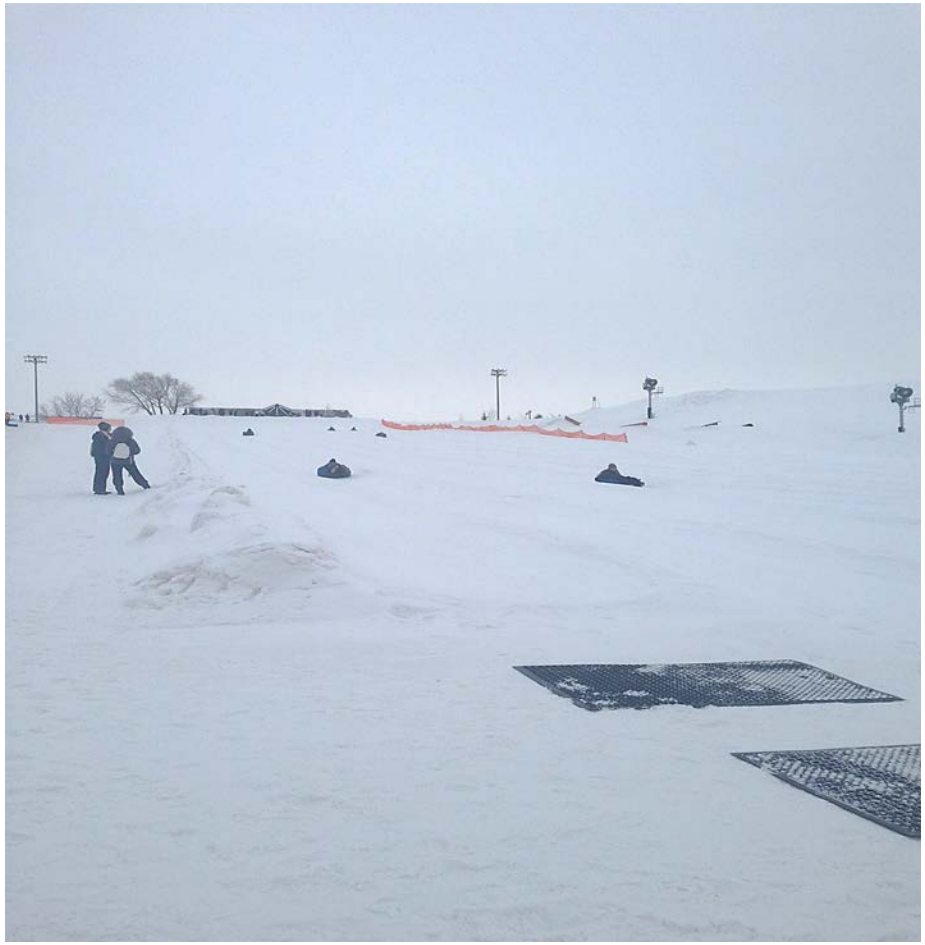
MASS-ters Of Tubing



Discovering the Physics Behind Tubing.

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Happy Tubing! 🙂

Table of Contents

Glossary

Acceleration: a change in the velocity of an object

Force: something that causes a change in the motion of an object

Height: the vertical distance from the bottom or lowest part of something to the top

Joules: the standard unit of work or energy in the International System of Units

Kinetic Energy: the energy possessed by an object as a result of its motion dependent on velocity and mass

Mass: the measure of the amount of matter present in an object

Power: the amount of energy put in or produces in a given amount of time, measured in watts or kilowatts

Potential Energy: the energy possessed by an object in correlation to its location

Speed: the ratio of the distance traveled by an obje

Work: the transfer of energy from once object to another

Watt: the standard unit of power in the International System of Units, equal to one joule per second

Extra Work Space...

Learning Targets

LT1: I can relate tubing to physics

LT2: I can calculate mass

LT3: I can converts units of measuring

LT4: I can calculate acceleration

LT5: I can calculate the work force of an object

LT6: I can calculate the power of an object

LT7: I can find the potential energy of a person tubing.

Exploring

Introducing Physics

When you go tubing there are surprisingly so many things involved in the process that relate directly to physics!

