Design Your Own

Comparing Motion from Different Forces

Lab Preview

Directions: *Answer these questions before you begin the Lab.*

1. Why do you think goggles are recommended for this lab?

2. Do you think it would take more force to move a baseball or a basketball? Why?

Think about a small ball. How many ways could you exert a force on the ball to make it move? You could throw it, kick it, roll it down a ramp, blow it with a large fan, etc. Do you think the distance and speed of the ball's motion will be the same for all of these forces? Do you think the acceleration of the ball would be the same for all of these types of forces?

Real-World Problem

How will the motion of a small toy car vary when different forces are applied to it?

Form a Hypothesis

Based on your reading and observations, state a hypothesis about how a force can be applied that will cause a toy car to go fastest.

Possible Materials

small toy car
ramps or boards of different lengths
springs or rubber bands
string
stopwatch
meterstick or tape measure
graph paper

Goals

- **Identify** several forces that you can use to propel a small toy car across the floor.
- **Demonstrate** the motion of the toy car using each of the forces.
- **Graph** the position versus time for each force.
- **Compare** the motion of the toy car resulting from each force.

Safety Precautions

Test Your Hypothesis

Make a Plan

1. As a group, agree upon the hypothesis and decide how you will test it. Identify what results will confirm the hypothesis that you have written.
2. **List** the steps you will need to test your hypothesis. Be sure to include a control run. Be specific. Describe exactly what you will do in each step. List your materials.
3. **Prepare** a data table on a separate sheet of paper to record your observations.
4. **Read** the entire experiment to make sure all steps are in logical order and will lead to a useful conclusion.
5. **Identify** all constants, variables, and controls of the experiment. Keep in mind that you will need to have measurements at multiple points. These points are needed to graph your results. You should make sure to have several data points taken after you stop applying the force and before the car starts to slow down. It might be useful to have several students taking measurements, making each responsible for one or two points.

LAB (continued)

Follow Your Plan

1. Make sure your teacher approves your plan before you start.
2. Carry out the experiment as planned.
3. While doing the experiment, record your observations and complete the data tables you created.

Analyze Your Data

1. **Graph** the position of the car versus time for each of the forces you applied. How can you use the graphs to compare the speeds of the toy car?

2. **Calculate** the speed of the toy car over the same time interval for each of the forces that you applied. How do the speeds compare?

Conclude and Apply

1. **Evaluate** Did the speed of the toy car vary depending upon the force applied to it?

2. **Determine** For any particular force, did the speed of the toy car change over time? If so, how did the speed change? Describe how you can use your graphs to answer these questions.

3. **Draw Conclusions** Did your results support your hypothesis? Why or why not?

Communicating Your Data

Compare your data to those of other students. **Discuss** how the forces you applied might be different from those others applied and how that affected your results.