Worlds of Fun®

Education Days

for before, during, and after your visit

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Fan Favorites!

Worlds of Fun covers 235 acres in Kansas City, Missouri. Some of Worlds of Fun's most popular rides and attractions include Mamba, Spinning Dragons, Patriot, Detonator, Prowler and Monsoon.

We would like to conduct a survey of our students to decide which is the best ride of the most popular rides at Worlds of Fun. After all the information is collected, students will graph results and make comparisons.

Below are your choices, please circle only one ride in each category.

Roller Coasters

Mamba Drop	-200 feet and soar over 70 mph!
Spinning Dragons	-Rotate freely on sharp banked twists and turns
Patriot	-Four amazing inversions are an American scream!
Prowler	-A beast of a coaster-one of the world's best wooden coasters

Water Rides

Monsoon
Viking Voyager
Fury of the Nile

Thrill Rides

ThunderHawk
Detonator
Zulu
Cyclone Sam's

Amusement Park Classics

Skyliner Ferris Wheel
Worlds of Fun Railroad
Le TaxiTour classic cars
Autobahn bumper cars

Collect data from as many people as possible. Complete graphs on the following page showing your results.
Help us determine which rides are fan favorites!

Was the data similar to what you expected?
Do girls have different preferences than boys?
Which ride was the most popular of the rides?
Think of as many different categories as you can!

Fan Favorites
Comparison Graphs

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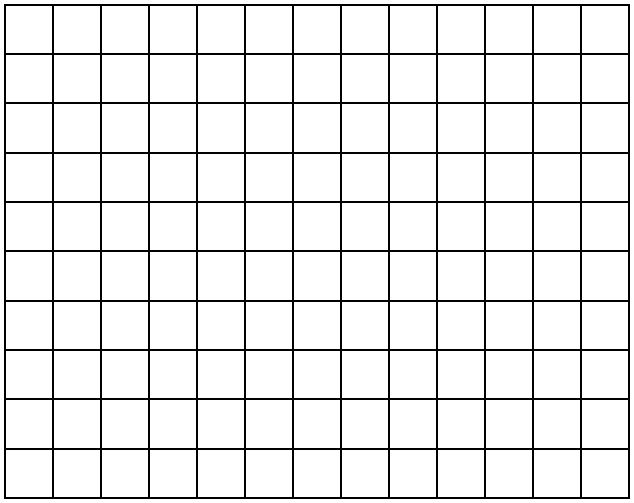

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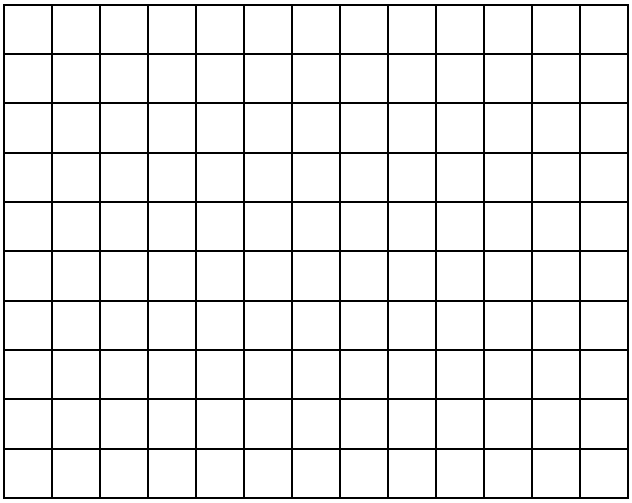

