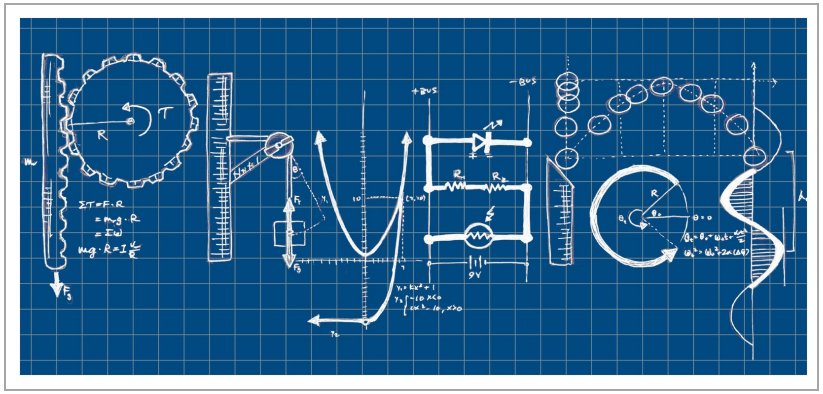
Teacher Information

The Rock Snow Park
7900B Crystal Ridge Drive
Franklin, WI 53132



A Science of Tubing Physics Adventure

THE ROCK SNOW PARK

Experience our Physics Adventure at The Rock Snow Park by enrolling in our Science of Tubing Field Trip!

What educational advantage is there for a student to participate in a hands-on physics experiment? Our Science of Tubing Experience is the ideal setting for students, allowing them an opportunity to witness the laws of physics in operation. Tubing down our hill is exhilarating, but it also allows students to feel the physics first hand and study what is happening.

This three-hour field trip includes tube rentals, lift rides, equipment needed for experiments, and all LOADS of fun for teachers and students alike!

Reservations are required. Minimum number of participants exists.
Weather Sensitive.

Available weekdays from 10:00 AM to 4:00 PM only.

What you Need to Know

Pre-Trip Preparation

1. Have each child's parent or guardian complete one of our waivers (you can find these online)

2.Instruct students to dress in layers. Leggings or jogging pants work best under snow pants and jackets. Warm socks are your most important piece of clothing as well as snow boots.

3.Assign students to lab groups of four or six which gives each group enough help to get the job done.

4.Remind students to follow all safety instructions. Review our seven rules before arriving at The Rock Snow Park

5.No restricted safety zones are to be entered to obtain data.

Organizational Suggestions:

1.A day or so prior to the trip to The Rock, spend time with your class and go through the student section of this packet so that your students have a sense of how to use the pages most efficiently.

2.Assign Zone Teachers for each zone

3.If you do not wish to have your students complete the entire set of exercises, pick and choose which sections you would like your students to fill out before you leave for The Rock.

4.Depending on the weather, it may be better to have your students collect their calculations at the hill, but have the students complete their calculations later in the classroom or at home.

Learning Goals:

We hope that your students will:

Goals 1:

Upon Completion of our Science of Tubing Physics Adventure, we hope that your students are able to better understand the physical sciences.

1. Be motivated to study physics by being challenged by a fun exercise that allows them to learn by physical experience.
2. Gain appreciation of the physics involved in something as fun and seemingly effortless as snow tubing.

Goal 2:

Our second goal for your students, is that they will be able to apply practical learning in a fun and hands-on experiment by showing them what they learn in a classroom in a physical and applicable way.

We want your students to:

1. Gain an appreciate of physics studied in the classroom by seeing them applied while having fun.
2. Be encouraged to work as a member of a team while working together to collect the data and work through the problems to find the answers to the following equations.

Cognitive Goals:

After completing the experiments, your students will have an enhanced understanding of the following concepts of physics on the macroscopic scale:

WORK * POWER * FORCE * KINEMATICS * FRICTION * ACCELERATION * PRINCLIPLE OF GRAPHING * RIGHT TRIANGLE TRIG

CONSERVATION OF ENERGY ~ POTENTIAL ENERGY ~ KINETIC ENERGY

SPEED ~ AVERAGE ~ INSTANTANEOUS

The Student Will:

1. Calculate the power required to haul a tuber up the hill.
2. Apply the principles of conservation of energy to determine the speed and acceleration of an object while traveling down the hill.
3. Calculate the work needed to pull a tuber up the hill.
4. Calculate the work done by friction.
5. Use right triangle trig to calculate the height of the hill
6. Apply Newton's Laws of motion to explain the effect of forces on passengers.
7. Calculate the coefficient of friction.
8. Calculate the effect of friction bringing the tube to rest at the bottom of the hill.
9. Calculate the potential and kinetic energy

Notes of Interest for Science of Tubing Lab Zones:

ZONE 1: MASS

Use the electric scale at The Lodge to weigh yourself. Weigh yourself carrying the tube. Record this or use with other zone data.

