are heating. It takes different amounts of energy to raise the temperature of different materials.

You need to add 4,184 joules of heat to 1 kilogram of water to raise the temperature by 1°C. You only need to add 470 joules of heat to raise the temperature of a kilogram of steel by 1°C. It takes nine times more energy to raise the temperature of water by 1 degree than it does to raise the temperature of the same mass of steel by 1 degree. Calories is the more common SI unit for heat energy. Because they are both measuring energy we can easily convert one to another. **4.184 joules = 1 calorie**



The **specific heat** is a property of a substance that tells us how much heat is needed to raise the temperature of one kilogram of a material by one degree Celsius. A large specific heat means you have to put in a lot of energy for each degree increase in temperature. Specific heat is measured in joules per kilogram per degree Celsius (joule/kg°C) which means how many joules it takes to raise 1kg of the substance 1°C. It can also be measured in Calories (calorie/ml °C) which means how many calories of energy it takes to raise 1ml of a substance 1°C.

The specific heat is the energy that will raise the temperature of one kilogram by 1°C.

1. If 100 joules of energy were applied to all of the substances listed in the table at the same time, which would heat up fastest? Explain your answer.

2. Which has more thermal energy, 1 kg of aluminum at 20°C or 1 kg of gold at 20°C? Why do you think so?

3. How much heat in joules would you need to raise the temperature of 1 kg of water by 5°C?

By 50°C?

4. How many calories would it take to raise the temperature of 1 ml of oil 1°C? 5°C?

By 100°C?

5. How does the thermal energy of a large container of water compare to a container of water at the same temperature that is 10 times smaller?

6. Is there more thermal energy in 1 kg of steel that is heated to melting, or in all of the water in the ocean? Explain why you think so.

7. Why are aluminum pans considered better for frying than iron or copper?

Material	Specific Heat J/kg EC	Calories c/ml °C
Air	21	.005
Aluminum	897	.21
Concrete	880	.21
Copper	385	.36
Gold	129	.03
Iron	448	.11
Lead	134	.03
Oil	1,900	.45
Sea Water	3900	.93
Silver	235	.06
Water (pure)	4,184	1