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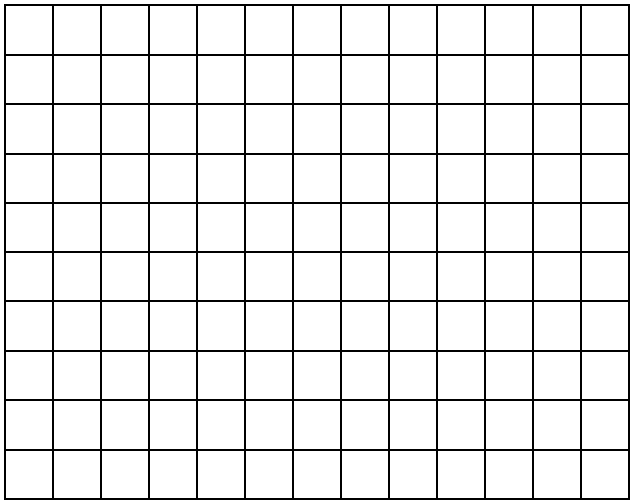

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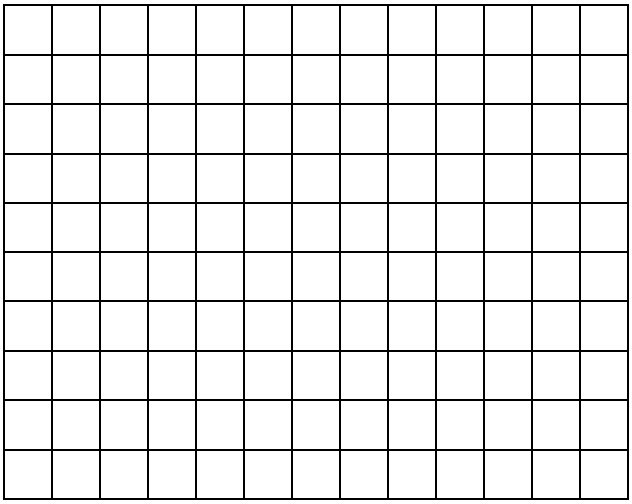


Where Did Worlds of Fun Get This Ride?

Using the information about the manufacturing of the rides, plot the location of where the ride came from on a map of the USA. Draw a straight line from the point of manufacturing to Worlds of Fun. Use an atlas to help plot the exact locations of the manufacturing cities. Also look up the latitude and longitude of the cities mentioned.

Name of Ride	Location	Latitude	Longitude
RipCord	Layton, Utah		
Timber Wolf	Cincinnati, Ohio		
Cyclone Sam's	Wichita, Kansas		
Mamba	La Selva Beach, California		
Detonator	Logan, Utah		
Octopus	Salem, Oregon		
Scrambler	Jacksonville, Illinois		
Worlds of Fun Railroad	Wyano Pennsylvania		
Viking Voyager	Mountain View, California		
Prowler	Sunbury, Pennsylvania		

Ride Distance Traveled

Using a map of the United States with the below cities plotted, measure the distance between a particular city where a ride was manufactured to Worlds of Fun in Kansas City. Use rulers to measure the distances and then convert them into miles using the map's scale. Round to the nearest ¼, ½, ¾, or whole inch

	Inches	Miles
Layton, Utah to Kansas City		
Cincinnati, Ohio to Kansas City		
Wichita, Kansas to Kansas City		
La Selva Beach, California to Kansas City		
Logan, Utah to Kansas City		
Salem, Oregon to Kansas City		
Jacksonville, Illinois to Kansas City		
Wyano Pennsylvania to Kansas City		
Mountain View, California to Kansas City		
Sunbury, Pennsylvania to Kansas City		

Figure It Out

Using the information from the conversion activity sheet, "Where Did Worlds of Fun Get This Ride?" calculate the estimated travel time given an average speed of **60 miles per hour**.

Remember: Time = miles / speed

Calculate the amount of gas used to bring the ride to Worlds of Fun when a truck gets **15 miles per gallon**.

Remember: Amount of gas = miles / mpg

	Miles	Time	Gallons of Gas
Layton, Utah to Kansas City			
Cincinnati, Ohio to Kansas City			
Wichita, Kansas to Kansas City			
La Selva Beach, California to Kansas City			
Logan, Utah to Kansas City			
Salem, Oregon to Kansas City			
Jacksonville, Illinois to Kansas City			
Wyano Pennsylvania to Kansas City			
Mountain View, California to Kansas City			
Sunbury, Pennsylvania to Kansas City			

Words in the Park

Use a dictionary to define the following words.
After you have defined each word, write a sentence.

