



**Figure 2**

**Step 9:** When the timer is mounted on the ring stand, tape the cord to the stand to keep it out of the way.

**Step 11:** Use a piece of tape to mark the stand at the starting point, and start the mass from the same point for all trials.

## Speed and Acceleration of a Falling Object

- 9.** Set up the apparatus as shown in **Figure 2**. If the timer cannot be mounted on the stand, clamp the timer to the edge of the table.
- 10.** Cut a length of paper tape that is at least 20 cm longer than the distance between the timer and the floor. Thread the end of the tape through the timer.
- 11.** Fold the end of the paper tape and fasten it with masking tape to make a loop. Hook a 200 g mass through the looped end of the paper tape, as shown.
- 12.** Position the mass at a convenient level near the timer, as shown. Hold the mass in place by holding the tape behind the timer. Make sure the area is clear of people and objects. Simultaneously, start the timer and release the tape so the mass falls to the floor. Stop the timer when the mass hits the floor.
- 13.** Label the tape with the mass used. Label the second and third dots *A* and *B*, respectively. Count four dots from *B* and label the seventh and eighth dots *C* and *D*, respectively. Label the twelfth and thirteenth dots *E* and *F*, and label the seventeenth and eighteenth dots *G* and *H*.
- 14.** Repeat this procedure using different, larger masses, such as 300 g and 400 g masses. Drop each mass from the same level in each trial. Label all tapes, and record all data.
- 15.** On each tape, measure the distance between *A* and *B*, between *C* and *D*, and so on. Record the distance in meters in your data table.
- 16.** Clean up your work area. Put equipment away safely so that it is ready to be used again.

## ANALYSIS

- 1. Organizing Data** For each trial with the falling mass, find the magnitude of the average velocity,  $v_{avg}$ . Divide the distance *A–B* by the average period of the timer. Repeat this calculation for the other marked distances for each trial.
- 2. Organizing Data** Using the results from item 1, calculate the average acceleration. Find the change of speed between the distance *A–B* and the distance *C–D*, between the distance *C–D* and the distance *E–F*, and so on. (Hint: Remember to use the total time interval for each calculation. For example, for the first calculation, use the time interval from *A* to *D*.)