
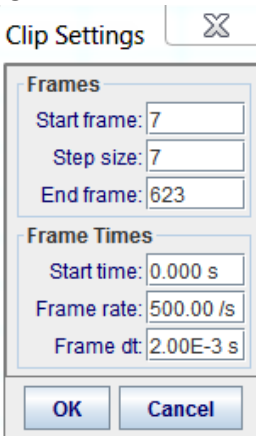


Procedure

1. Download the file ball_drop.mov from <http://jmh.nbed.nb.ca/teacher/note/physical-science-10-motion-analysis-videos> and load it into the Tracker program.
2. Once loaded in to the Tracker program click on the film settings icon,  and change the start frame, step size, end frame and frame rate to match the following:



3. Forward the video so the ball has dropped enough to be clear of the hand. Click on the calibration icon and insert a calibration stick. Stretch the calibration stick across the diameter of the ball and set its value to 0.026. Zoom in on the ball to set the stick as accurately as possible across the ball.
4. Insert a coordinate system and place the origin near the bottom left – the x-axis should cut through the middle of the wooden board.
5. Click on the create icon – then point mass (rename and edit colours of the track if you want). Track the ball as in bounces to the ending frame.

Analysis (to be completed in WORD)

1. Click on the vertical axis label (probably says “x”) and select the letter y. Insert that graph into your report. Remember, this is a graph of how high the ball was with time (not the actual path of the ball through the air).
 - a. Other than the start, at what times did the velocity of the ball reach zero and the ball changed direction? (Note: you can click on a data point and its value will appear in a yellow box.)
 - b. Based on this graph, how can you tell if the ball is accelerating? (Hint: Each dot is made at equal intervals of time.)
2. Click on the vertical axis label and select v_y . Insert it into your report. This is a graph of the ball’s up-and-down velocity with time. Notes: The nearly vertical lines are from the ball bouncing on the wood because its velocity changes very quickly – it has a very high acceleration. The three “normal” looking lines are when the ball is moving through the air. Right-click and select *Analyze*.
 - a. Use a line of best fit to determine the acceleration (slope) of the ball for the three times it was freely moving through the air.
 - b. Take the average of the three results above to calculate the acceleration of gravity acting on the ball and compare that value to the accepted value of -9.81 m/s^2 .
 - c. Use a line of best fit to determine the acceleration of the ball during the bounce (the nearly vertical lines).
 - d. Consider your answers in (c), do you think a human could survive such an acceleration? Take your answers from (c) and divide them by -9.81 ; that will tell you how many “g-s” the ball experienced. So many “g-s” is a multiple of Earth’s acceleration of gravity and is commonly used by fighter and stunt pilots as the talk about the strength of g-forces.
3. List at least three sources of error that could have lead you to get slightly inaccurate results or results that differ from your classmates. Is it possible to get exact results in an experiment?