Name: _____

Class: _____

Due Date: _____

Physics Topic 5 – Vertical Motion in One Dimension

Answer the following questions. The solutions to this worksheet can be found on the YouTube channel Go Physics Go.

1. E: Adam throws a ball vertically upwards with an initial velocity of 40.0 m/s in the absence of air friction. For this problem let the acceleration due to gravity be 10.0 m/s^2 down.

   a. Complete the table below:

Time (s)	Acceleration $\left[\frac{\text{m}}{\text{s}^2}\right]$	Velocity $\left[\frac{\text{m}}{\text{s}}\right]$ $v_\text{f} = at + v_\text{i}$	Displacement [m] $y_\text{f} = \frac{1}{2}at^2 + v_\text{i}t + y_\text{i}$	Total distance traveled [m]
0				
1				
2				
3				
4				
5				
6				
7				
8				

b. **Use a pencil and ruler!** Draw an *acceleration vs. time* graph, a *velocity vs. time* graph, a *speed vs. time* graph, a *displacement vs. time* graph, and a *distance vs. time* graph for the ball.

2. E: Enoch throws a ball vertically upwards with an initial speed of 47.0 m/s at an elevation of 8,848 m above the surface of the Earth.

   a. What will be the acceleration of the ball (number and direction) at the moment after it is thrown upwards?

   b. What will be the acceleration of the ball (number and direction) when it reaches its maximum height?

   c. What will be the velocity of the ball when it reaches its maximum height?

   d. How long will it take for the ball to reach its maximum height?

   e. How many meters above the surface of the Earth will the ball be when it reaches its maximum height?

   f. What will be the acceleration of the ball (number and direction) just before it strikes the surface of the Earth?

   g. What will be the velocity of the ball when it is 8,950 m above the surface of the Earth?

h. How long will it take for the ball to be 8,950 m above the surface of the Earth?

i. What will be the velocity of the ball just before it strikes the ground?

j. What is the total distance the ball travels during the first 4.50 s?

k. What is the total distance the ball travels?

l. How long will it take for the ball to be 300. m above the surface of the Earth?

m. **Use a pencil and ruler!** Draw a *displacement vs. time* graph, a *velocity vs. time* graph, and an *acceleration vs. time* graph for the ball.

3. E: Noah drops a ball from rest at an elevation 830. m above the surface of the Earth.

   a. What will be the acceleration of the ball (number and direction) at the moment it is dropped?

   b. What will be the acceleration of the ball (number and direction) when it is 415. m above the surface of the Earth?

   c. What will be the acceleration of the ball (number and direction) just before it strikes the surface of the Earth?

   d. How long will it take for the ball to be 415 m above the surface of the Earth?

   e. What will be the velocity of the ball 415 m above the surface of the Earth?

   f. What will be the velocity of the ball just before it strikes the ground?

g. What is the total distance the ball travels during the first 8.00 s?

h. How long will it take for the ball to be 300. m above the surface of the Earth?

i. What is the average speed of the ball?

j. **Use a pencil and ruler!** Draw a *displacement vs. time* graph, a *velocity vs. time* graph, and an *acceleration vs. time* graph for the ball.

4. E: Eber throws a ball vertically downwards with an initial speed of 22.0 m/s from a height of 8,848 m above the surface of the Earth.

   a. What will be the acceleration of the ball (number and direction) at the moment after it is thrown downwards?

   b. What will be the acceleration of the ball (number and direction) just before it strikes the surface of the Earth?

   c. What will be the velocity of the ball just before it strikes the surface of the Earth?

   d. How long will it take for the ball to reach the surface of the Earth?

   e. What will be the velocity of the ball when it is 4,000 m above the surface of the Earth?

f. How long will it take for the ball to reach 4,000. m above the surface of the Earth?

g. What is the total distance the ball travels after 12.5 s?

h. **Use a pencil and ruler!** Draw a *displacement vs. time* graph, a *velocity vs. time* graph, and an *acceleration vs. time* graph for the ball.

5. E: You are standing on the top of a building 135 m tall. You throw a ball upward with a velocity of 22.0 m/s. At the exact same moment a friend throws a second ball upward from the ground with a velocity of 46.0 m/s. These two balls then collide at some later time.

   a. How long after these two balls are released will they collide?

   b. Where will these two balls be when they collide?

   c. What will be the velocity of each ball just as they collide?

   d. What will be the relative velocity between these two balls at the moment they collide?

6. E: From the top of a building 85.0 m tall a ball is dropped. At the same time another ball is thrown upward from the ground with a speed of 46.0 m/s.

   a. How long after the balls are released will they hit?

   b. How high above the ground will these two balls hit?

7. E: You are on the top of a building 44.2 m tall. The adjacent building is 98.1 m tall. You throw the ball upward so that the ball lands on the roof of the adjacent building 4.15 s after the ball is thrown. What will be the speed of the ball when it lands on the roof?

Take a break and play this video game:
https://universeandmore.com/motion-mapper/