

Fizix Of Phun



☺ Final ☺

Lab Experiments

In Conjunction with

THE GREAT ESCAPE[®]
& SPLASHWATER KINGDOM

Student Name	
Group Partners	

The Fizix of Phun - Background

A Theme Park is a great demonstration of physics principles. These investigations will give you the chance to demonstrate your knowledge of physics.

The group will be divided into working groups of two to four students. You will work with your group to collect the data with which to answer questions. When you have the data needed, write your individual answer to each question in your packet. (Answers are not to be a group effort).

Some measurements will be crude, but make them as accurately as possible. You should explain the method used when guesstimating measurements.

Equipment

- ▶ packet
- ▶ Pencils
- ▶ reference table
- ▶ altitude finder
- ▶ stop watch
- ▶ calculator

NOTE: If you have a documented affliction of any of the following phobias, you do not have to ride to answer the questions.

Updownaphobiafear of roller coasters

Roundaphobia

Kinesophobia

Tachyphobia

Acrophobia

Claustrophobia

Stenophobia

Gephyrophobia

Chremnophobia

Demophobia

Semaphobia

Barophobia

Anemophobia

Mechanophobia

Agoraphobia

Phonophobia

Epistemophobia

fear of circular rides

fear of movement

fear of high speeds

fear of heights

fear of confined places

fear of narrow places

fear of bridges

fear of cliffs

fear of crowds

fear of flashing lights

fear of gravity

fear of high winds

fear of mechanical objects

fear of open places

fear of sounds

fear of places of learning

The Boomerang Coaster #1

This page considers the drop from rest...

1. What is the vertical drop?
2. What should your velocity be at the base of the drop?
3. What is your velocity at the base of the drop?
4. How long did it take you to travel the drop?
5. From #2, what should your acceleration be?
6. From #3, what is your acceleration?
7. How much acceleration is robbed from the system during the drop?
8. What is the coefficient of friction during the drop?

The Boomerang Coaster #2

This page considers the loop portion...

1. What force or forces do you feel at the top of the loop?

2. Draw a free body diagram of the forces acting on you at the bottom of the loop.

3. Draw a free body diagram of the forces acting on you at the top of the loop.

4. Assuming the loop is a circle (which it is not) what minimum speed must the Demon maintain at the top of the loop to prevent riders from falling out?

The Comet #1

This page considers your trip up the 1st hill.

Complete the following data table.

ave mass of student		height of 1 st (up)hill	
time up 1 st (up)hill		angle of 1 st (up)hill	

1. How long is the 1st (up)hill?
2. Calculate your average speed up the first hill.
3. What is your potential energy at the top of the 1st hill?
4. How much work was needed to move you up the 1st hill?
5. What force was used to move you to the top of the 1st hill?

The Comet #2

This page considers the apex of the 1st camelback.

1. What is the vertical drop from the top of the 1st hill to the apex of the 1st camelback?
2. What should the train's kinetic energy be?
3. What should the train's velocity be?
4. What is the train's velocity?
5. What is the train's kinetic energy?
6. How much energy did the train lose during this part of the ride?

The Comet #3

This page considers the 1st switch back. This page also assumes that the track distance from the 1st hill's top to the 1st camelback's apex is the same as the track distance from the 1st camelback's apex and the 1st switchback (hence the total energy lost between the 1st hill's top and the 1st switchback is twice the energy lost between the 1st hill's top and the 1st camelback's apex).

1. What is the vertical difference between the 1st hill's top and the 1st switchback?
2. What should the train's kinetic energy be if the track were friction free?
3. What is the train's kinetic energy after accounting for energy losses due to the track?
4. What is your speed at the switchback?
5. Given that the diameter of curvature of the switchback is 16.46 m, what is the centripetal force applied to the train by the track?
6. How many *G*'s do you pull in the switchback?

The Steamin' Demon #1

Complete the following data table.

ave mass of student		height of 1 st (up)hill	
time up 1 st (up)hill		angle of 1 st (up)hill	

1. How long is the 1st (up)hill?
2. Calculate your average speed up the first hill.
3. What is your potential energy at the top of the 1st hill?
4. How much work was needed to move you up the 1st hill?
5. What force was used to move you to the top of the 1st hill?

The Steamin' Demon #2

This page considers the 1st drop (not the teaser drop)...

