Name Date Class

LAB

Design Your Own

Motion from Different Forces

LAB A

Background

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, and so on.

Question

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?

Possible Materials

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

Objectives

- **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

Form a Hypothesis

Based on your reading and observations, state a hypothesis about how the size of the force applied will affect the acceleration, speed, and distance of a toy car.

Make a Plan

❑ **1.** Read the procedure and safety information, and complete the lab form.

❑ **2.** As a group, agree upon a hypothesis and decide how you will test it. Identify which results will confirm the hypothesis that you have written.

❑ **3.** Identify the steps that 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. Include your materials.

❑ **4.** Prepare a data table to record your observations.

❑ **5.** Read the entire experiment to make sure all steps are in logical order and will lead to a useful conclusion.

❑ **6.** Identify all constants, variables, and controls of the experiment. Make sure your plan tests only one variable at a time. Keep in mind that you will need to have measurements at multiple points. These points are needed to graph your results. You should 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.

Data and Observations

Table 1

Follow Your Plan

❑ **1.** Make sure your teacher approves your plan before you begin.

❑ **2.** Carry out the experiment as planned.

❑ **3.** While doing the experiment, record your observations in your data table.

LAB (continued)

LAB A

Analyze Your Data

1. **Graph** the position of the car versus time for each type of the force that you applied.
2. **Analyze** How can you use the graphs to compare the speeds of the toy car?

3. **Calculate** the average speed of the toy car over the same time interval for each type of force that you applied.

4. **Analyze** How do the calculated average speeds compare?

5. **Identify** some ways that you might improve your experiment.

Conclude and Apply

1. **Evaluate** Did the average 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?

4. **Design** Whether or not a hypothesis is supported, experimental results often lead to new hypotheses and experiments. Based on what you have learned from this lab, state a new problem, your hypothesis, and describe how you would test it.

Communicate Your Data

Compare your data with those of other students. Discuss how the forces that you applied might be different from those others applied. How were your results affected?