

# Patterns of Motion

(This lab contains the why we are doing what we are doing!!)

*Welcome to the world of Kinematics where motion rules!! From the flight of a rocket, plane, or bird to the path of a football or baseball, to the orbits of planets, to the falling of an acorn, all these motions and more exhibit a predictable pattern!! Kinematics does not care about the how or the why, only the what; what motion do you see? This is part 1 of a two-part lab.*

## Skills

- Observe with detail.
- Describe an observation using the Language of Physics
- Record motion using a Motion Detector and a Spark Timer.
- Relate your motion to the output of the Motion Detector (Graph) and Spark Timer (Ticker Tape).
- Recognize type of motion based on Motion Detector (Graph) and Spark Timer (Ticker Tape) data.

## Vocabulary

Vector  
Scalar

Position  
Position vs Time graph

Velocity  
Velocity vs Time graph

Distance  
Displacement  
Acceleration

## Activity 1: Graffiti Walk ~ Observe and Tell (30 minutes)

*Our amazing brain will integrate new information into our pre-existing understandings. This we call learning. Often, however, with someone new to physics that prior knowledge is incomplete or flawed which results in the inability to properly retain and use that new information. To overcome this stumbling block, we will bring that prior knowledge to the forefront where we can examine it and compare it to what we need to know and learn.*

*We will use our observations of moving toys to force us to think and see how we currently view the world. Once we see where we are, we will then be ready to move forward. Let the Observing begin!!*

You will be divided into groups of two or three. You will then travel to each of 3 stations, each with a moving toy: a car, a truck, and a train. (You will also have the opportunity next class to 'play' with these again!!)

### At each station you will,

Observe: Play with the vehicle and see what it does and what it can do.

- As a group (of 2 or 3), discuss your observations.

Tell: Each person will write one observation using only 1 or 2 words on the sticky note paper provided.

- Each person will add one sticky note with their observation to the giant poster paper for that vehicle.
- Try to make your observation unique, different than the other observations in some way. You can also expand upon another observation with your own observation. This will get more difficult as groups rotate through the stations!! Enjoy the challenge!!

Examine: We will come together as a class to examine and discuss the content and quality of our observations. (Examining our current understandings).

Compare: We will compare to Sue's Observations (Comparing to what we need to know)

Learn: Define and begin to use the proper terminology (Integrate / replace the new to the old!!)

### **Activity 2: Dry Erase Response ~ Red Buggy Investigation (15 minutes)**

*As a physicist, I need to figure out what data I need to gather. In this case, what data can we gather that might be useful in describing the motion of this buggy in a more complete and precise way? Let's see what ideas we currently have about what that data might be. This activity will be done by the whole class at once. It is meant to be fairly quick activity.*

Demonstrate: I will demonstrate the Red Buggy in front of the class.

Question: I will ask the class: *What information should we gather, that would help us provide a more complete description of the motion of our Red Buggy?*

Write: You write 1 or 2 words on your dry-erase board that tell me what data you think would be helpful.

Discuss: We will discuss briefly as a class.

### **Activity 3: Tool Meet and Greet (40 minutes)**

*What are some of the measurement tools that will allow us to gather the data we decided upon in Activity 2? A physicist needs to be knowledgeable about the tools at his or her disposal. And how does a physicist do that? We play....the physics way!! Let's 'play' with some of these tools as a physicist would to learn more about them and become more confident in our ability to use them properly.*

Meet the Tools: You will be introduced to the tools we will be using for our explorations of motion. (There are other more basic tools we could use. But these will be most helpful in understanding the concepts being taught, as well as the material being presented by Science Mom.)

- Spark Timer
- Motion Detector

Play like a Physicist: Working in groups, investigate and familiarize yourself with the equipment. For each tool, ask yourself the following,

- How does it work?
- How do I gather data?
- What information does this measuring device tell me?
- What must I do such that I collect useful / clear / clean data?
- How does my motion relate to the data collected?
- What are the pros, cons, and limitations as far as I can tell?
- Whatever question you can come up with!!

See me: I will be walking around reviewing your progress and answering any questions. When you think you have learned enough, see me so I can see what you've done and hand you the ***Patterns of Motion Challenge Worksheet.***

## Activity 4: Patterns of Motion Challenge!!

*Let's test our new knowledge!! How well did you investigate the tools? Challenge yourself!!*

When I hand you the **Patterns of Motion Challenge Worksheet**, **Read all the instructions before proceeding!!**

The Motion Challenge Worksheet will challenge your knowledge of the tools and the data they provide. It will contain graphs and ticker tapes that I have created to help you discover how well you learned this new material!!

Predict: Before doing anything, you will predict what motion you must do to match the graph or spark tape. Write down using the proper amount of detail and vocabulary. Show me before moving on.

Do: After you complete the predictions, see me. When I give the ok, perform your motion using the appropriate tool (Motion Detector or Spark Timer or both).

Compare: Compare your results to the data handed to you. Is it a match? If yes, Yay!! If not, keep going...

Re-try: If your results were not a match to the data you were handed, figure out what motion you need to do and re-test. Continue this process until you get it correct.

Present: If there is time, each group will present their challenge to the rest of the group and any parents in the room.