Acceleration Activity

**Purpose:** To perform a simple investigation showing acceleration.

**Materials**: Stop Watch

**Procedures**:

1. You will use the hallway, gymnasium or outdoors for this activity … whatever the teacher decides.
2. Assign a “timer” and a “recorder” for your group. You need two “runners” who will actually perform the activity. You can use different runners for the different distances.
3. Mark off a starting position and pace off three large steps (~1 m each) for the finish line. Have the “timer” stand at the finish line.
4. The timer will call out “ready, set, go” at a steady cadence. The first runner will race **the 3-meter distance** while the timer keeps time to the nearest TENTH of a second. Record the time in the chart below.
5. Have the second runner run the **3 meters**. Record the times in the chart below. Calculate the speed for both runners, showing your work below the chart.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Distance (m) | Time (s) | Speed (d/t) in m/s |
| Runner #1 |  |  |  |
| Runner #2 |  |  |  |

1. Repeat procedures # 3-5 using a distance of **10 meters** (ten large paces). Record all the times in the chart below. Calculate the speed for both runners, showing your work below the chart.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Distance (m) | Time (s) | Speed (d/t) in m/s |
| Runner #1 |  |  |  |
| Runner #2 |  |  |  |

1. Repeat procedures # 3-5 using a distance of **20 meters** (20 large paces). Record all the times in the chart below. Calculate the speed for both runners, showing your work below the chart.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Distance (m) | Time (s) | Speed (d/t) in m/s |
| Runner #1 |  |  |  |
| Runner #2 |  |  |  |

**Calculations and Data:**

1. Be sure to complete the charts above, showing your work directly below the charts. Make sure you put units to all your measurements.
2. Copy the calculated SPEEDS from the “Speed” column from the chart on page 1 onto the chart below. Also copy the TIME it took to run that particular distance (*copy the “Time” column from the charts on page 1*). **USE UNITS** for all your measurements.

|  |  |  |  |
| --- | --- | --- | --- |
| **Runner #1** | for 3 m | for 10 m | for 20 m |
| Speed (m/s) |  |  |  |
| Time (s) |  |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **Runner #2** | for 3 m | for 10 m | for 20 m |
| Speed (m/s) |  |  |  |
| Time (s) |  |  |  |

1. Make TWO straight line graphs below:
2. Use the speed and time for RUNNER #1 [*plot points using an “X”*] … instantaneous acceleration
3. Use the speed and time for RUNNER #2 [*plot points using a “.”*].
4. Draw a **straight line** for each runner, representing the 3 points you plotted … average acceleration

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Speed m/s

Time (s)

**Conclusions and Questions:**

1. Compare the speeds for runner #1 only. Were all the speeds close or were they different?
2. Compare the speeds for runner #2 only. Were all the speeds close or were they different?
3. Give at least two factors that could account for the speeds being different?

 a.

 b.

1. If the speed changed over time, what scientific term describes this?

ANSWERS

5. Have the second runner run the **3 meters**. Record the times in the chart below. Calculate the speed for both runners, showing your work below the chart.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Distance (m) | Time (s) | Speed (d/t) in m/s |
| Runner #1 |  |  |  |
| Runner #2 | 3 m | 1.5 s | 2.0 m/s |

 *v = d/t = 3 m / 1.5 s = 2.0 m/s*

6. Repeat procedures # 3-5 using a distance of **10 meters** (ten large paces). Record all the times in the chart below. Calculate the speed for both runners, showing your work below the chart.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Distance (m) | Time (s) | Speed (d/t) in m/s |
| Runner #1 |  |  |  |
| Runner #2 | 10 m | 3.3 s | 3.0 m/s |

 *v = d/t = 10 m / 3.3 s = 3.0 m/s*

7. Repeat procedures # 3-5 using a distance of **20 meters** (20 large paces). Record all the times in the chart below. Calculate the speed for both runners, showing your work below the chart.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Distance (m) | Time (s) | Speed (d/t) in m/s |
| Runner #1 |  |  |  |
| Runner #2 | 20 m | 4.0 s | 5.0 m/s |

 *v = d/t = 20 m / 4.0 s = 5.0 m/s*

**Calculations and Data:**

Copy the calculated SPEEDS from the “Speed” column from the chart on page 1 onto the chart below. Also copy the TIME it took to run that particular distance (*copy the “Time” column from the charts on page 1*). **USE UNITS** for all your measurements.

|  |  |  |  |
| --- | --- | --- | --- |
| **Runner #1** | for 3 m | for 10 m | for 20 m |
| Speed (m/s) | 2.0 m/s | 3.0 m/s | 5.0 m/s |
| Time (s) | 1.5 s | 3.3 s | 4.0 s |

1. Make TWO straight line graphs below:

a. Use the speed and time for RUNNER #1 … instantaneous acceleration

c. Draw a **straight line** for each runner, representing the 3 points you plotted … average acceleration

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5

4

Speed m/s

3

2

1

0

4

3

0

1

2

Time (s)

**Conclusions and Questions:**

1. Compare the speeds for runner #1 only. Were all the speeds close or were they different?

 *The speeds changed for each distance (acceleration)*

2. Compare the speeds for runner #2 only. Were all the speeds close or were they different?

 *The speeds changed for each distance (acceleration)*

3. Give at least two factors that could account for the speeds being different?

 a. *longer distance allows more acceleration to “full speed”*

 b. *runners run at different intensity for each distance (3 m, 10 m, 20 m)*

 c. *tripped, fell, didn't run “for real”*

4. If the speed changed over time, what scientific term describes this? *Acceleration*

*In a true sprint race (i.e. 100 m dash) the velocity time graph would look something like:*

*velocity versus time*

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Constant velocity

Speed m/s

Acceleration

0

0

Time (s)