# Kinematics

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**Activity 1: Graph and interpret motion data of a moving object**

**Activity 1. Table 1**

|  |  |
| --- | --- |
| Time (x axis) (seconds) | Position (y axis) (meters) |
| 0 | 0 |
| 5 | 20 |
| 10 | 40 |
| 15 | 50 |
| 20 | 55 |
| 30 | 60 |
| 35 | 70 |
| 40 | 70 |
| 45 | 70 |
| 50 | 55 |

Insert your graph here for Distance vs Time of a Moving Object.

meters

seconds

**Questions for Activity 1**

Question 1:  
What is the average speed of the train during the time interval from 0 s to 10 s?

**4m/s**

Question 2:

Using the equation: , calculate the average speed of the train as it moves from position x = 50m to x = 60m.

**.67m/s**

Question 3:

What does the slope of the line during each time interval represent?

**The Velocity of the train during the timeframe between each interval**

Question 4:  
From time t = 35 s until t = 45 s, the train is located at the same position. What is slope of the line while the train is stationary?

**0**

Question 5:  
Calculate the average speed of the train as it moves from position x = 70m to x = 55m. What does the sign of the average velocity during this time interval represent?

**-1m/s, negative acceleration or deceleration**

Question 6:

What is the displacement of the train from time t = 0s until t = 50s?

**55m**

Question 7:

What is the total distance traveled by the train from time t = 0s until t = 50s?

**80m**

Question 8. What is the slope of the line during the time interval t = 45 to t = 50?

**15.81m**

Question 9: What does the sign of the slope in question 8 represent in terms of the motion of the train?

**Displacement**

Question 10: What is the average velocity of the train during the interval t= 0s to t = 50s?

**80m/s**

Question 11: Does the train’s average velocity during the interval t= 0s to t = 50 s provide a complete picture of the train’s motion during this time?

**No, it doesn’t show how at some point in mid-travel the train was at rest for 10 sec.**

**Activity 2. Calculate the velocity of a moving object.**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  | | | | | | | |  |  |
|  | **Activity 2. Table 1**   |  |  | | --- | --- | | **Time (s)** | **Displacement (m)\*** | | **0** | **0.00** | | **.86** | **0.25** | | **1.99** | **0.50** | | **2.91** | **0.75** | | **3.96** | **1.00** | | **4.87** | **1.25** | | **5.78** | **1.50** | | **6.72** | **1.75** | | **7.72** | **2.00** | |  |  |  |
|  | **\*Note that 0.25 m = 25 cm**  Insert a graph of Table 1 here. Include a chart title, axes titles and units.  meters  seconds  **Activity 2. Table 2**   |  |  | | --- | --- | | **Time (s)** | **Velocity (m/s)** | | **1** | **0.26** | | **2** | **0.26** | | **3** | **0.26** | | **4** | **0.26** | | **5** | **0.26** | | **6** | **0.26** | | **7** | **0.26** | | **8** | **0.26** | |  |  |  |  |  |  |  |  |  |  |  |

Insert a graph of Table 2 here. Include a chart title, axes titles and units.

velocity

seconds

**Activity 3 Graphing the motion of an Object with Constant Acceleration**

**Activity 3. Data Table 1.**

|  |  |  |  |
| --- | --- | --- | --- |
| Time (s) | Average Time (s) | Average Time2(s2) | Distance (m) |
| Trial 1 = 0 | 0 | 0 | 0 |
| Trial 2 = 0 |
| Trial 3 = 0 |
| Trial 1 = 1.02 | 1.05 | 1.1 | 0.1 |
| Trial 2 = 1.09 |
| Trial 3 = 1.04 |
| Trial 1 = 1.21 | 1.22 | 1.5 | 0.2 |
| Trial 2 = 1.25 |
| Trial 3 = 1.22 |
| Trial 1 = 1.59 | 1.54 | 2.36 | 0.3 |
| Trial 2 = 1.48 |
| Trial 3 = 1.54 |
| Trial 1 = 1.76 | 1.78 | 3.16 | 0.4 |
| Trial 2 = 1.86 |
| Trial 3 = 1.71 |
| Trial 1 = 2.08 | 1.97 | 3.87 | 0.5 |
| Trial 2 = 1.87 |
| Trial 3 = 1.95 |
| Trial 1 = 2.05 | 2.2 | 4.83 | 0.6 |
| Trial 2 = 2.25 |
| Trial 3 = 2.29 |
| Trial 1 = 2.67 | 2.57 | 6.62 | 0.7 |
| Trial 2 = 2.49 |
| Trial 3 = 2.56 |
| Trial 1 = 2.81 | 2.75 | 7.58 | 0.8 |
| Trial 2 = 2.75 |
| Trial 3 = 2.70 |

**\*Note that 0.10 m = 10 cm**

Insert your graphs of Distance vs Time (m) and Distance vs Time Squared here:

meters

seconds

Seconds Squared

meters

**Questions for Activity 3**

Question 1: What is the shape of the graph when displacement is graphed vs. time?

**A continually growing line in a positive direction.**

Question 2: What is the shape of the graph when displacement is graphed against time squared?

**A continually growing line in a positive direction but will eventually curve upwards into a steeper slope.**

Question 3: What do the shapes of these graphs tell you about the relationship between distance and displacement for an object traveling at a constant acceleration?

**It shows that the more time that goes by the feather something went and at a continually faster speed.**

**Activity 4: Predict the time for a steel sphere to roll down an incline.**

|  |  |  |  |
| --- | --- | --- | --- |
|  |  | Steel Sphere | Acrylic Sphere |
| A | Length of Track (cm) (s)  (Step 1, use 80 cm) | 80 cm | 80 cm |
| B | Angle of Elevation (θ) in Degrees ⁰  (Step 1) | 6⁰ | 6⁰ |
| C | Calculated Time from s=0 to s=80  (formula from step 2) | 40s | 40s |
| D | Measured Time from s=0 to s=80  (step 3 with stopwatch) | 47.81s | 47.81s |
| E | % Difference (step 4) | 18% | 18% |

Question for Activity 4: What effect does the type of the sphere have on the time of the object to travel the measured distance, explain?

**If they are perfect spheres with the same smoothness, it will not have any difference. The force of gravity does not change and therefore pulls on both spheres at the same rate.**

**Activity 5: Demonstrate that a sphere rolling down the incline is moving under constant acceleration.**

Questions for Activity 5:

1. Describe your observations of the sounds made as the sphere crosses the equally spaced rubber bands (procedure step 4)? (If the sounds are too fast to discern, lower the angle of the ramp.)

**Due to the acceleration, the noise got closer and closer together as the ball got closer to the floor. The sound reminded me of a car that is speeding and getting closer and closer.**

1. Describe your observations of the sounds made as the sphere crosses the unequally spaced rubber bands (procedure step 9)? (Use the same angle as step4).

**Even though the rubber bands are unequally apart, it produces a similar output. The noise gets closer and closer together as the acceleration picks up and the bands get closer together.**

1. Explain the differences you observed if any between the sounds with equal spacing and sounds with unequal spacing.

**To human ears it doesn’t really put out much of a difference in noise. The acceleration due to gravity causes the speed of the sphere to increase. This increase is then present in the sound waves.**