Answer on Question#39742, Physics, Other

If we boil a load of aluminum beads in water until everything reaches the same temperature. We then use a wire mesh strainer to quickly transfer the balls to a calorimeter containing 0.2 kg of water at 20 degrees celsius. The final temperature is 60 degrees celsius. This is so the temperature drop of the aluminum exactly equals the temperature gain of the water. The mass of the aluminum beads is 0.944 kg. What is the specific heat of aluminum? c of water=4186 J/kg

Solution:

Specific heat capacity is the amount of heat required to change the temperature of 1kg of a substance by 1K. Its unit is the joule per kilogram per kelvin.

The relationship between heat and temperature change is usually expressed in the form shown below where c is the specific heat.

$$Q = cm\Delta T$$

The temperature change is symbolized by ΔT where

$$\Delta T = Final\ temperature - Original\ temperature$$

When two or more objects at different temperatures are brought together in an isolated environment, they eventually reach the same temperature by the process of heat exchange. That is, warmer materials transfer heat to colder materials until their temperatures are the same.

$$-Q_{aluminum} = Q_{water}$$

$$Q_{aluminum} = c_{Al}m_{Al}(60 - 100) = -40c_{Al}m_{Al}$$

$$Q_{water} = c_{H2O}m_{H2O}(60 - 20) = 40c_{H2O}m_{H2O}$$

Thus,

$$c_{Al}m_{Al} = c_{H2O}m_{H2O}$$

The specific heat of aluminum is

$$c_{Al} = \frac{c_{H2O}m_{H2O}}{m_{Al}}$$

$$c_{Al} = \frac{4186 \cdot 0.2}{0.944} = 886.86 \approx 887\,\frac{\text{J}}{\text{kg K}}$$

Answer. $c_{Al} = 887\,\frac{\text{J}}{\text{kg K}}$.