Name: _____

Date: _____

MCHS Honors Physics 2014-2015

Kinematics

5 Steps to solving a physics problem (also good for other classes):

1) Draw a picture
2) Make a list of what you know (label the picture if possible)
3) Make a list of what you don't know and what you are looking for
4) List any equations you may need to find what you're missing
5) Solve the problem

Definitions:

Position

$\Delta\vec{x}$ = Displacement

$\vec{x}$ = Final position

$\overrightarrow{x_0}$ = Initial position

$\Delta\vec{x} = \vec{x} - \overrightarrow{x_0}$ (units = meters)

Velocity and Speed

Average speed = $\frac{distance}{time}$ (units = m/s) = How fast (can't be negative)

Average velocity = $\frac{\vec{x}-\overrightarrow{x_0}}{t-t_0} = \frac{\Delta\vec{x}}{\Delta t}$ = How fast and in what direction (can be negative)

Instantaneous velocity = How fast at an instant of time

Acceleration

Average acceleration $\vec{a} = \frac{\vec{v}-\vec{v}_0}{t-t_0}$ or $\frac{\Delta\vec{v}}{\Delta t}$ (units = m/s^2)

If average velocity and average acceleration have different signs, it can be said that the object in motion is decelerating (slowing down).

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3 Equations

Velocity	$v = v_0 + at$	
Position	$x = v_0 t + \frac{1}{2}at^2$	
Velocity^2	$v^2 = {v_0}^2 + 2ax$	(used to find final velocity without time)

Where: x=displacement, a=acceleration, v =final velocity, v_0 =initial velocity, t =total time

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Classwork / Homework

On a separate piece of paper, stapled to this one, use the 5 Steps to solving a physics problem to answer these questions...

1) Jules Verne in 1865 suggested sending people to the moon by firing a space capsule from a 220m long cannon with a launch speed of 11,000 m/s. What incredibly large acceleration would the occupants of such a capsule experience, if the capsule started from rest and reached a speed of 11,000 m/s by the time it exited the end of the cannon? Convert that acceleration into "G's".

2) A large commercial plane needs to reach a speed of 290 km/hr to have a successful takeoff. If the length of the runway is 3000 meters, and the plane starts from rest, what acceleration is needed to make sure the plane can take off at the end of the runway?

3) A BMW 745i can brake to a stop in a distance of 37 meters from a speed of 100 km/hr. What is the cars acceleration?

4) A car moving at 25 m/s approaches a school zone and must slow down to 10 m/s. The driver sees the "school zone" sign and immediately begins to slow the car with a constant acceleration of -3.5 m/s^2. If the car reaches the required reduced speed just as the car passes the speed limit sign, how far from the sign was the car when the driver hit the brakes?

5) For many years, Colonel John Paul Stapp of the USAF, held the world's land speed record. On March 19, 1954 he rode a rocket-propelled sled that moved down a track at a speed of 1017 km/hr (631.9 mph). He and the sled were brought safely to rest in 0.6697 seconds. What was the acceleration that Colonel Stapp experienced at the end of his ride?

6) What was the distance needed to bring the sled in problem 5 to a stop?

7) While already sliding across a sheet of ice at a rate of 10 m/s (assume no friction), a student wearing a jetpack is accelerated at 20 m/s^2 for 20 seconds. How far has the student traveled during those 20 seconds of acceleration?

8) While cruising along at 50 km/hr, the driver of a car stomps on the gas and is accelerated at 0.5 m/s^2. How long does it take to reach a speed of 100 km/hr?