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Holt Physics
Problem 2E
FINAL VELOCITY AFTER ANY DISPLACEMENT

PROBLEM
In 1975 a rocket-powered car called Blue Flame achieved a maximum speed of 1.08×10^3 km/h (274 m/s). Suppose the magnitude of the car's constant acceleration is 3.16 m/s². If the car is initially at rest, what is the distance traveled during its acceleration?

SOLUTION
1. **IDENTIFY** Given: $v_f = 274$ m/s
 $a = 3.16$ m/s²
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 their equation(s) and solve:
 $\Delta x = \frac{(274 \text{ m/s})^2 - (0 \text{ m/s})^2}{2(3.16 \text{ m/s}^2)} = 6.93 \times 10^3 \text{ m}$

4. **EVALUATE** Using the appropriate kinematic equation, the time of travel for Blue Flame is found to be 56.0 s. From this value for time the distance traveled during the acceleration is confirmed to be correct. Thus, the car reaches its maximum speed, it travels about 6.93 km.

ADDITIONAL PRACTICE

- In 1974, Kitty Hawk of the United States drove a rocket engine car to a maximum speed of 963 km/h. Suppose Kitty started at rest and underwent a constant acceleration with a magnitude of 4.8 m/s². What distance would she have had to travel in order to reach the maximum speed?
- With a cruising speed of 2.80×10^2 km/h, the French supersonic passenger jet Concorde is the fastest commercial airplane. Suppose the landing speed of the Concorde is 210 percent of the cruising speed. If the plane accelerates at -3.80 m/s², how far does it travel between the time it lands and the time it comes to a complete stop?

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Answers Holt Physics Problem 6g