Lab 2-8: The Acceleration of a Bouncing Ball

Purpose: To determine the acceleration of a racquetball while it is bouncing.

Materials: 1 racquetball 1 photogate 1 stand 1 clamp

Procedure:

1. Arrange the photogate so that the light beam is just above the top of the ball when the ball is on the table.
2. Start Logger Pro and open up the file *"Experiments/Probes & Sensors/Photogates/Bounce.cmbl."*
3. Double-click on the column marked "Velocity" and in the equation, change the "0.1" to the actual diameter of your raquetball (which is 0.057 meters.)
4. Click on the "Collect" button, and then carefully drop the racquetball so that it falls in the beam of the photogate and catch it so that it only bounces once. Please make sure to not drop the ball on the photogate.
5. Record the speeds and time in the data table below.

Data:

Speed of ball just before hitting the table	
Speed of ball just after hitting the table	
Time ball was in contact with the table	

Conclusions:

1. Which direction do you want call positive? What were the initial and final velocities of the ball?

   Up = _____ v_i = _____ v_f = _____

2. What was the acceleration of the racquetball as it fell? How do you know?

3. How did Logger Pro calculate the speeds of the ball?

4. What was the change in velocity of the ball? Give the magnitude as well as the direction.

5. What was the acceleration of the ball while it was in contact with the table and bouncing?

6. How many times greater than gravity was the acceleration during the bounce?

7. Why was it wrong to just subtract the two speeds to answer question 3 above?

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Follow-Up Questions:

1. A ball of clay hits the ground with a speed of 2 m/s. It doesn't bounce, but "splats" to a stop in only 0.04 seconds.
   a. What was the change in velocity of the clay? (Magnitude & direction.)

   b. What was the acceleration of the clay while splatting? (Magnitude & direction.)

2. A ball hits the ground with a speed of 6.5 m/s and bounces back up with a speed of 5.0 m/s. The actual bounce only lasted for 0.004 seconds.
   a. What was the change in velocity of the ball during the bounce? (Magnitude & direction.)

   b. What was the acceleration of the ball while in contact with the ground? (Magnitude & direction.)

3. You throw ball at a wall with a speed of 15 m/s. During the bounce off the wall, the ball has an acceleration of 2400 m/s^2 for 0.008 seconds.
   a. In what direction is the acceleration? How do you know?

   b. What is the velocity of the ball come as it comes back at you?

4. A basketball hits the ground with a speed of 12 m/s and bounces back up with a speed of 9 m/s. If the bounce lasted 0.003 seconds, what was the acceleration of the basketball during the bounce? (Magnitude & direction.)

*5. A super ball is dropped from a height of 12 meters, hits the ground and bounces up. During the actual bounce, the acceleration of the ball was 3700 m/s^2 and the bounce lasted for 0.007 seconds. How high does the ball go after the bounce?

Answers: 1. a) 2 m/s up b) 50 m/s^2 up 2. a) 11.5 m/s up b) 2875 m/s^2 up
3. a) Away from wall b) –4.2 m/s 4) 7000 m/s^2 up 5) 5.4 m