Chapter 16   Problem 53 [†]

Given

$m = 1500\ kg$

$v = 40\ km/h = 11.1\ m/s$

$m_{disk} = 5.0\ kg$

Solution

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

The kinetic energy of the car is

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

Now use the heat capacity equation

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

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

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

[†]Problem from Essential University Physics, Wolfson