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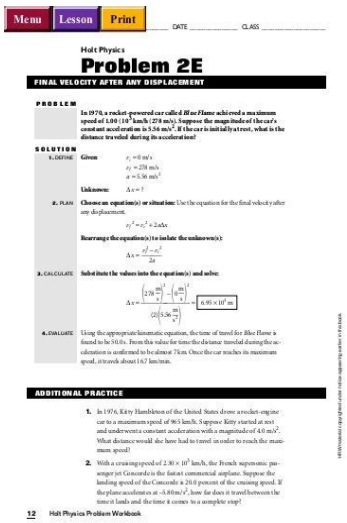
Menu Lesson Print

Holt Physics

Problem 2E

FINAL VELOCITY AFTER ANY DISPLACEMENT

PROBLEM

In 1976, a rocket-powered car called *Blue Flame* achieved a maximum speed of 1.00 $\times 10^3$ km/h (278 m/s). Suppose the magnitude of the car's constant acceleration is 5.56 m/s^2. If the car is initially at rest, what is the distance traveled during its acceleration?

SOLUTION

1. DEFINE Given: $v_i = 0$ m/s, $v_f = 278$ m/s, $a = 5.56$ m/s^2

Unknown: $\Delta x = ?$

2. PLAN Choose an equation(s) or situation: Use the equation for the final velocity after any displacement.

$v_f^2 = v_i^2 + 2a\Delta x$

Rearrange the equation(s) to isolate the unknown(s):

$\Delta x = \frac{v_f^2 - v_i^2}{2a}$

3. CALCULATE Substitute the values into the equation(s) and solve:

$\Delta x = \frac{\left(278 \frac{m}{s}\right)^2 - \left(0 \frac{m}{s}\right)^2}{(2)\left(5.56 \frac{m}{s^2}\right)} = 6.95 \times 10^3$ m

4. EVALUATE Using the appropriate kinematic equation, the time of travel for *Blue Flame* is found to be 50.0 s. From this value for time the distance traveled during the acceleration is confirmed to be almost 7 km. Once the car reaches its maximum speed, it travels about 16.7 km/min.

ADDITIONAL PRACTICE

1. In 1976, Kitty Hambleton of the United States drove a rocket-engine car to a maximum speed of 96.5 km/h. Suppose Kitty started at rest and underwent a constant acceleration with a magnitude of 4.0 m/s^2. What distance would she have had to travel in order to reach the maximum speed?
2. With a cruising speed of 2.30 $\times 10^3$ km/h, the French supersonic passenger jet Concorde is the fastest commercial airplane. Suppose the landing speed of the Concorde is 20.0 percent of the cruising speed. If the plane accelerates at -5.00 m/s^2, how far does it travel between the time it lands and the time it comes to a complete stop?

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