1. Specification

2. Spectacle

3. Meander

4. Revenue

5. Unprecedented

6. Fatigue

7. Traverse

8. Summit

9. Incremental

Words in the Park Search

D Z N U I M E A N D E R N A

U L G E T U J P O G S O L U

T P S I L L V F O E I G U N

H O P U I N M U O T L B G P

R I E S M A M B A F E S G R

I I C D B M U C W P R M T E

L V T M I P I L X Q E N E C

L R A N T F R T P G V N J E

I A C A I Z B E F D E U P D

N H L C C K I O C R N V B E

G R E O J O B V F E U D E N

Q P B A F A T I G U E L O T

S G F S E W W C H L N E A E

A Q W T B T R A V E R S E D

M G V E K F Y T C X F U I T

I N C R E M E N T A L L R O

U I O S H L N T R F M E Q O

Words in the Park Vocabulary List: SPECIFICATION MEANDER SPECTACLE
REVENUE FATIGUE TRAVERSE SUMMIT INCREMENTAL

COASTERS MAMBA THRILLING UNPRECEDENTED

Worlds of Fun-ny

Entertain your audience with an amusing story about something that happened to you at Worlds of Fun. Your story can be true or you can use your imagination to create a funny fiction story.
Make people laugh!

The ABC's of Worlds of Fun

A is for

B is for

C is for

D is for

E is for

F is for

G is for

H is for

I is for

J is for

K is for

L is for

M is for

N is for

O is for

P is for

Q is for

R is for

S is for

T is for

U is for

V is for

W is for

X is for

Y is for

Z is for

My Day at the Park Mad-Lib

Fill out the following information with the word of your choice and then insert your answers into the story on the following page.
Share your best Mad-libs with your class!

Noun:
Verb that ends in "ing":
Adjective:
Verb:
Adverb:
Number:
Verb:
Adjective:
Plural Noun:
Verb that ends in "ing":
Adjective that ends in "est":
Past tense verb:
Number:
Adverb:
Adjective:

My Day at the Park Mad Lib (Continued)

Our class was so excited to go to Worlds of Fun. We met in the school parking lot and boarded a _____ (noun) to travel to the amusement park. When we got there, I was so excited I felt like _____ ("ing" verb). My friends and I entered into the park and jumped on the first ride we saw, the _____ (adjective) Dragons. When I got off the coaster, I felt a little _____ (verb), but I knew it was only temporary. Next, we saw the bumper cars and _____ (adverb) ran to get in line; there were only _____ (number) people in front of us. My friends were already talking about the way they were going to _____ (verb) into each other on the little cars. After the bumpy ride, I decided to get a _____ (adjective) drink and a couple of _____ (plural noun) to eat. We decided it was time to ride the Mamba. I was so nervous. We were on the way up the first hill when I heard someone below shout "Good Luck." The last time I rode Mamba I ended up _____ ("ing" verb). After hitting speeds of 75 miles per hour on the first hill, I decided that this was the _____ ("est" adjective) ride I had ever been on! When the ride was over, I _____ (past tense verb) over to a bench and sat down for a few minutes. With the encouragement of my friends, I built up the courage and rode the Mamba _____ (number) more times. The rest of the day went _____ (adverb). Worlds of Fun is a _____ (adjective) amusement park and I can't wait to go back again!

Take a Ride Through the Body

Smalltown, North Dakota would like to build an amusement park dedicated to the human body. They have hopes that each section of the amusement park will relate to one of the systems in the body (i.e. circulatory, respiratory, digestive, etc.). You and your classmates have been asked to design this new park.

