Physics 5A Review Problems

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Contents

1 Short Response

1. Does odometer measure distance or displacement?
2. Does speedometer measure speed of velocity?
3. Draw the velocity and acceleration graph of each position function.

   A. $x = t^2$

   B. $x = 2t$

   C. $x = e^t$

4. A plane accelerates at $5\frac{m}{s^2}$ and needs to have a velocity of $50\frac{m}{s}$ to take off. At what time does the plane take off at? Assume at $t = 0$, $v = 0$ and $x = 0$. How far does the plane travel in that time? A. 5 seconds , 50 meters B. 50 seconds, 250 meters C. 10 seconds, 500 meters D. 1 second, 100 meters

5. If $a(t) = a_0 t$ draw the graph of acceleration versus time, and velocity versus time. Where a_0 is some positive constant.

6. I launch a projectile into the air at 45° from the horizontal. Remember that the projectile gets acted upon by gravity. What is the equation of position for the x-direction.

7. A ball thrown downward and a ball dropped which one has the greatest acceleration?

8. A ball thrown upward and a ball dropped which one has the greatest acceleration?

9. A ball thrown upward and a ball thrown vertically downward which one has the greatest velocity when they hit?

10. Does the force of friction always opposes the direction of motion?

11. If your have a constant speed can you be accelerating? If yes give an example. If no explain.

    A. $30\frac{m}{s^2}$, 20580 N

    B. $450\frac{m}{s^2}$, 308700 N

    C. $900\frac{m}{s^2}$,617400 N

    D. $300\frac{m}{s^2}$, 205800 N

12. You are driving and want to stop as quickly as possible, you should:

    A. slam on the brakes as hard as you can and skid to stop

    B. smash into the nearest object

    C. firmly press the brakes, with out skidding

13. Which of the following statements are true, in regards to the highest point in a trajectory.

    A. The projectiles vertical acceleration is zero.

    B. The projectiles horizontal acceleration is not zero.

    C. The projectiles vertical velocity is zero.

    D. The projectiles horizontal velocity is zero.

14. $8.000 \times 1.000 \times 3.0 + 2 =$

    A. 26.000

    B. 26.00

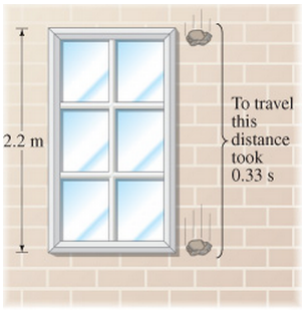
    C. 26.0

    D. 26

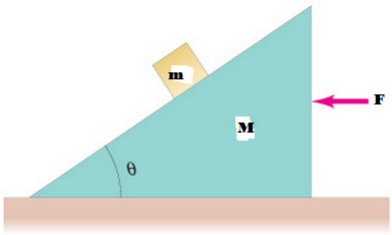
2 Free response problems

1. Find the times where the y-positions are equal in a trajectory. We start with our equation for position.

2. A falling stone takes 0.33 s to travel past a window 2.2 m tall. Your friend throw it straight down from a 0.5m above the top of the window. What velocity did your friend throw it at?



3. There is a wedge of mass M that is free to move on a table. There is small mass m that sits on the slope of the wedge. What force, F, on the big block is needed to keep the little block from sliding down the wedge?



4. The two components of a double star are observed to move in circles of radii r_1 and r_2. What is the ratio of their masses?

5. An aircraft is to fly to a destination $800km$ due north of its starting point. Its airspeed is $800\frac{km}{hr}$. The wind is from the east at a speed of $30\frac{m}{s}$. On what compass heading should the pilot fly? How long will the flight take? If the wind speed increases to $50\frac{m}{s}$, and the wind backs to the north-east, but no allowance is made for this change, how far from its destination will the aircraft be at its expected arrival time, and in what direction?

3 Challenge Problem!

Find the equation for the trajectory of a projectile launched with velocity v at an angle α to the horizontal, assuming negligible atmospheric resistance. Given that the ground slopes at an angle β, show that the range of the projectile (measured horizontally) is

$$x = \frac{2v^2}{g} \frac{sin(\alpha - \beta)cos\alpha}{cos\beta}$$

At what angle should the projectile be launched to achieve the maximum range?