IB SL Physics Period ____ Date _____

Ball Drop Group Members: _____

In this exercise we will use the following convention:

- Up is positive
- Down is negative

In a group with 2-3 students, drop a ball and observe it's behavior. During the process of falling (ignore when it hits the ground and comes to a halt)

1. **Describe** the motion of the ball in words
    a. At the instant the ball is dropped, does it have a zero, a positive, or a negative velocity? What is it's speed?
    b. As the ball falls is it speeding up, slowing down, or moving at a constant speed?
    c. Is it's velocity negative or positive? Why?
    d. As the ball continues to fall (time increases), is it covering a greater distance or a smaller distance in the same amount of time? Why?
2. **Sketch** the velocity vectors for t=t0, t=t1, and t=t2 where t2>t1>t0
3. By looking at the velocity vectors you have drawn, determine if the ball is accelerating. If it is accelerating, what is the direction of the acceleration?
4. **Sketch** a velocity vs time graph for the ball. When you have done this, make sure that your graph is consistent with your answers to 1a,b,&c
5. **Sketch** a speed vs time graph for the ball (remember, speed is always positive!). Make sure your graph is consistent with 1a &1b
6. **Sketch** the displacement of the ball vs time. (think about 1d)

Now, throw the ball up and observe the ball's behavior on the way up to its highest point. For this motion (as you throw it up and it reaches the high point) answer the following

7. **Describe** the motion of the ball in words
    a. At the instant the ball is thrown upwards, does it have a zero, a positive, or a negative velocity?
    b. After you throw it upwards and let go of it, is it speeding up, slowing down, or moving at a constant speed?
    c. On the way up, is it's velocity negative or positive? Why?
    d. At it's highest point, what is it's velocity? What is it's speed?
    e. On the way up, as time goes on, is it covering a greater distance or a smaller distance in the same amount of time? Why?
8. **Draw** the velocity vectors for t=t0, t=t1, and t=t2 where t2>t1>t0, and it is at it's high point at t2.
9. By looking at the velocity vectors you have drawn, determine if the ball is accelerating. If it is accelerating, what is the direction of the acceleration?

10. **Sketch** a velocity vs time graph for the ball. When you have done this, make sure that your graph is consistent with your answers to 1a,b,c&d
11. **Sketch** a speed vs time graph for the ball (remember, speed is always positive!). Make sure your graph is consistent with 7a ,b,&d
12. **Sketch** the displacement of the ball vs time. (think about 7e)

Introduction to CER: Claim, Evidence, and Reasoning. (Refer to the CER Rubric.)

CLAIM: *A statement or conclusion that answers the original question/problem.*

EVIDENCE: *Scientific data that supports the claim. The data needs to be appropriate and sufficient to support the claim.*

REASONING: *A justification that connects the evidence to the claim. It shows why the data counts as evidence by using appropriate and sufficient scientific principles.*

Question 1: What is the direction of a ball's acceleration when the ball is dropped? *(Class discussion* to determine the CLAIM.)

Students will work in their group to complete the CER for Question 1.

CLAIM	
EVIDENCE	1. 2.
REASONING	1.
	2.

Question 2. What is the direction of a ball's acceleration when the ball is thrown up? Write the CLAIM in the space provided.

CLAIM	