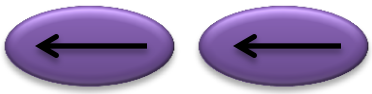
In small groups, decide which section of the park you would like to design. You will be responsible for naming and creating rides and attractions for your "system's section". Remember that anatomical accuracy is as important as the creative design. Your group will present your design idea to the class, so please have a written explanation for each ride and attraction that you are proposing.

Bumper Car Science

The Autobahn bumper cars can be a crazy ride. Crash into other cars, or steer clear of the danger! Think of the Autobahn bumper cars at Worlds of Fun when answering the questions below.

1. If you are in a head-on crash on the Autobahn, you are thrown
    a. **forward**
    b. **backward**
2. When you are hit from the rear, you are thrown
    a. **forward**
    b. **backward**

3. You are thrown forward when your car
    a. **stops**
    b. **starts**
4. You are thrown backward when your car
    a. **stops**
    b. **starts**

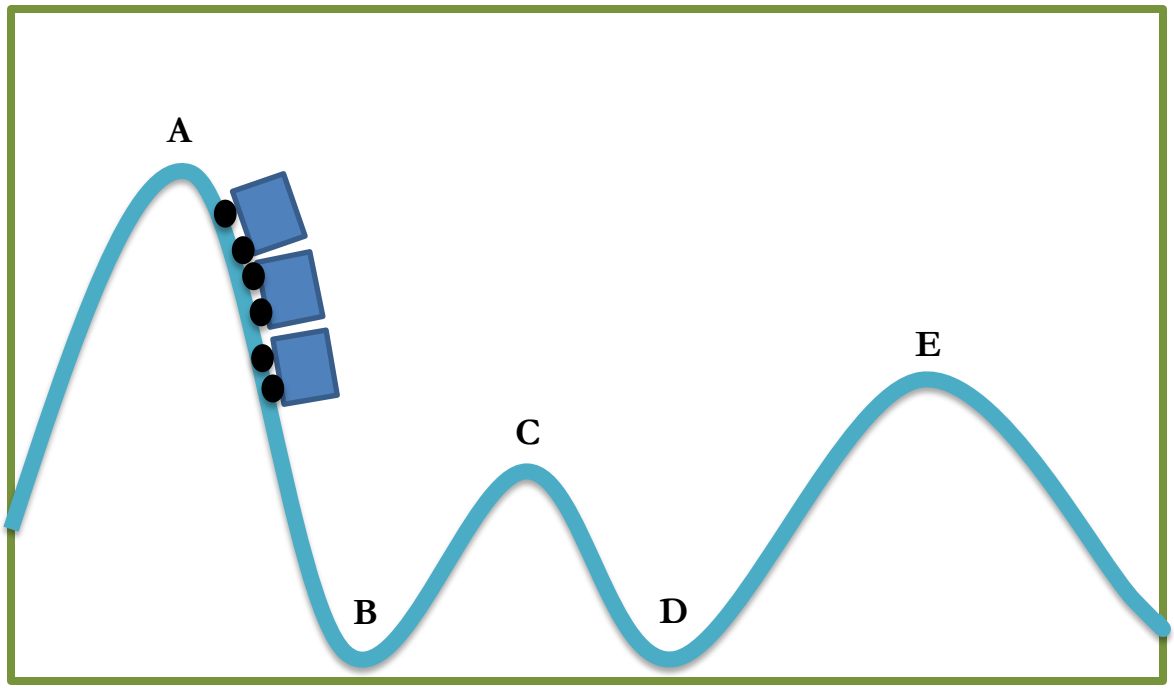


5. You feel the biggest jolt when you hit another car
    a. **straight on**
    b. **in the back**
    c. **on the side**
6. Bumpers make the crashing cars
    a. **stick together**
    b. **bounce away from each other**

Describe how the mass of a rider would affect a head-on crash.
(Use drawings if needed.)

Describe how the velocity of the bumper car would affect a head-on crash.
(Use drawings if needed.)

