

Chapter 16 Problem 55 †

Given

$$m = 1500 \text{ kg}$$

$$v = 40 \text{ km/h} = 11.1 \text{ m/s}$$

$$m_{\text{disk}} = 5.0 \text{ kg}$$

Solution

Find the temperature change in the brake pads when the car is brought to a halt.

The kinetic energy of the car is

$$K = \frac{1}{2}mv^2 = \frac{1}{2}(1500 \text{ kg})(11.1 \text{ m/s})^2 = 92408 \text{ J}$$

Now use the heat capacity equation

$$\Delta Q = mc\Delta T$$

The disks are made of steel, which has a specific heat of $502 \text{ J/kg} \cdot \text{K}$. The total mass of the disks is 20.0 kg . Solving for ΔT gives

$$\Delta T = \frac{\Delta Q}{mc} = \frac{92408 \text{ J}}{(20.0 \text{ kg})(502 \text{ J/kg} \cdot \text{K})} = 9.2 \text{ K}$$

†Problem from Essential University Physics, Wolfson