



Heartrace! (Understanding Speed & Velocity)

INTRODUCTION: When describing the motion of objects in terms of distance, time, and direction, physicists use the basic quantities of speed and velocity. Yet, they are NOT the same. Why?

The reason is simple. **Speed** is the time rate at which an object is moving along a path, while **velocity** is the rate and direction of an object's movement. Speed is a **scalar** value, while velocity is a **vector**. For example, 50 km/hr (31 mph) describes the speed at which a car is traveling along a road, while 50 km/hr *west* describes the velocity at which it is traveling.

The mathematical calculation for speed is relatively straightforward, wherein the average speed of an object is calculated by dividing the **distance** traveled by the **time** it took the object to travel the distance. Velocity, on the other hand, is **DISPLACEMENT** divided by time. Its **CHANGE** in **POSITION** (Where it ended – where it started) over time.



$$\text{Speed} = \frac{\text{Distance}}{\text{time}}$$

$$\text{Velocity} = \frac{\text{Displacement}}{\text{time}}$$

$$\text{Velocity} = \frac{\text{Final position} - \text{initial position}}{\text{time}}$$

PURPOSE: Differentiate between SPEED and VELOCITY by applying the concept and calculations to movement of the body

PROCEDURE:

- 1) Count the number BEATS in your pulse for 60 secs (put two fingers to the left or right of your throat) and Record in the table
- 2) Time how long it takes to Walk 10 meters (33 ft) and record it in the table (STAY WHERE YOU ARE!)
- 3) Repeat Step 1
- 4) Time how long it takes for you to RUN back to your starting point
- 5) Repeat Step 1
- 6) Repeat Steps 1-5 with a different person

TASK	PERSON #1	PERSON #2
# of Beats BEFORE walking 10 m		
Time to WALK 10 m		
# of Beats AFTER walking 10 m		
Time to RUN 10 m		
# of Beats AFTER running 10 m		

LET'S APPLY!

1) A RATE is the AMOUNT of SOMETHING measured against another variable. Example: # of text messages PER class period # of texts/class pd
What TWO variables does your HEARTRATE measure

2) Heartrate is USUALLY measured in BPM (Beats/min). Calculate ALL Heartrates in this lab below. LABEL them

3) Calculate all heartrates in Beats per SECOND! Label and Show all work!





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LET'S APPLY (cont)!

4) *SPEED is a rate!* What TWO variables does SPEED measure?

5) Calculate the speed it took to WALK 10m and RUN 10m for each person. Label and show your work!

6) *VELOCITY is also a rate! However, it is a RATE of CHANGE.* What TWO variables does velocity measure?

7) *A rate of change measures how much a variable CHANGES. Meaning, where it ENDED subtracted from where it STARTED. EXAMPLE: If Meagan runs 30 meters EAST. She STARTED at the 0 meter mark and ENDED at the 30 meter mark which was east of where she was. Her CHANGE in POSITION is 30 meters EAST.*

a. When you walked, what was YOUR displacement? (Pick a DIRECTION you THINK you were going, if you dont know)

b. Calculate your velocity

8) *Moving the opposite direction changes things up a bit...*

a. When you RAN back? Did you START in the same place you did when you walked?

b. When you ran, what your DISPLACEMENT (Think about the MARK where you STARTED this time...)

c. Calculate your velocity

9) Does a having a negative value for velocity mean an object is slowing down? Explain.

10) Is heartrate a TRUE measurement of speed? Explain why or why not.

EXTENSION: Using your knowledge of other science subjects. Construct an explanation to describe why heartrate would increase after exercise.