Energy in Motion



Using the above diagram, answer the following questions:

1. Which letter shows the roller coaster's greatest potential energy?
2. Which letter shows the roller coaster's greatest kinetic energy?
3. Which letter demonstrates the roller coaster having the least potential energy?
4. Which letter, C or E, would demonstrate the roller coaster having more potential energy?
5. How would you demonstrate the kinetic-potential energy conversions that happen on Mamba?

The Sea Dragon

Use the following data to determine the speed of the Sea Dragon.

Materials: Stop watch, calculator

Procedure:

1. While standing on the ground, use the stopwatch to measure the amount of time it takes the Sea Dragon to make one complete swing. Record your data and repeat for two additional swings. Then, calculate the average time.

Observations	**Times**
Swing 1	_____
Swing 2	_____
Swing 3	_____
Total	_____
Average Time =	_____ (Total divided by 3)

2. The arc of the Sea Dragon's swing is 150 degrees and the radius of the arc is 45 feet. Use the radius to calculate the complete circle (circumference) of the Dragon's trip, if the ship went completely around in a circle.

   $C = 2 \pi R$

   Then calculate the actual distance the Dragon travels by this calculation:
   150/360 = .42

   C x .42 = _____ actual distance.

3. Calculate the Sea Dragon's speed.

   Speed = Distance / Time Speed = _____

The Zany Zulu

The unsuspecting passenger who boards the Zulu will get more than just a spin in the park! This ride takes its passengers and flings them upside-down as it moves in a circular motion. In this activity you will find out what a rider's speed is in one revolution.

Problem:
What is the speed of a rider when the Zulu is spinning vertically at top speed?

Materials: stopwatch, calculator, data sheet

Procedure:

1. Find the circumference of the Zulu. Record data. ($C = 2 \times \pi \times R$)
   Hint: R = 23'9" (23.75)

2. Pick a rider. Determine the time it takes that person to make one revolution in a vertical position. Use a stopwatch and record your data. Try multiple times, this will take practice!

3. Using the formula ($S = D/T$) calculate the speed of the passenger. Your answer will be in feet per second.

4. Calculate your answer in m.p.h. Use the following calculation to figure the Zulu's speed of _____ MPH:
   $$\frac{\text{Circumference in feet x 1 mile x 3600 seconds}}{\text{Time of one revolution x 5280 feet x 1 hour}}$$

5. Knowing the time of one revolution, estimate the number of revolutions in the vertical position that the passenger would make in one minute.

6. What would your answer be in meters per second?
   To convert feet to meters, multiply by .3048

7. Why do you feel pushed against your seat as the ride spins you around?

Traveling the World

Directions: Use a park map to navigate your day at Worlds of Fun!

As I enter the park through the main entrance, I would be on the _____ side of the park.

As I traveled the path directly west, I decided to take a spin on the dragon' …..Oops…..we meant 'attraction' _____.

I decided to cross into Americana and take a spin on the red, white and blue ride just north of Timber Wolf, _____.

I skipped a few rides since I was still a little dizzy and continued on to _____, the southernmost attraction in the park. I hope I have the guts for this!

Time to take a break. I grabbed a seat at the _____ Theater in the northeast corner of the park and watched the show.

After the break, I was ready for a water ride. I headed to the southeast part of Scandinavia and took a voyage on the _____.

_____, full of frontward and backward fun, had me screaming at the top of my lungs in Africa!

Afterward, I walked south to cool off on the _____.

Then I trotted southeast to another water ride, the _____.

After the ride, I decided it was time to head west to the twin towers of _____. I was blasted straight up to the sky!

With the sun setting, I knew I had to get on one more ride so I hustled straight west to the _____ coaster.

When it was time to go home, I headed this direction to get to the main entrance _____.

Money-Mania

The following people are having trouble figuring out their budget. Help them find out how much money they will need!

