Physics 01-05 Equations for One-Dimensional Motion with Constant Acceleration *Name: _____*

Equations of 1-D Motion

Assume _____, so _____ and acceleration is _____

$$x = \overline{v}t + x_0$$

$$\overline{v} = \frac{v_0 + v}{2}$$

$$v = at + v_0$$

$$x = \frac{1}{2}at^2 + v_0 t + x_0$$

$$v^2 = v_0^2 + 2a(x - x_0)$$

Problem Solving Strategy

1. Examine the situation to determine which _____ are involved.
    a. Maybe _____
2. Make a _____ of what is _____ or can be _____ from the problem.
3. Identify exactly what needs to be _____ in the problem.
4. Find an _____ or set of equations that can help you solve the problem.
5. _____ the knowns along with their _____ into the appropriate equation, and Solve
6. Check the answer to see if it is _____: Does it make sense?

A plane starting from rest accelerates to 40 m/s in 10 s. How far did the plane travel during this time?

To avoid an accident, a car decelerates at 0.50 m/s^2 for 3.0 s and covers 15 m of road. What was the car's initial velocity?

A cheetah is walking at 1.0 m/s when it sees a zebra 25 m away. What acceleration would be required to reach 20.0 m/s in that distance?

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The left ventricle of the heart accelerates blood from rest to a velocity of +26 cm/s. (a) If the displacement of the blood during the acceleration is +2.0 cm, determine its acceleration (in cm/s^2). (b) How much time does blood take to reach its final velocity?

Homework

1. Is it possible for speed to be constant while acceleration is not zero? Give an example of such a situation.
2. Is it possible for velocity to be constant while acceleration is not zero? Explain.
3. Give an example in which velocity is zero yet acceleration is not.
4. An object moving with a constant acceleration can certainly slow down. But can an object ever come to a permanent halt if its acceleration truly remains constant? Explain.
5. A marble is dropped from 2.5 m and hits the ground in 0.71 s. What is the final velocity before it hits the ground? (RW) **7 m/s**
6. A jet takes off from an aircraft carrier starting from rest and travels 93 m in 1.2 s when being pushed by the catapult. What is its final velocity at takeoff? (RW) **160 m/s**
7. An Olympic-class sprinter starts a race with an acceleration of 4.50 m/s^2. (a) What is her speed 2.40 s later? (b) Write an equation for position as a function of time. (c) Sketch a graph of her position vs. time for this period. (OpenStax 2.20) **10.8 m/s**
8. Freight trains can produce only relatively small accelerations and decelerations. (a) What is the final velocity of a freight train that accelerates at a rate of 0.0500 m/s^2 for 8.00 min, starting with an initial velocity of 4.00 m/s? (b) If the train can slow down at a rate of 0.550 m/s^2, how long will it take to come to a stop from this velocity? (c) How far will it travel in each case? (OpenStax 2.29) **28.0 m/s, 50.9 s, 7680 m, 713 m**
9. A fireworks shell is accelerated from rest to a velocity of 65.0 m/s over a distance of 0.250 m. (a) How long did the acceleration last? (b) Calculate the acceleration. (OpenStax 2.30) $\mathbf{7.69 \times 10^{-3}\ s,\ 8.45 \times 10^{3}\ m/s^2}$
10. A car skids to a stop to try to avoid hitting a deer. The car skids 21 m in 2.3 s. How fast was the car originally going? (RW) **18 m/s**
11. What is the final velocity of a car that starts from rest and accelerates at 3.90 m/s^2 for a distance of 100 m? (RW) **27.9 m/s**
12. A hockey puck slides across the ice with an initial velocity of 7.2 m/s. It has a deceleration of 1.1 m/s^2 and is traveling toward the goal 5.0 m away. How much time does the goalie have to stop the puck? (RW) **0.74 s**
13. If a moose can accelerate at 2.1 m/s^2 from rest, how much time will it take for it to accelerate to a speed of 4 km/h? (RW) **0.53 s**
14. When you try to stop your car in an emergency, there is some time before you can react. Your car is going 25 m/s and your reaction time is 0.20 s, then after you hit your brakes it decelerates at 9.5 m/s^2. How far will your car travel before it stops? (RW) **38 m**