ZONE 2: FRICTION

Use the spring scale and pull a loaded tube for 10 meters on a flat surface. Record the force used to pull the tube. Correlate with data from the mass zone. You need to know mass of the object pulled.

ZONE 3: AVERAGE SPEED

Use lanes one and two. Use three stopwatches for each tuber. Record average times. Use the flag to start the tuber and the stopwatches. Time the tuber for the entire length of the slope (excluding the run-out). Note the slope length is 500 feet. (convert to meters)

ZONE 4: ACCELERATION AND INSTANT SPEED

Use a minimum of 10 (max 18) timers, each standing on one of the red marks on the slope. (These markers are 10 meters apart). When the flag drops, the tuber starts and ALL stop watches start. Each timer should stop their watch when the tuber passes them. They should record their time and their position. This can be used to calculate the interval time between points and rate of acceleration.

ZONE 5: DECELERATION AND FINAL VELOCITY

You will need two stopwatches doing two separate functions. First watch times how long it takes to travel the last 10 meters of the run (before the run out). These are red marks on lane eight. Start the watch as the tuber passes the first red mark…stop the watch as it passes the second red mark. Second watch times the total deceleration times. Start the watch when the tuber comes to a complete stop at the end. Calculate the speed (final velocity) using the time for the pat 10 meters. This is really the start speed for the deceleration calculation. The ending speed is zero.

ZONE 6: WORK AND POTENTIAL ENERGY, POWER

Using a spring scale pull a tuber (with mass known from Zone 1) up a slope similar to the lift line. Record the force needed to pull the tuber for 10 meters. Calculate the work done to pull a tuber the 500-foot slope. How many tubers are on the lift at one time?

Time how long it takes for the lift to pull one tuber to the top. Calculate the power needed.

WORKBOOKS:

Record all data in your workbooks or shared worksheets and do all calculations when you return to the classroom.

Note: These equations may be better solved in the classroom, after collecting the information at The Rock.

Calculations:

These Lab experiments are able to be completed qualitatively as well as quantitively, depending on the skill level of your class.

I. Converting MPH to m/s

$$20 \text{ miles/hour} \times \frac{1\text{hr}}{3600 \text{ sec}} \times \frac{1609\text{m}}{}$$

$$\text{your weight in lbs} \times \frac{1\text{kg}}{2.202 \text{ lbs}} \times \frac{9.8 \text{ newton's}}{1\text{kg}}$$

II. A. Weight in pounds to mass in kilograms

$$\text{Total weight in pounds} \times \frac{1\text{kg}}{2.202 \text{ lbs}}$$

B. Height of the Hill

$$\text{Height} = \text{length} \times \sin\theta$$

C. Coefficient of Friction:

$$u = \frac{\text{Force of Friction}}{\text{total weight}}$$

$$\text{total weight (pounds)} \times 1\text{kg} \times 9.8 \text{ (newtons)}$$

$$V(\text{ave}) = \frac{\text{change in distance}}{\text{change in time}}$$

E. Instantaneous Speed

$$V(\text{inst}) = \frac{\text{change in distance}}{\text{change in time}} \text{ (small time interval)}$$

F. Potential Energy

$$PE = mgh \quad \left(g = 9.8 \frac{\text{newtons}}{\text{Kg}}\right)$$

G. How far will a tube slide before coming to rest at hills bottom?

$a = ug$ (u is coefficient of friction)
(g is 9.8 m/s^2)

H. Work

$$W = mgh$$

I. $P = \frac{mgh}{T}$ (power will be in watts)

Conversion – 1Hp – 746 watts

Equipment Needed to Participate:

Stopwatch – Provided by The Rock

300-foot measuring tape – Provided by The Rock

Brightly colored flag – Provided by The Rock

Spring Scale (20-pound max) – Provided by The Rock

Clipboard – Provided by The Rock

Dye (marking distance) – Provided by The Rock

Tube – Provided by The Rock

Sheet of Material (coefficient of friction) – Provided by The Rock

Angle Finder – Provided by The Rock

Weighing Scale – Provided by The Rock

Lunch – Provided by The Rock at additional cost

Staff at each zone – Provided by school. The Rock does not provide a teaching staff at any zone.

One Gallon or Large Zip Lock Bag – Provided by Teachers. Not Provided by The Rock.