Chris wants to purchase Photo Memories photos for himself and his group of three friends. Two of his friends want a 4x5 photo, and two of them want a 5x7. Chris also wants to buy each of them a key chain.
Figure out his total cost for the photo memories: 4x5 - $10, 5x7 - $12, Keychain - $9

April wants to treat herself to a lunch after she rides Mamba for the first time. She decides on Coasters restaurant and has $15 to spend. List three possibilities for meals using the choices below.

Steak - $7.50
Hamburger - $8.00
Cheeseburger - $8.50
Fries - $3.00
Funnel Cake - $6.50
Salad - $5.25
Soda - $4 Small, $6 large
Lemonade - $4.75
Apple pie - $3
Cookies - $2
Cheesecake - $2
Brownie - $3
Candy Bar - $1

Option 1:

Option 2:

Option 3:

Jamie bet her friend Maren that she could not eat 3 apple pies, 2 hamburgers, 1 brownie, and a large soda from Coasters before she rides Finnish Fling. Find out how much Jamie will spend if she pays for 2/3 of the meal.

If Maren completes the task, she will pay for a ¼ of the meal. How much will she pay?

Erin and Brad want to ride the Ripcord. If they ride separately, the cost is $30 each. If they want to ride together, the cost is $25 each. What percentage of money will they save if they ride together? What if they add their third friend, Nick, and the cost decreases to $20 per person?

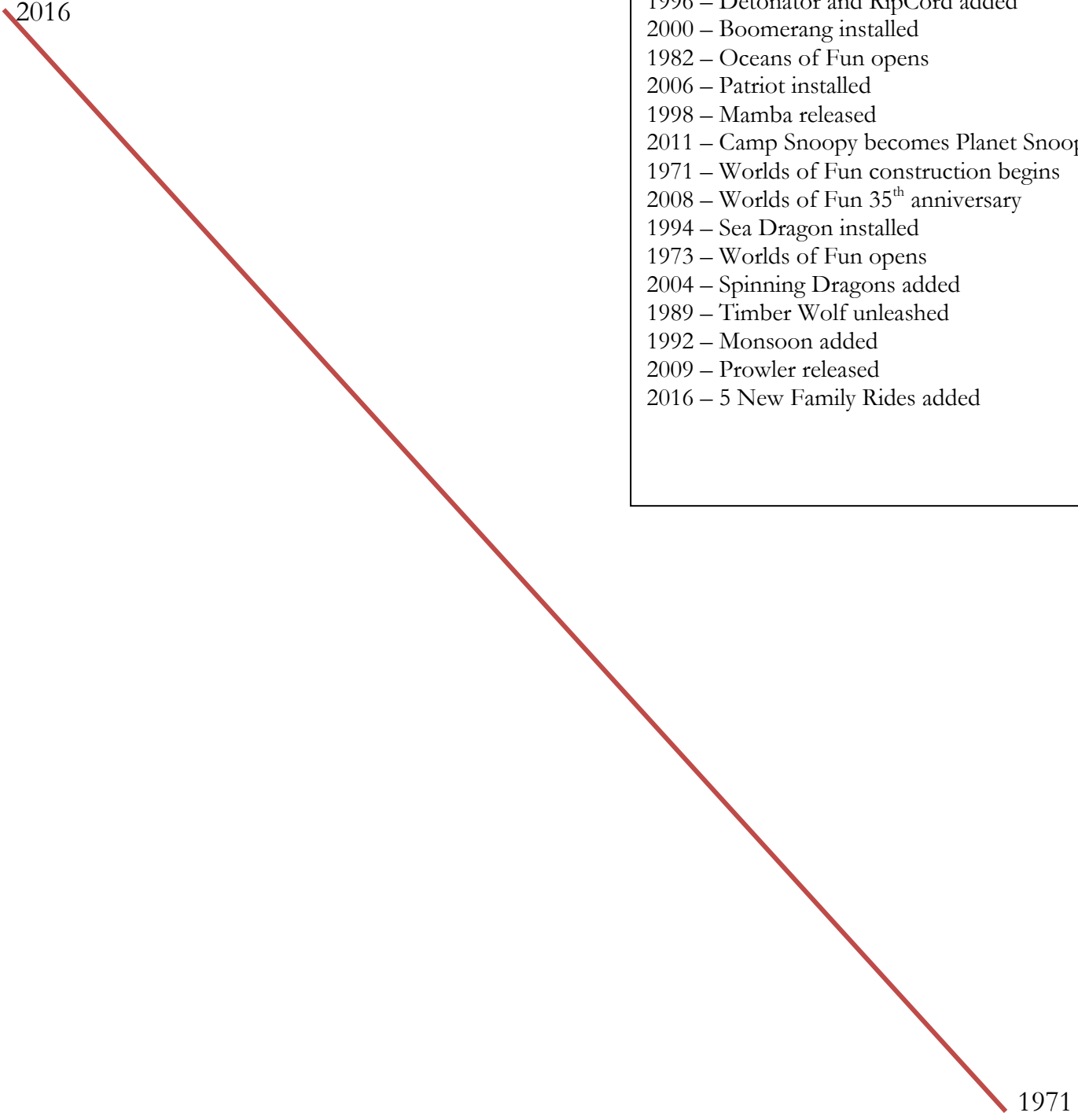
Brandon plays the super shoot basketball game at the arcade and receives 24 tickets each time he plays. Each game is $1.50. How much money will he need to spend if he wants to win a baseball hat that costs 432 tickets?

