56. (a) The kinetic energy K of the automobile of mass m at $t = 30\,\text{s}$ is

$$K = \frac{1}{2}mv^2 = \frac{1}{2}(1500\,\text{kg})\left((72\,\text{km/h})\left(\frac{1000\,\text{m/km}}{3600\,\text{s/h}}\right)\right)^2 = 3.0 \times 10^5\ \text{J} .$$

(b) The average power required is

$$P_{\text{avg}} = \frac{\Delta K}{\Delta t} = \frac{3.0 \times 10^5\,\text{J}}{30\,\text{s}} = 1.0 \times 10^4\ \text{W} .$$

(c) We use Eq. 7-48 ($P = Fv$) for the instantaneous power delivered at t. Since the acceleration a is constant, the power is $P = Fv = mav = ma(at) = ma^2t$, using Eq. 2-11. By contrast, from part (b), the average power is $P_{\text{avg}} = \frac{mv^2}{2t}$ which becomes $\frac{1}{2}ma^2t$ when $v = at$ is again utilized. Thus, the instantaneous power at the end of the interval is twice the average power during it:

$$P = 2P_{\text{avg}} = (2)\left(1.0 \times 10^4\,\text{W}\right) = 2.0 \times 10^4\ \text{W} .$$