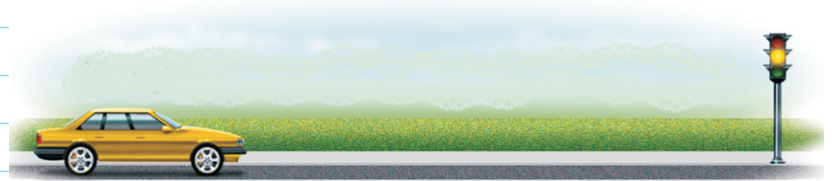## PROBLEM: 003

GIVEN:

The car is traveling at 30 mi/h when the traffic light 295 ft ahead turns yellow. The driver takes 1 s to react before he applies the accelerator. If the car has a constant acceleration of 5 ft/s² and the light remains yellow for 5 s, will the car reach the light before it turns red? How fast is the car moving when it reaches the light?

REQUIRED:

SOLUTION:

Solution: First, convert the initial speed into ft/s.

$$(30 \text{ mph}) \left(\frac{88 \text{ ft/s}}{30 \text{ mph}} \right) = 44 \text{ ft/s}.$$

At the end of the 5 s, the car will have traveled a distance

$$d = (44 \text{ ft/s})(1 \text{ s}) + \left[\frac{1}{2}(5 \text{ ft/s}^2)(5 \text{ s} - 1 \text{ s})^2 + (44 \text{ ft/s})(5 \text{ s} - 1 \text{ s}) \right] = 260 \text{ ft}.$$

When the light turns red, the driver will still be 35 ft from the light.

No.

To find the time at which the car does reach the light, we solve

$$295 \text{ ft} = (44 \text{ ft/s})(1 \text{ s}) + \left[\frac{1}{2}(5 \text{ ft/s}^2)(t - 1 \text{ s})^2 + (44 \text{ ft/s})(t - 1 \text{ s}) \right]$$

$$\Rightarrow t = 5.54 \text{ s}.$$

The speed at this time is

$$v = 44 \text{ ft/s} + (5 \text{ ft/s}^2)(5.54 \text{ s} - 1 \text{ s}) = 66.7 \text{ ft/s} \left(\frac{60 \text{ mph}}{88 \text{ ft/s}} \right) = 45.5 \text{ mph}.$$

$v = 66.7 \text{ ft/s} = 45.5 \text{ mph}.$