Motion

(01/11)

Physical Science 101

Name _____

Partner's Name _____

Part 1. What's your pace?

Purpose To estimate the number of meters, feet, and yards for each of your normal walking steps.

Equipment Meter stick and chalk

Procedure

Design a method to measure the average step length of each person in you group. Make sure you walk at a normal pace and walk over a distance of at least 10.0 meters to get a good average.

Person #	Step length (m)	Step length (ft)	Step length (yds)
1.			
2.			
3.			

3.28 ft=1.00 m **1.00 yd=3.00 ft**

Example to convert 8.0 meters into feet:

$$8.0\ \text{m} \times \frac{3.28\ \text{ft}}{1.0\ \text{m}} = 26.6\ \text{ft}$$

Using this pace size find:

the width of lab room _____

the total length of the corridor downstairs _____

Would your step length be (longer/shorter) if you walked faster than your normal pace? Explain.

Part 2 Average Walking Speed

Purpose

Measure your own walking speed and to study the relation between average speed, v, and distance travelled, d.

Average Speed = distance / time

or $v = \frac{d}{t}$ or $d = v \cdot t$

where t is the time required to travel the distance d.

Equipment

meter stick, stop watch, chalk

Procedure

Design a method to measure the average walking speed of each person in your group.

1. Pick a distance that each person will walk. This distance should be at least 10.0 m to give you a good average. Measure your distance to the nearest 0.01 m (1.0 cm). Include units with this measurement and with all other numerical values in this lab that should have units.

   distance, d = _____

2. In the table below record the time it took for each person to walk the distance .

3. Calculate each person's average walking speed using the formula above. Record the average speed in the table in units of meters/sec.

Person #	Time (sec)	Speed (m/s)
1.		
2.		
3.		

4. Find the average of all average walking speeds of your group.(show work below).

$$\text{Average Walking Speed} = \frac{(V_1 + V_2 + \dots)}{N} = \_\_\_\_\_$$

Where V_1 is the speed of person 1, V_2 is the speed of person 2, etc., and N is the number of people in your group.

5. Convert this average speed to miles per hour (i.e., multiply meters per second by 3600 to get meters per hour and then divide by 1609 to get miles per hour). The average should be around 3 – 4 miles per hour.

Average = _____

Questions

1. How far would you walk in 8 hours? (Give units with your answer.)

2. How long would it take you to walk 1.0 mile? 5 miles? 20 miles? 50 miles? (Give units with your answer.)

3. What is the average speed of a group if the members walk 30.0 m with an average time of 5.5 s?

4. A girl is to cover a 200 meter course. She walks the first 100 m at a speed of 4.00 m/s and the second 100 meters at a speed of 10.00 m/s. What is her average speed for the 200 meter course? (Hint: The answer is not 7.00 m/s)

Part 3 Average Acceleration

Purpose

To study change in velocity, $\Delta V = V_f - V_o$, and acceleration, **A**, where

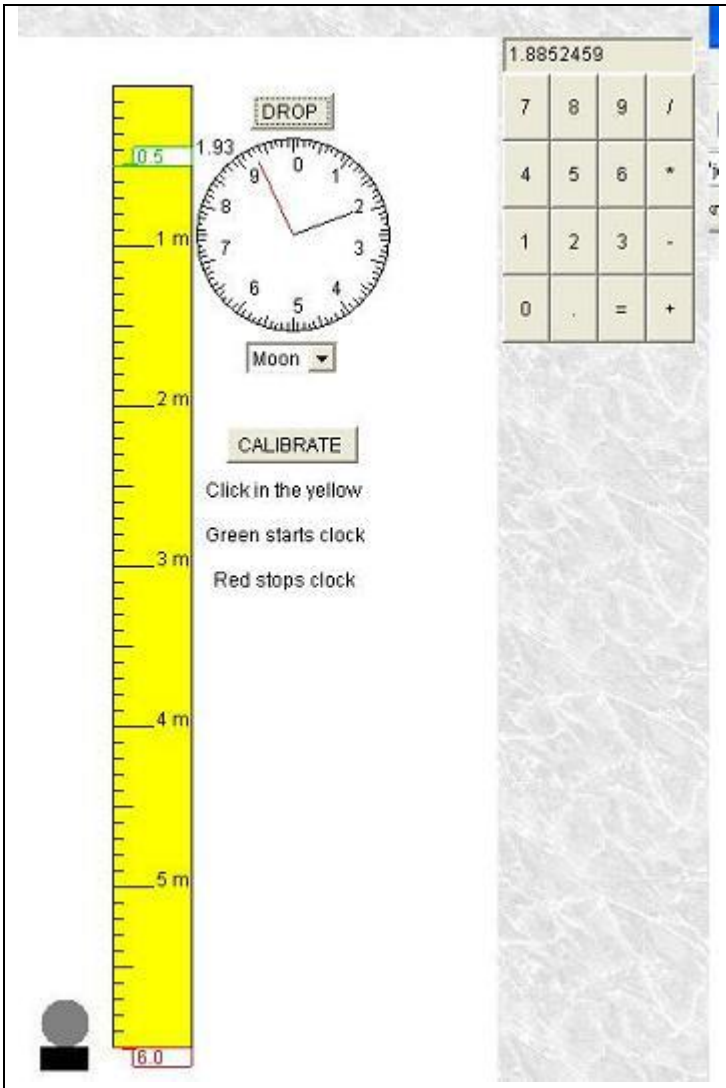
$A = \frac{\Delta V}{t}$ or $\Delta V = A \times t$ **t** is the time taken for the velocity to change from initial velocity, V_o , to final velocity, V_f .

Equipment

Virtual Lab at http://jersey.uoregon.edu/vlab/AverageVelocity/index.html

Procedure:

Use the website above to estimate the freefall acceleration **on the moon**.



Slide the green and red marks to where you want to start and stop the stopwatch.

The Ball starts from rest at the top so we can take the velocity at the instant it is released as zero.

V_o= 0.0 m/s

We'll have to use the time to estimate the velocity of the ball after it has fallen for some time. This is V_f.

Place the green mark at 5.50 m and the red mark at 6.00 m. Click drop to measure the time, t_f , required to fall over the last 0.50 m distance (d=0.50m). Calculate the velocity over this 0.50 m interval and use it as the final velocity for our acceleration calculation.

$V_f = {}^{d}/_{tf}$ = _____

This is a good estimate of its speed right as it passes 5.75 m.

Now place the green mark at 0.0 m and the red mark at 5.75 m. Click drop to measure the time, t , required speed up from V_o to V_f. Calculate the freefall acceleration using this data. Remember to include units.

$$A = \frac{\Delta V}{t} = \frac{V_f - V_o}{t} = \_\_\_\_\_$$

Questions {Remember : $A = \frac{\Delta V}{t}$ or $\Delta V = A \times t$ }

1. If the ball starts from rest (V_o=0.0) and continues to accelerate at this rate (rate your got for the moon) how fast would it be going in 60 sec?

2. How long will it take the ball (starting from rest) to break the sound barrier? That is, how many seconds will it take the cart to accelerate to a speed of 330 m/s?

3. What is the acceleration of a drag racer going from rest to a speed of 200 m/s in 6 seconds?