Carts and Tracks Labs Name, Date, Period:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Reminders – Safety and Product Upkeep

Safety:

1. Do not allow any of the products to drop or fall; always handle all of the products CAREFULLY.
2. Do not be careless in your actions at your group. Do not handle anything carelessly. Take your turn and give others a chance.
3. No horseplay; please move through the room and at your lab station carefully.

Product Upkeep:

1. You can periodically check the leveling of your track. Ask for the level tool.
2. Don’t dent or scratch the equipment.
3. NEVER push the carts. Let them move by the spring action only.

Lab 1: Effects of mass on motion

Follow all procedures correctly and fill in all of the spaces with your answers. (The cart weighs 500 grams itself. One bar mass weighs 500 grams.)

No Masses

1. Test with the plunger ½ way 3x and record the distance the car goes each of the 3x. Find the average distance.

 NO MASS with plunger ½. Distance is in cm.

Distance 1 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Distance 2 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Distance 3 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Average Distance \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

2. Test with the plunger all the way depressed and follow the same steps as above.

NO MASS with plunger fully depressed. Distance is in cm.

Distance 1 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Distance 2 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Distance 3 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Average Distance \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

One Mass

1. Now that it is carrying one of the weights, predict how far it will go with the plunger ½ depressed. Base this on what you’ve learned so far. Prediction in cm: \_\_\_\_\_\_\_\_\_\_\_\_\_\_

2. With one mass, test with the plunger ½ way 3x and record the distance the car goes each of the 3x. Find the average distance.

 ONE MASS with plunger ½. Distance is in cm.

Distance 1 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Distance 2 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Distance 3 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Average Distance \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

3. How well did you predict? Circle one: AWESOME GOOD OKAY

4. Test the one-mass load with the plunger all the way and follow the same steps as above. Don’t forget to make a prediction: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

ONE MASS with plunger fully depressed. Distance is in cm.

Distance 1 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Distance 2 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Distance 3 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Average Distance \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

4. How well did you predict? Circle one: AWESOME GOOD OKAY

5. Now it is time to repeat using Two Masses.

 a. First predict (in centimeters): 1/2\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ full\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

TWO MASSES with plunger fully depressed. Distance is in cm.

Distance 1 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Distance 2 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Distance 3 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Average Distance \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 TWO MASSES with plunger ½. Distance is in cm.

Distance 1 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Distance 2 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Distance 3 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Average Distance \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

b. How well did you predict? AWESOME GOOD OKAY

Lab 2: Collisions – Join two lab groups together.

One Car in Motion/One Car Sitting Still

1. Position one car in the center of the track, making sure it is at rest. With the plunger ½ depressed, release the other car in order to enact a collision with the car in the center. Observe what happens and record the following:

Sketch what it looked like before:

Sketch what it looked like after all movement stopped:

How many collisions had occurred?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Describe the collision event:

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

2. Repeat the scenario above with the plunger fully depressed.

Sketch what it looked like before:

Sketch what it looked like after all movement stopped:

How many collisions had occurred?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Describe the collision event:

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Both Cars in Motion

Remember: NEVER PUSH THE CARS. ONLY THE SPRING ACTION OF THE PLUNGERS MAY BE USED TO SET THE CARS INTO MOTION.

1. Position both cars at the ends of the track. With the plunger on both cars ½ depressed, release them both at the same time. Observe what happens and DISCUSS WITH AT LEAST ONE CLASSMATE WHAT YOU OBSERVED.

Name(s) of classmates with whom you discussed the collision: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

2. Repeat the scenario above with the plunger on both cars fully depressed. Observe what happens and DISCUSS WITH AT LEAST ONE **DIFFERENT** CLASSMATE WHAT YOU OBSERVED.

Name(s) of a different classmate(s) with whom you discussed the collision: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Design an Experiment

Now you can design an experiment to try. Each student must sketch out their own experimental concept in the space below. You must also have a hypothesis of what will happen.

List the specifications you want for Car 1:

Plunger\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Where it starts on the track\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Any weights? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

List the specifications you want for Car 2:

Plunger\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Where it starts on the track\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Any weights? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Sketch what they look like before starting:

Sketch what you think the scene will look like after both cars have come to rest:

How many total collisions will there be? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Why do you think so?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Attempt to write out a hypothesis in the space below of what will happen due to your design.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

AFTER SHARING IDEAS, TEST 3 OF THE IDEAS AND TALK WITH EACH OTHER ABOUT WHAT MADE EACH OF THE EXPERIMENTS A SUCCESS.

Name, Date, Period:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Carts and Tracks Labs II – Overcoming Frictional Force

Safety:

1. Do not allow any of the products to drop or fall; always handle all of the products CAREFULLY.
2. Do not be careless in your actions at your group. Do not handle anything carelessly. Take your turn and give others a chance.
3. No horseplay; please move through the room and at your lab station carefully.

**PURPOSE: You will perform tests to determine how friction affects the movement of the cart on the overturned track.**

1. Define friction from your memory:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

2. Practice with the spring scales so that you understand how to record the force that is needed to OVERCOME FRICTION. We are NOT trying to find out the force to continue to move the object. We ARE trying to find out what force it takes to INITIALLY MOVE the cart.

 I got it \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ I’m still fuzzy on this & need help\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

3. You will complete a typical **3-trial/average the 3** experimental design with which you have become very familiar.

Experiment 1 – What force does it take to overcome friction to move the cart with no mass? WITH YOUR LAB GROUP, prepare a way to record all of the necessary data from a **3-trial/average the 3** experimental design below.

Experiment 2 – What force does it take to overcome friction to move the cart with one mass? **INCLUDE A PREDICTION.**

Experiment 3 – What force does it take to overcome friction to move the cart with two masses? Include a prediction.

4. Now, design a unique experiment that includes *one* of the following options:

Option 1: How can you design a situation that will INCREASE the frictional force to a quantity greater than what you discovered from Experiment 3?

Option 2: How can you design a situation that will DECREASE the frictional force to a quantity less than what you discovered from Experiment 1?

Circle the option you have chosen. Sketch the experimental design below. If granted permission, try out your experiment in front of the class.