Physics Unit 2 – 1-Dimensional Kinematics

Objectives:

- ❏ I can use kinematics equations to solve for unknown quantities describing the motion of objects.

Standards:

SPI.3231.1.4: Solve motion and conceptual problems regarding velocity, acceleration, and displacement using displacement-time graphs and velocity-time graphs.

CLE 3231.1.4: Investigate kinematics and dynamics

SPI 3132.1.2: Given various examples of quantities, categorize them as scalar or vector quantities

Vocabulary:

Position
Displacement
Initial Velocity
Final Velocity
Acceleration
Time

Assignments:

- ❏ 1D Motion Marble Lab
- ❏ Problem Set A - Due Sept. 29!
- ❏ Problem Set B - Due Oct. 5!
- ❏ Exam

Formulas:

$x = v_i t + \frac{1}{2} a t^2$	$v_f = v_i + at$
$v_f^{\,2} = v_i^{\,2} + 2ax$	$x = \frac{1}{2}(v_i + v_f)t$

t = time (seconds) x = displacement (meters)

v_i = initial velocity (m/s) v_f = final velocity (m/s) a = acceleration (m/s^2)

Unit 2 – One Dimensional Kinematics - Problem Sheet

Section A - DUE FRIDAY, SEPTEMBER 29!!!

1. An airplane starts at rest and accelerates down a runway at 3.20 m/s^2 for 32.8 s until it finally lifts off the ground. Determine the distance traveled before takeoff.

2. Upton Chuck is riding the Giant Drop at Great America. If Upton starts from rest and free falls (a = 9.8 m/s^2) for 2.60 seconds, what will his final velocity be?

3. I accelerate from a velocity of 10 m/s to a velocity of 20 m/s in 15 seconds. What distance have I traveled?

4. I start from rest and accelerate at 5 m/s^2 for 20 m. What is my final velocity?

5. Rocket-powered sleds are used to test the human response to acceleration. If a rocket-powered sled starts at rest and is accelerated to a speed of 444 m/s in 1.83 seconds, then what is the distance that the sled travels?

6. I am driving at 6 m/s and accelerate at 7 m/s^2 for 40 meters. What is the final velocity?

7. A car traveling at 22.4 m/s skids to a stop in 2.55 s. Determine the skidding distance of the car.

8. A car starts from rest and accelerates at 5 m/s^2 for 10 seconds. What is its final velocity?

9. I accelerate from a velocity of 2 m/s to a velocity of 15 m/s in 10 seconds. What distance have I traveled?

10. I drop a ball from a building, meaning that it starts at rest. It falls with an acceleration of 9.8 m/s^2 for 7 seconds before hitting the ground. What was the final velocity of the ball before it hit the ground?

Section B - DUE THURSDAY, OCTOBER 5!!

11. A train starts from rest and gets up to 30 m/s over 75 meters. How long did this take?

12. A bike accelerates uniformly from rest to a speed of 7.10 m/s over a distance of 35.4 m. Determine the acceleration of the bike.

13. A plane has a takeoff speed of 88.3 m/s and requires 1365 m to reach that speed. Determine the time required to reach this speed.

14. A train starts from rest and gets up to 30 m/s over 75 meters. How long did this take?

15. I start from rest and get to a velocity of 20 m/s at an acceleration of 4 m/s^2. How long does this take?

16. I am running at 1 m/s and accelerate for 100 meters at 2 m/s^2. What is the final velocity?

17. A feather is dropped on the moon from a height of 1.40 meters. The acceleration of gravity on the moon is 1.67 m/s^2. Determine the time for the feather to fall to the surface of the moon.

18. An engineer is designing the runway for an airport. Of the planes that will use the airport, the lowest acceleration rate is likely to be 3 m/s^2. The takeoff speed for this plane will be 65 m/s. Assuming this minimum acceleration, what is the minimum allowed length for the runway?

19. A bus accelerates at 2.1 m/s^2 for 5 seconds. If its final velocity was 20 m/s, what was its initial velocity?

20. I drop a penny off of a 300 m tall building. (Acceleration from gravity is 9.8 m/s^2.) How long does it take for the penny to hit ground?