

Lesson Plans for Winding UP

Prior Knowledge: Students are proficient with the concepts of displacement, time, and velocity

Objective:

SWBAT Choose which data to collect, graph the data, and determine how to analyze the graph to find the average velocity of a wind-up toy (student walk)

Engage & Explore:

1. Students predict the velocity of winding toys
 - a. “Will the toys have a constant velocity? Why or why not?”
 - b. Students predict the motion graph.
2. Students determine what data is needed to determine the motion
 - a. Displacement
 - b. Velocity
3. Students devise an experiment to determine the data to graph the motion.
4. Students collect data
 - a. Students organize and perform an experiment to determine displacement and time
5. Students interpret their data
 - a. Students plot their data & “connect the dots”
6. Students draw conclusions
 - a. Does the data set demonstrate constant velocity?
 - b. What is your evidence for making this conclusion?

Explain & Elaborate

1. Teacher facilitates a class discussion on graphing
 - a. “How should graphs look?”
 - i. Students are led in a Q&A discussion on the purpose of graphs
 - ii. Students will understand the purpose of graphing and their function is interpreting data.
 - b. “What does these data mean?”
 - i. Students will learn to draw conclusions from their lab data
 1. Respond to and interpret slopes
 2. Understand the meaning of slope in position and time plots
 3. Line of best fit and calculating velocity

Evaluate

1. Students analyze position versus time plots.
 - a. Is the object moving away, moving towards initial position, or at rest?
 - i. Students interpret slopes and direction of velocity
 - ii. Students are able to provide evidence for their responses.

2. Galileo's Incline Plane

Objective:

SWBAT to create an experiment to interpret motion of accelerating objects

Engage and Explore

1. Students devise an experimental procedure to determine the velocity of balls rolling down an incline
2. Students predict the velocity of rolling marbles
 - a. "Will the marbles have a constant velocity? Why or why not?"
 - b. "What will the motion on a graph look like?"
3. Students collect data
 - a. Students organize and perform an experiment to determine displacement and time
 - b. Displacement is measure on the incline of the ramp!
4. Students interpret their data
 - a. Students plot their data & "connect the dots"
5. Students draw conclusions
 - a. Does the data set demonstrate constant velocity?
 - b. What is your evidence for making this conclusion?
 - c. Why do you think this occurred?

Explain & Elaborate

1. Students make observations from their plots
 - a. What trend do you see in this graph?
 - b. Students ought to draw conclusion that elevation affects the velocity of objects
 - i. Students may or may not be able to attribute their findings to the acceleration of gravity

Evaluate

1. Students analyze position versus time plots.
 - a. Is the velocity increasing, decreasing, or constant?
 - i. Students interpret slopes and direction of velocity
 - ii. Students are able to provide evidence for their responses.

3. Galileo's Falling Objects

Objective:

SWBAT devise an experiment to analyze the acceleration of falling objects

Engage and Explore:

1. Students devise an experiment to collect data to determine the acceleration of a falling object
2. Students make predictions
 - a. "Which object will hit the ground first?"
 - b. "What evidence can you present to support this prediction?"
3. Students collect data
 - a. Students design and perform an experiment to determine Displacement and Time
4. Students interpret their data
 - a. Students use $X=1/2*at^2$ to calculate the acceleration of their objects
 - b. Students plot their data in a displacement versus time plot
5. Students draw conclusions
 - a. "Does the data set demonstrate constant velocity?"
 - b. "What is your evidence for making this conclusion?"
 - c. "What conclusion can you draw about falling objects?"

Explain & Elaborate

1. Students compare the two projects
 - a. Students look at data from their inclined plane and falling objects
 - b. Students draw conclusions on similarities and differences between the two experiments.

Evaluate

1. Students perform a problem set to identify graphs (x vs t) and (v vs t) and to identify the direction and type of motion (i.e. moving away from initial position, at rest, accelerating, decelerating etc.)

4. Culminating Activity – Mouse Trap Car

Engage

1. Students construct mouse trap cars using materials from T4T
 - a. Students are introduced to the materials & objectives that should be met for the build
 - b. Teacher may provide restrictions on outside materials that may be used (optional)
 - c. Safety considerations should be addressed.

Explore and Explain

1. Students devise an experiment to determine the velocity of their mouse trap cars
 - a. Teacher should oversee their procedures to determine if they are sufficient to collect data
2. Students make a prediction about the velocities of their cars
3. Students collect data

- a. Students carry out their procedure and collect displacement and time data to analyze their cars
 - b. Students perform the experiment 2 to 3 times to gather more accurate results
4. Students analyze their data
 - a. Plot their data
 - b. Calculate the velocity values
5. Students draw conclusions from their data

Elaborate & Evaluate

1. Students will prepare lab write up
 - a. Students will present all of their lab from the explore and explain above in a well structured lab write up

*During all activities teacher serves as a facilitator of student learning (i.e. student centered instruction). Most tasks should be completed by students after simple directions, or facilitated questions to enhance student learning.

Accommodations

All individual accommodations for students should be met with respect to your particular students and classroom dynamics and will vary from class to class and group to group. Facilitator should always differentiate instruction by providing the necessary blend of guidance and exploration for each student group and their specific needs.