

Kinematics

AT kinematics(10)

Solve the following problems. Show all work, and circle your answer. The test is worth 50 points. Each problem is worth 5 points.

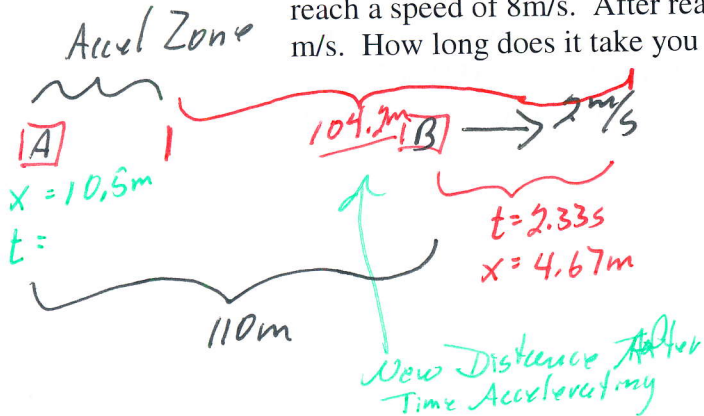
- 1) The football game is at Northern High School (hypothetically) which is 11 miles away (approximately from the high school). If you leave MASH at 3:45 on a Friday and it takes you 17 minutes to drive there, what is your average speed?

$$\frac{11 \text{ mi}}{17 \text{ min}} = 0.65 \text{ mi/min}$$

$$38.8 \text{ mi/hr}$$

$$17.2 \text{ m/s}$$

- 2) Leaving school one Friday, you realize that your friend asked you to meet them at their car after school. This is important because they drove, and you really don't want to ride the bus, and they threatened to leave without you if you were not at the car right after school. After talking with some friends and checking with some teachers after school, you realize that you need to get to the parking lot. When you get out the door by the training room, you see your friend nearing the middle of the parking lot, 110 m away, and walking at about 2 m/s. (...and you start to wonder if they are "Trying" to leave you!!!). At the moment you saw them, you were walking at 1 m/s, so you accelerate at a rate of 3 m/s² until you reach a speed of 8 m/s. After reaching a speed of 8 m/s, you run at a constant 8 m/s. How long does it take you to catch your friend?



After Accelerating

A
 $v_0 = 1 \text{ m/s}$
 $a = 3 \text{ m/s}^2$
 $v = 8 \text{ m/s}$
 $x = ?$

$v_0 = 1 \text{ m/s}$
 $a = 3 \text{ m/s}^2$
 $v = 8 \text{ m/s}$
 $t = ? 2.33s$

A
 $v_A = 8 \text{ m/s}$
 $t_A = t_B$
 $a = \text{Zero}$
 $x_A = x_B + 104.2 \text{ m}$

B
 $v_B = 2 \text{ m/s}$
 $t_B = t_A$
 $x_B = x_B$
 $a = \text{Zero}$

Looking For Time

$x_A = v_A t$
 $x_B + 104.2 \text{ m} = v_A t$
 $x_B = v_B t$

$v^2 = v_0^2 + 2ax$
 $v^2 - v_0^2 = x$

$\frac{2a}{(v^2 - v_0^2)} = x = 10.5 \text{ m}$

$v_B t + 104.2 \text{ m} = v_A t$
 $104.2 \text{ m} = v_A t - v_B t$
 $104.2 \text{ m} = t(v_A - v_B)$
 $104.2 \text{ m} = t$

[I Can't Follow my Own notes!!]

$v = v_0 + at$
 $\frac{v - v_0}{a} = t$

$\frac{104.2 \text{ m}}{(8 \text{ m/s} - 2 \text{ m/s})} = t = 17.4 \text{ s}$ Time To Catch @ Const Speed
 2.33s Time During Acceleration

$\frac{8 \text{ m/s} - 1 \text{ m/s}}{3 \text{ m/s}^2} = 2.33 \text{ s}$

19.7s To Catch

key Level I Physics Pd 2

- 3) Hand grenades typically have 3 second fuses, which mean 3 seconds after they are thrown, they explode. Imagine that you are on a roof top and wish to have a grenade explode just as it hits the ground 6 meters below you. How should you "throw" the grenade to make this happen? (6 meters is about 20 feet, which is the typical height of the roof of a 2 story building)

$$\begin{aligned}y &= -6\text{m} \\ a &= -9.8\text{m/s}^2 \\ t &= 3\text{s} \\ v_0 &= ?\end{aligned}$$

$$y = v_0 t + \frac{1}{2} a t^2$$

$$y - \frac{1}{2} a t^2 = v_0 t$$

$$\frac{y - \frac{1}{2} a t^2}{t} = v_0$$

$$\frac{-6\text{m} - \frac{1}{2}(-9.8\text{m/s}^2)(3\text{s})^2}{3\text{s}} =$$

$$\frac{12.7\text{m/s}}{}$$

Upward

key Level I Physics Pd 2

- 4) Top Fuel Dragsters, which are the "rail-type" cars that are the fastest cars in the NHRA drag racing circuit, are capable of running the quarter mile strip in 4.5 seconds!!! What would be their average acceleration during a run? For comparison, Top Thrill Dragster roller coaster at Cedar Point reaches 120 mph in 3.8 seconds.