1. What is the vertical drop?
2. What should a Demon's velocity be at the base of the first drop?
3. What is a Demon's velocity at the base of the first drop?
4. How long did it take a Demon to travel the 1st drop?
5. From #2, what should a Demon's acceleration be?
6. From #3, what is a Demon's acceleration?
7. How much acceleration is robbed from the system during the 1st drop?
8. What is the coefficient of friction during the 1st drop?

The Steamin' Demon #3

This page considers the loop portion...

1. What force or forces do you feel at the top of the loop?

2. Draw a free body diagram of the forces acting on you at the bottom of the loop.

3. Draw a free body diagram of the forces acting on you at the top of the loop.

4. Assuming the loop is a circle (which it is not) what minimum speed must the Demon maintain at the top of the loop to prevent riders from falling out?

The Steamin' Demon #4

The following questions refer to your ride in the front car of the Steamin' Demon from the loading area to the bottom of the first drop (not the teaser drop).

1. When do you feel the maximum force?

2. Is the force "net up" or "net down?" Why?

The following questions refer to your ride in the back car of the Steamin' Demon from the loading area to the bottom of the first drop (not the teaser drop).

3. When do you feel the maximum force?

4. Is the force "net up" or "net down?" Why?

The Flying Trapeze (The Swings) #1

1. What is the length of the chain at rest?
2. What is the vertical difference between the upper arm and the swing chair when at full rotation?
3. What horizontal distance is the chair pushed to the side?
4. At what angle is the chair pushed to the side?
5. Diagram the relationship between mg , F_c , and F_T .
6. What centrifugal force is felt by the riders?

The Flying Trapeze (The Swings) #2

1. What is the ride's radius at rest?
2. What is the length of the chain at rest?
3. What is the vertical difference between the upper arm and the swing chair when at full rotation?
4. What horizontal distance is the chair pushed to the side?
5. What is the ride's radius at full revolution?
6. What is the ride's period of revolution?
7. What centrifugal force is felt by the riders?

The High Divers #1

Answer questions 1 & 2 via Energy Considerations & your "Protractor Elevation Device"

1. What is the height of the highest platform relative to the water's surface?
2. With what velocity does the diver hit the water's surface?

Answer questions 3 & 4 via classical free fall calculations.

3. How long does it take the diver to fall to the water's surface?
4. What is the height of then platform relative to the water's surface?
5. With what velocity does the diver hit the water's surface?

Comparing the two processes...

6. What is the R%E between your answers to #'s 1 & 4?
7. What is the R%E between your answers to #'s 2 & 5?

The Merry-Go-Round

	Trial 1 (outer horse)	Trial 2 (inner horse)
distance from center		
period of rotation		
1. your velocity		
2. Centripetal force acting on you		

3. What effect did changing your location have on centripetal force?

4. If you are near the center of the Merry-Go-Round, explain how you would throw a ball to a partner on the outside edge.

5. If the output of the engine is 25 hp, calculate the work required to turn the Merry-Go-Round once.

The Pirate Ship

Weight of empty Pirate	63,606 N	Max height during swing	
Radius of swing		Period of swing	

1. Are you more likely to be weightless when riding at the end of the Pirate Ship or in the middle of the Pirate Ship? Why?

2. Assume that the pivot bearing of the Pirate is nearly friction-free and calculate the maximum velocity of the Pirate Ship (when it is going full bore). Where does this maximum velocity occur?

3. Using the Pirate as a pendulum, estimate gravity for this park.

4. What is the relative percentage of error between your answer in #3 and the currently accepted value?

5. Using your answer from #1 and the accepted value for gravity, estimate the coefficient of friction for the Pirate Ship.

The Water Tube Rides

Place an X next to the tube ride used for this page.

Ride Used	Ride Name	Ride Length (m)
	Black Cobra	
	Twister Falls	
	Banzee Plunge	
	Blue Typhon	

1. What is the tube's vertical drop?
2. What would a person's velocity be at the end of the tube if the tube were friction free?
3. What would a person's acceleration be during the ride if the tube were friction free?
4. What is a person's ride time?
5. What is a person's actual velocity at the end of the tube?
6. What is a person's actual acceleration during the ride?
7. How much acceleration was lost during the ride?
8. What was the coefficient of friction between the person and the tube?

The Wave Pool

This page considers water waves in the wave pool.

1. How long is one wavelength?
2. What is the period of a wave?
3. What is the velocity of a water wave in the wave pool?
4. What is the total volume of water in the wave pool?

5. If the wave pool were your private pure H₂O source after a catastrophic aquifer event, how many day's supply would there be for yourself and 4 of your closest friends if you were to continue to drink the eight 8 oz glasses of water per day as recommended by the FDA?