

# Speed

Name: \_\_\_\_\_

Date: \_\_\_\_\_

Today we're going to learn a few things about speed, and what happens when you're moving fast.

We'll be measuring speed with radar guns, using the "Hot Wheels speed" setting. The "Hot Wheels speed" (HW speed) is 64 times the real speed in miles per hour, since hot wheels cars are about 1/64 the length of real cars.

About what number do you get for the "HW speed" of someone walking?

\_\_\_\_\_

## Speed of the Carts vs. Height of the ramp

1. When it's your groups turn to measure the maximum speed of the cart, record your data in the chart below. Also, make sure that someone in your group adds this data to the big graph.

| Height of Ramp: | 1 Box | 2 Boxes | 3 Boxes | 4 Boxes |
|-----------------|-------|---------|---------|---------|
| HW Speed        |       |         |         |         |

1. In which case did the cart travel the fastest?

2. How does the maximum speed of a cart depend on the height of the ramp?

## Crash Test Smarties

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Use the following scale to judge how badly each of the Play-Doh people from your group were damaged. Then enter that number into the chart below.

0 - There is no damage to the person.

1 - There is slight damage to the person, but he or she could probably walk away from the crash.

2 - There is significant damage to the person. He or she would probably go to the hospital.

3 - The person was thrown from the car or hurt so badly that he or she might not live.

|                                   | 1 Block | 2 Blocks | 3 Blocks | 4 Blocks |
|-----------------------------------|---------|----------|----------|----------|
| <b>No seatbelt</b>                |         |          |          |          |
| <b>Seatbelt at waist only</b>     |         |          |          |          |
| <b>Seatbelt and shoulder belt</b> |         |          |          |          |

What does this tell you about seatbelts?

Do you think it is better to be in a 1-box ramp crash with no seatbelt, or a 4-box ramp crash with a shoulder harness and waist strap? Why do you think so?

# Rocket Cars

Name: \_\_\_\_\_ Date: \_\_\_\_\_

Write down your prediction for the combination that will lead to the fastest cars.

Soda type:

Candy type:

Number of candies:

Nozzle size:

Fuel load:

## **EXPERIMENT 1: Soda Type**

Rank the sodas in order from highest to lowest stream.

Which soda produced the highest stream?

## **EXPERIMENT 2: Candy Type**

Rank the candies in order from highest to lowest stream:

Which candy produced the highest stream?

Did you notice a difference between the types of Mentos? If yes, what was the difference?

### EXPERIMENT 3: Optimal Number

Rank the number of Mentos in order from highest to lowest stream:

Which number of Mentos produced the highest stream?

### EXPERIMENT 4: Nozzle Size

Rank the nozzle sizes in order from highest to lowest stream:

What size holes produced the highest stream?

### EXPERIMENT 5: Fuel Load Test

| Bottle Size | Distance Traveled |
|-------------|-------------------|
| 0.5 L       |                   |
| 1.0 L       |                   |
| 2.0 L       |                   |

Based on these experiments, which soda, candy, number of candies, nozzle size, and bottle size would make the best car?

Soda type:

Candy type:

Number of candies:

**When completed, please send to:  
SOCK Data ▪ Society of Physics Students ▪ One Physics Ellipse ▪ College Park, MD**

Nozzle size:

Fuel load:

# Super Slingshots!

Name: \_\_\_\_\_ Date: \_\_\_\_\_

In this activity we're going to be using Spandex slingshots and Hot Wheels radar guns to learn about launching things into orbit!

Fill out the first three columns with the data you collect, and then calculate the average speed of the trials and fill in the rest of the chart.

| <b>Pull Back Distance</b><br>(cm) | <b>Launch Speed Trial 1</b><br>(Hot Wheels Units) | <b>Launch Speed Trial 2</b><br>(Hot Wheels Units) | <b>Launch Speed Trial 3</b><br>(Hot Wheels Units) | <b>Average</b><br>(Hot Wheels Units) | <b>Average</b><br>(mph)<br>(average in Hot Wheels Units divided by 64) |
|-----------------------------------|---|---|---|--------------------------------------|--|
| 6                                 |   |   |   |                                      |  |
| 8                                 |   |   |   |                                      |  |
| 10                                |   |   |   |                                      |  |
| 12                                |   |   |   |                                      |  |
| 14                                |   |   |   |                                      |  |
| 16                                |   |   |   |                                      |  |
| 18                                |   |   |   |                                      |  |

1. Look at the data in the *lightly shaded blocks*; note that the pullback distance is doubled, from *6cm* to *12cm*.

Re-write the average mph speed for *6-cm* pullback here. \_\_\_\_\_

Now, re-write the mph speed for the *12-cm* pullback here. \_\_\_\_\_

About how many times faster is the *12-cm* pullback speed than the *6-cm* pullback speed?

A) about twice as big B) more than twice as big, or C) less than twice as big

2. Now do the same thing for the *darkly shaded blocks*:

Re-write the average mph speed for *8-cm* pullback here. \_\_\_\_\_

Now, re-write the mph speed for the *16-cm* pul-back here. \_\_\_\_\_

About how many times faster is the *16-cm* pullback speed than the *8-cm* pullback speed?

A) about twice as big B) more than twice as big, or C) less than twice as big

3. When you double the pullback distance, by about how much is the launch speed multiplied? \_\_\_\_\_.

**How far would we have to pull back the spandex to get an object into orbit?**

1. Estimate the average speed (in mph) of the disc for the pullback distances below. *Note that each pullback distance is two times the previous one*; use this fact to estimate the speeds.

| <b>Pullback Distance<br/>(cm)</b> | <b>Estimated Average<br/>(mph)</b> |
|-----------------------------------|------------------------------------|
| 10                                |                                    |
| 20                                |                                    |
| 40                                |                                    |
| 80                                |                                    |
| 160                               |                                    |
| 320                               |                                    |
| 640                               |                                    |
| 1280                              |                                    |
| 2560                              |                                    |

2. How many cm would you have to pull back the super slingshot to get the disc into orbit? Remember that you'd need a speed of 18,000 mph. \_\_\_\_\_

3. How many feet is this? Multiply by .033 to convert cm to feet) \_\_\_\_\_