In what ways does physics apply to tubing? List at least 3.

What techniques would you use to make it down the hill the fastest?

Reflecting...

In what other ways can physics relate to tubing?

What is another recreational activity that this information in physics could relate to?

Full of Potential

Potential energy is an object that has the ability to move because of its position relative to another location. The potential energy can be found by multiplying the mass of an object by the gravitational (on earth it is 9.8m/s) by the height of the hill as shown below:

PE(in Joules)**=mass**(rider plus tube) **x free fall** (9.8m/s^2) **x height**(of hill)

Rider1:_____kg x (9.8m/s^2) x _____m

=_____J

Rider2: :_____kg x (9.8m/s^2) x _____m

=_____J

Rider 3: :_____kg x (9.8m/s^2) x _____m

=_____J

What is Mass?

Mass is the amount of matter present in an object. It is measured in units such as kilograms or pounds. The gravitational pull of an object depends on its mass; the greater the mass the greater the gravitational pull. With that being said, the heavier the person on the tube, the faster they will travel down the hill which also causes more friction. Calculating the mass of the tuber and tube will help one calculate how fast they will travel down the hill. Finding the mass is the first step, but a few conversions will be necessary.

Find mass:

1lb = 0.453kg (kilograms)

Tube:

(HINT: it should not equal larger than 33kg)

Rider:

Tube+Rider:

Speeding Things Up!

The speed of each rider may vary depending on the mass of the rider, but to find the speed the mass is not needed. To find the speed, find the distance of the hill and divide it by the average time it took to reach the bottom of the hill.

First the distance of the hill must be found by using tools such as a range finder or a walking measuring wheel.

Record the distance calculated below.

Distance of hill in meters:_____m

I've Got the Power

Power is the amount of energy consumed per unit time, measured in Watts. The power is found by taking the work force and dividing it by time. Since the work has already been calculated, you will now need to find how much time it takes to travel up the magic carpet.

Time (in seconds) of magic carpet: _____seconds

P=W/t

Rider 1: P= _____J/_____s

=_____Watts

Rider2: P= _____J/_____s

=_____Watts

Rider3: P= _____J/_____s

=_____Watts

Working Hard or Hardly Working?

Next you will find the **work** force of the object and rider. Work is the amount of **force** that it takes to move an object. To pull the riders and tube up the hill the magic carpet uses a certain amount of force to move each person and tube up the hill. This force is what will be calculated. The equation to do so is:

W (work, measured in, J, Joules)**=F(d)(sinθ)**

F force, measured in, N, newtons uses Kilograms (kg), so the weight of the rider and tube.

D= distance of the hill in meters

Sinθ= (calculator needed) use the angle of the hill as θ to find the sine

Find Work:

Rider 1:W= _____N(_____m)(sin____)

=_____J

Rider 2:W= _____N(_____m)(sin____)

=_____J

Rider3:W= _____N(_____m)(sin____)

= J

Dashing Through the Snow...

Find the average acceleration (Amount of time it took to reach the bottom of hill):

Rider	Trial 1 (in seconds)	Trial 2	Trial 3	Averages
1.				
2.				
3.				

Observations:

How Fast Are We Really Going?

Now take the average acceleration of each rider to find their speed.

Speed (m/s) **= distance** (of hill)**/time** (average acceleration)

Rider 1:_____m/s

Rider 2:_____m/s

Rider3: _____m/s

Now, calculate that speed in Miles Per Hour!

1,768 meters = 1 mile

3,600 seconds = l hour

Rider 1:_____mph

Rider2:_____mph

Rider 3:_____mph

What's the Angle on this?

For the next problem you will need to find the angle of the hill. This will be calculated by using a protractor attached to a string and washer. To accurately measure the slope you will need to do the following:

1. Hold the protractor straight side up, as straight as possible parallel to the ground if it were flat.

2. Let the string and washer hang down, and sway until it stops.

3.Hold the string against the protractor, and read the angle that the string matches up with

4.Read the bold, larger numbers on the protractor for your measurement

5. Subtract the angle found from 90°

Angle of hill:_____°

(HINT: the angle should be under 45°)