$$x = 400\text{m}$$

$$t = 4.5\text{s}$$

$$a = ?$$

$$v_0 = \text{zero}$$

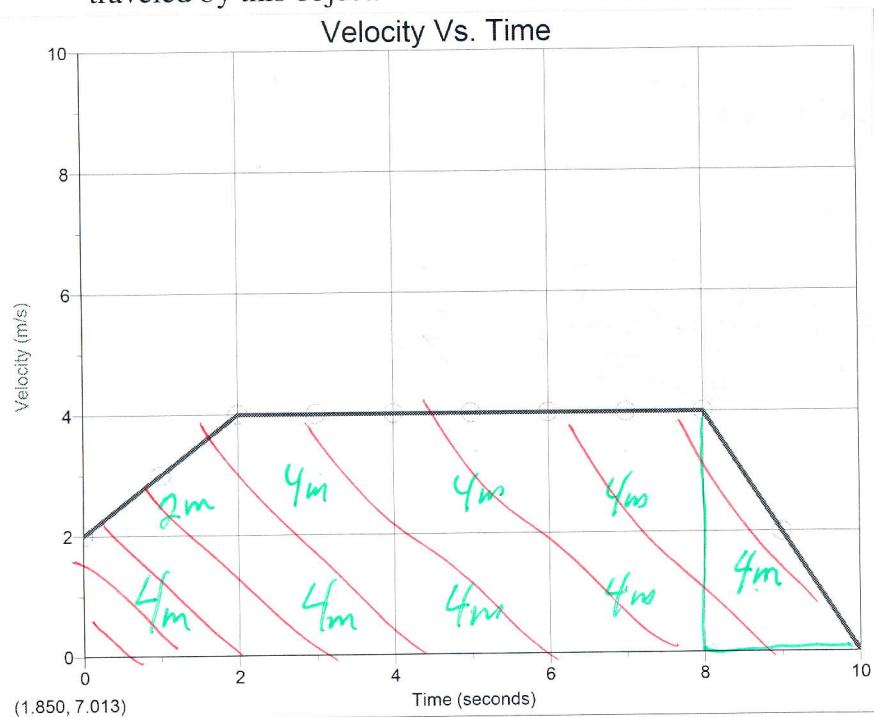
$$x = v_0 t + \frac{1}{2} a t^2$$

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

$$\frac{2x}{t^2} = a = \frac{(2)(400\text{m})}{(4.5\text{s})^2} = 39.5\text{m/s}^2 \approx 4g$$

key Level I Physics Pd 2

- 5) An object moves to create the velocity graph below. Determine the distance traveled by this object.



$$\frac{1}{2}bh = \left(\frac{1}{2}\right)(2)(4) =$$

34m (Via Logger Pro)

34m

key Level I Physics Pd 2

- 6) If you were to stand on a basketball rim (10ft, or 3.05 m) in the air, how long would it take you to hit the floor if you were to jump?

$$y = v_0 t + \frac{1}{2} a t^2$$

$$y = \frac{1}{2} a t^2$$

$$\sqrt{\frac{2y}{a}} = t = \sqrt{\frac{(2)(3.05\text{m})}{-9.8\text{m/s}^2}} = 0.795$$

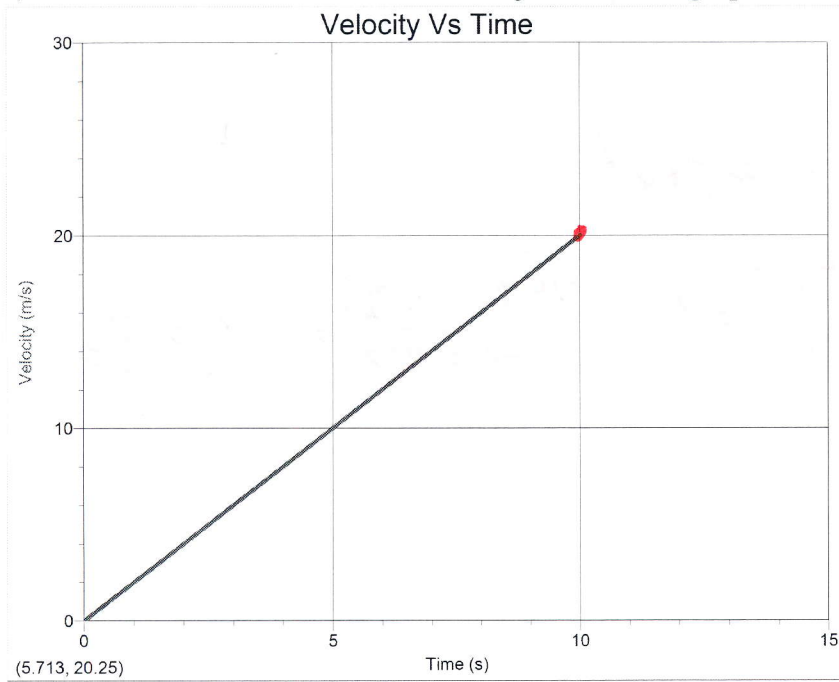
key Level I Physics Pd 2

- 7) If you were to throw a ball straight up in the air at 18 m/s, how long would it be in the air?

$$v = v_0 + at$$

$$\frac{v - v_0}{a} = t = \frac{-18 \text{ m/s} - 18 \text{ m/s}}{-9.8 \text{ m/s}^2} = t = 3.7 \text{ s}$$

8) Determine the acceleration of the object from the graph below.



$$\frac{20 \text{ m/s}}{10 \text{ s}} = 2 \text{ m/s}^2$$

- 9) State the acceleration and the velocity at the top of the path of a ball that was thrown in the air.

$$a = -9.8 \text{ m/s}^2$$

$$v = \text{zero}$$