

Name _____ Period _____ Date _____

WS7: Word Problems with Position, Velocity, and Acceleration

In all these problems, assume that there is no air resistance or friction to interfere with "perfect" motion. Also assume that acceleration is constant and all motion is in a straight line. If an acceleration is not given and the object is not undergoing free-fall, assume that acceleration is equal to zero (it's still constant). Acceleration due to gravity = $g = -9.81 \text{ m/s}^2$

$$x_f = x_i + v_i \Delta t + \frac{1}{2} a (\Delta t)^2$$
$$v_f^2 - v_i^2 = 2a \Delta x$$
$$v_f = v_i + a \Delta t$$
$$v = \frac{\Delta x}{\Delta t} \quad a = \frac{\Delta v}{\Delta t}$$
$$x_f = x_i + v \Delta t$$

- 1) ~~Minimum stopping distance is important in traffic design. The average human reaction time is 0.22 s, meaning there's a 0.22 s delay between when one decides to brake and when he or she actually begins braking. A typical car can decelerate at 6.0 m/s^2 in good conditions. Knowing this, calculate the total stopping distance in meters for a vehicle that is traveling at 28 m/s. 71 m~~
- 2) An object is observed to be moving away from you at a velocity of 10 m/s. You measure its position from you at two times. At one time, it is 90 m away from you. How far away from you was it three seconds **earlier**? 66 m
- 3) An object, initially at rest, undergoes an acceleration of 4 m/s^2 . What distance will it travel in 6 seconds? 72 m
- 4) An object with an initial velocity of 10 m/s is observed to have a velocity of 70 m/s 10 seconds later. What was the object's acceleration? 6 m/s^2
- 5) At an initial time $t_i = 7 \text{ s}$, an object is observed to have an initial position of 30m, an initial velocity of 15 m/s, and an acceleration of 5 m/s^2 . What is its position and velocity at $t_f = 27 \text{ s}$? 115 m/s , position = 1330m
- 6) At some initial time, an object is observed to have a position of 50 m and a velocity of 15 m/s. Its position is then observed to be at 230 m six seconds later. What was the object's acceleration? 5 m/s^2

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7) An object with an initial velocity of 10 m/s is observed to undergo an acceleration of 5 m/s^2 for a period of 10 s. How far will the object travel in that time? 350 m

8) A baseball pitcher throwing a fastball accelerates the ball from rest to a speed of 44 m/s during the throwing motion, which is a displacement of about 3.5 m from behind the body to the point where it is released. Estimate the acceleration of the ball during the throwing motion. 280 m/s^2

9) A police car at rest is passed by a speeder traveling at a constant 110 km/hr and takes off in hot pursuit. The police officer catches up to the speeder in 700 m, maintaining a constant acceleration.

a. Plot the position vs. time graph for both cars from the police car's start to the catch up point. Use a ruler.

b. How long did it take the police officer to catch up to the speeder? 22.9 sec

c. What is the police car's acceleration? 2.67 m/s^2

d. What is the speed of the police car at the point when it catches up to the speeder? 61.1 m/s

10) An object is undergoing free fall near the Earth's surface. The object is initially at rest.

a. How long will it take for the object to fall 1 km? 14 seconds

b. How far will the object fall after one minute? $1.8 \times 10^4 \text{ m}$ or 18 km

c. How fast will the object be traveling after one minute in m/s? Convert that velocity to km/hr. ~~588 m/s~~

588 m/s
 2120 km/hr