Physics Name: _____
Unit 1: Motion
Calculating Acceleration

Notes:

Something's average **Acceleration** tells you how much something's _____ during each

_____. **Units for acceleration are _____. This is pronounced**

_____

If I say "the runner accelerated at a rate of 3m/s^2," what does that MEAN?

Acceleration due to gravity = _____ = _____

We will use an approximation for acceleration due to gravity → _____

This means that, if something falls from a height, for every second that it falls…

Acceleration Formula:

Practice Problems:

1. If your velocity increases by 15m/s over a time of 2 seconds, what is your acceleration?

2. A car goes from 0m/s to 27m/s (this is like 0-60mph) in 3 seconds. What is its acceleration?

3. A mantis shrimp strikes out with a special arm that it uses to bash snails. The velocity of this arm increases by about 70 m/s over a time period of 0.001 seconds. What is the acceleration of the shrimp's appendage?

More Problems:

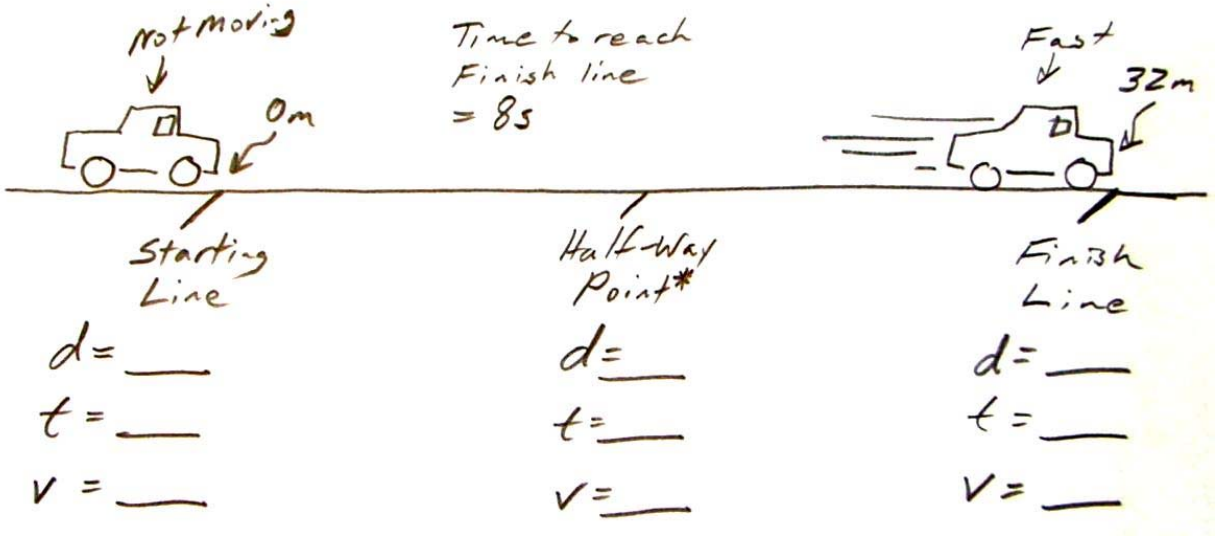
4. A policeman has a radar gun pointed at a car. The radar says 40 m/s. Five seconds later, the car passes a second policeman, whose radar gun clocks the car's velocity at 55m/s. Assuming that the radar guns are correct, how much did the car accelerate between the two policemen?

5. A sprinter takes off from the starting line at time. After 4 seconds, the sprinter has sped up to 15 miles per hour. What was the sprinter's average acceleration?

6. A car was traveling down the interstate with a velocity of 28 m/s. The driver sped up to pass, increasing the car's velocity to 33 m/s. It took the driver 2 seconds to speed up to this new velocity. What was the car's acceleration during those two seconds?

How to calculate the acceleration of an accelerating object:

The race car on the next page starts moving with a constant acceleration. This means it is speeding up at an even rate. Its speed changes, but its acceleration stays the same. [If you were in the car, you would feel yourself pushed back in to the seat with an unchanging force.] In the beginning the car is not moving at all.



To calculate the car's acceleration, we need to find its change in velocity and the change in time. To do that, we can find the following…

Initial velocity =

Average Velocity = d/t =

Final Velocity = 2 X Average Velocity =

Δt = change in time = final time – initial time =

ΔV = change in velocity = final velocity – initial velocity =

The car's acceleration is $\Delta v / \Delta t$ =

If this car stops and then accelerates for 10 seconds, how fast will it be going? _____ *How fast will it be going after one more second (11 seconds total)?* _____

Acceleration Measurement and Estimation Practice – ***Assuming Constant Acceleration ***

	Distance Traveled (m)	Change in Time (s)	Velocity at **starting** point (m/s)	Average Velocity (m/s)	Velocity at **ending** point (m/s)	Change in Velocity (m/s)	Acceleration (m/s^2)
Example A	16	4					
Example B	3	1.2					
Example C	2	10					

Velocity and Acceleration Practice Questions:

1. How long is the line below, in cm and in meters?

2. Fill in the correct units. This school is about 200 _____ long. A person is about 200 _____ tall.

3. It takes a pitcher's fastball about 0.46 seconds to travel 18.4m from the pitcher's mound to home plate.

   a. For this event, t= _____ and d = _____

   b. What is the fastball's average velocity on the way to the plate?

   c. About how many miles per hour is that?

4. A snail is traveling down the stem of a plant. The length of the stem is 0.4m, and it takes the snail 900 seconds (about 15 minutes) to travel down the stem.

   a. For this event, t= _____ and d = _____

   b. What is the fastball's average velocity on the way to the plate?

   c. About how many miles per hour is that?

5. Estimate the velocity of someone walking by. You are not allowed to use any measuring devices. Fill in the following blanks. Then explain how you came up with those numbers.

   a. For this event, t= _____ and d = _____

   b. What was the person's velocity, in m/s? _____

   c. About how many miles per hour is that?

6. What is the acceleration of gravity, in m/s^2?

7. If something is dropped from a high place, what velocity will it have after falling for four seconds? (ignoring air resistance)

8. Suppose you're standing still. Then you begin accelerating at a rate of 2 m/s^2. What will your velocity be after 6 seconds?

9. Write the formula for acceleration, and explain what it means.

10. If I say, the ball had an acceleration of $8m/s^2$, what does that mean?

11. A cheetah crouches in the grass. Then it sprints after a gazelle. After 2 seconds, the cheetah has sped up from 0 m/s to 17 m/s. What is the cheetah's acceleration?

a. Δv = _____ b. Δt = _____ c. acceleration = _____

12. You stop at a stop sign. Then you accelerate. After 10 seconds, you pass one of those speed limit signs that tells you your speed. It says you're going 30 mph (the same as 13.4 m/s). What was your average acceleration?

a. Δv = _____ b. Δt = _____ c. acceleration = _____

13. You hold a sled on a snowy hill, and then you let it go. While you're doing this, a friend is watching you with a timer. As soon as you let go of the sled, the friend starts the timer. As soon as the sled reaches the bottom of the hill, the friend stops the timer. Then the two of you measure how far the sled as it traveled down the hill. **The sled slid 20 m, in 8 seconds.**

a. What distance did the sled travel? d = _____

b. What amount of time passed by while the sled was sliding? t = _____

c. What was the initial velocity of the sled? $v_{initial}$ =_____

d. What was the average velocity of the sled? $v_{average}$ = _____

e. What was the final velocity of the sled? v_{final} = _____

f. Δv = _____ Δt = _____

g. What was the sled's acceleration? a = _____