1-dimensional motion problems
Honors Physics

Good techniques and habits for solving problems

- ☑ Draw a picture to help you visualize what's going on.
- ☑ Label the picture with given information (numbers and/or words).
- ☑ Write down what you know with variables (e.g., d = 5 m t = 2 s)
- ☑ Write down what you are looking for with a variable (e.g., a = ???)
- ☑ Choose an appropriate formula that will allow you to solve for the unknown. Write it down.
- ☑ Mathematically solve the problem (either plug in numbers and solve OR rearrange algebraically and then plug in)

Speed and Velocity $\bar{v} = \frac{\Delta x}{\Delta t}$

1. The Mars rover, Curiosity, can cover 400 inches in 4.5 minutes at its top speed. What is the top speed of the rover in inches per minute?
2. You drive your car from your house to school and cover 10 kilometers in 30 minutes. What is your average velocity in km/min? In meters/second?
3. A bullet is fired out of a gun at a constant speed of 394 m/s. If it's in the air for 0.37 seconds before hitting its target, how far away is the target?
4. A runner is able to run at a constant 8.6 m/s pace over 400 meters. How much time will it take the runner to finish?
5. A satellite is launched at a constant velocity of 30,000 miles/hour into space. How long would it take the satellite to reach the nearest star that is 25,800,000,000,000 miles (25.8 trillion miles…that's 4.4 light years away)? How many years is that?

1) 88.9 in/min 2) 0.33 km/min ; 5.56 m/s 3) 146 m 4) 46.5 s
5) 860,000,000 hrs ; 98,000 years!

Acceleration $a = \frac{v_2 - v_1}{t}$

6. A marble accelerates down a ramp. The marble starts from rest and reaches 3.3 m/s in 0.8 s. What is the acceleration of the marble?
7. A Ferrari accelerates uniformly from rest at a rate of 2.8 m/s^2 for 4.5 seconds. What is the instantaneous velocity of the car at the end of the 4.5 s interval?
8. On the highway, you decide to pass someone going too slowly. You are traveling along at 21 m/s and accelerate at 0.7 m/s^2 for 6 seconds. What is the car's final velocity at the end of 6 s?
9. In your car, how much time will it take you to go from 10 m/s to 35 m/s if you accelerate at a constant rate of 1.7 m/s^2 ?

6) 4.13 m/s^2 7) 12.6 m/s 8) 25.2 m/s 9) 14.7 s

Mixed Bag using motion equations

$\bar{v} = \frac{\Delta x}{\Delta t}$

$a = \frac{v_2 - v_1}{t}$

$\bar{v} = \frac{v_1 + v_2}{2}$

$v_2 = v_1 + at$

$\Delta x = v_1 t + \frac{1}{2} a t^2$

$v_2{}^2 = v_1{}^2 + 2a\Delta x$

10. You drive your car across the country and your final trip timer indicates that you drove 3235 miles and you averaged 56 mi/hr. How much time were you driving (in hours)?
11. The 2011 Bugatti Veryon goes from zero to 27.8 m/s in 2.5 seconds. Calculate the acceleration of the car.
12. For the same car (the 2011 Bugatti Veryon), calculate the distance traveled if it accelerates from zero to 27.8 m/s in 2.5 seconds.
13. A marble starts from rest at the top of an incline and rolls down an incline with an acceleration of 2.5 m/s^2 for 3.5 seconds.
    a. Calculate the instantaneous velocity of the marble at 3.5 seconds.
    b. Calculate the distance the marble rolled during the 3.5 seconds.
14. A feather is dropped from rest on the moon from a height of 1.40 meters. The acceleration of gravity on the moon is 1.67 m/s^2. Calculate the time it takes the feather to fall to the surface of the moon.
15. A Remington rifle accelerates a bullet from rest to a muzzle velocity of 957 m/s. The length of the barrel of the rifle is 0.61 m. Determine the acceleration of the bullet.
16. In trying to pass someone on the highway, you accelerate from 28 m/s to 34 m/s in 8.0 seconds.
    a. Calculate the acceleration of the car.
    b. How much distance did you travel during this time interval?
17. The take-off speed of a Boeing 737 airliner is 69.4 m/s. If the airliner starts from rest and accelerates at a constant rate of 1.60 m/s^2, how long must the runway be to accommodate this plane?
18. In a head-on car crash, a car goes from 19 m/s to rest in 0.16 seconds.
    a. Calculate the acceleration of the passenger.
    b. Over what distance did the car come to a stop?

10) 57.8 hrs 11) 11.1 m/s^2 12) 34.8 m 13) 8.75 m/s ; 15.3 m 14) 1.3 s
15) 7.5 x 10^5 m/s^2 16) 0.75 m/s^2 ; 248 m 17) 1500 m 18) -119 m/s^2 ; 1.5 m