Required Skills
- Initiating and Planning
- Performing and Recording
- Analyzing and Interpreting
- Communication and Teamwork

Determining the Magnitude of the Acceleration due to Gravity

Question

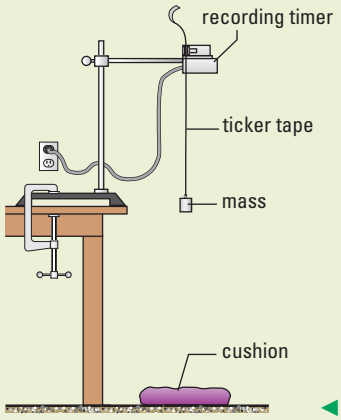
How can position-time and velocity-time graphs be used to determine the acceleration due to gravity?

Materials and Equipment

60-Hz spark timer	masking tape
ticker tape	C-clamp
carbon disk	retort stand
power supply	graph paper
small mass	cushion
metre-stick or ruler	

Procedure

1. Construct a data table in your notebook for recording time and position.
2. Set up materials as shown in Figure 1.59(a), ensuring that the timer is 1.5 m above the floor.

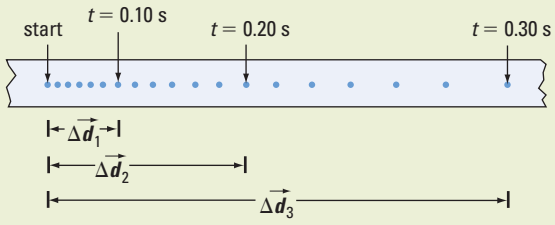


◀ **Figure 1.59(a)**

3. Attach a 1.5-m strip of ticker tape to the mass and thread the ticker tape through the spark timer.
4. Turn on the spark timer just before your partner releases the mass.
5. Repeat steps 3 and 4 for each person in your group.
6. Analyze the ticker tape by drawing a line through the first distinct dot on the tape. Label it "start". (On a 60-Hz timer, every sixth dot represents 0.10 s.) Continue labelling your ticker tape as shown in Figure 1.59(b).
7. Using a ruler, measure the position of the object at each time interval and record it in your data table.
8. Plot your collected data on a position-time graph.
9. With a sweeping motion, practise connecting the dots in a smooth curve that best fits the data.
10. Construct a data table in your notebook for recording instantaneous velocity and time.
11. Draw three tangents on the position-time graph.
12. Calculate the instantaneous velocities at these points by determining the slopes of the tangents. Record the data in your table.
13. Plot a velocity-time graph of your collected data.
14. Draw a line of best fit.
15. Calculate the acceleration experienced by the object, in m/s^2, by finding the slope of the velocity-time graph.

Analysis

1. Determine the experimental value of the magnitude of acceleration due to gravity by averaging your group's results.
2. Determine the percent error for your experimental value. Assume the theoretical magnitude of a is 9.81 m/s^2.
3. Describe the shape of the position-time graph you drew in step 9.
4. From your graph, describe the relationship between time and displacement for an accelerating object.



▲ **Figure 1.59(b)**

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