Timeline of Worlds of Fun

In our study of history, a timeline is a very helpful tool that allows a person to see when events occurred.
Fill in the timeline with the listed Worlds of Fun events and research an important world event in that year to add to your timeline.

Worlds of Fun Events

1996 – Detonator and RipCord added
2000 – Boomerang installed
1982 – Oceans of Fun opens
2006 – Patriot installed
1998 – Mamba released
2011 – Camp Snoopy becomes Planet Snoopy
1971 – Worlds of Fun construction begins
2008 – Worlds of Fun 35th anniversary
1994 – Sea Dragon installed
1973 – Worlds of Fun opens
2004 – Spinning Dragons added
1989 – Timber Wolf unleashed
1992 – Monsoon added
2009 – Prowler released
2016 – 5 New Family Rides added



Passport to Worlds of Fun

Directions: Use the following Ride Fact Chart to graph four various categories on the following page. Use the graphs to determine which rides you will visit multiple times!

Ride Fact Chart

Name of Ride	Year Introduced	Length of Track (ft)	Height (ft)	Ride Duration (min)	Maximum Speed (mph)
Mamba	1998	5600	205	3:00	75
Timber Wolf	1989	4230	95	2:13	45
Boomerang	2000	2000	110	1:00	30
Spinning Dragons	2004	1345	54	1:30	30
Monsoon	1992	780	50	1:30	35
Patriot	2006	3081	149	2:18	65
Prowler	2009	3074	102	2:30	51

Passport to Worlds of Fun
Comparison Graphs

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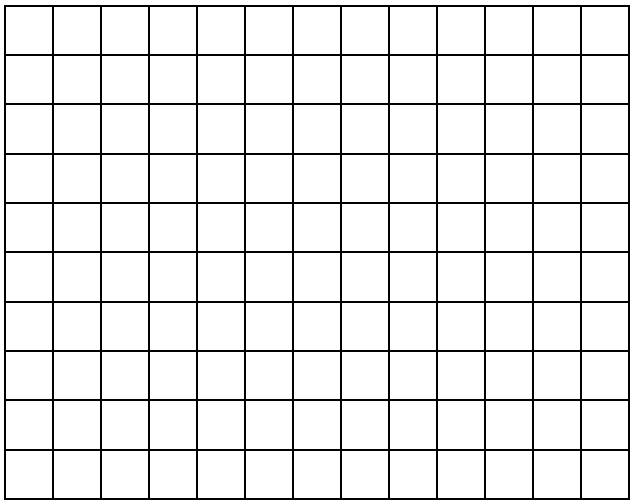

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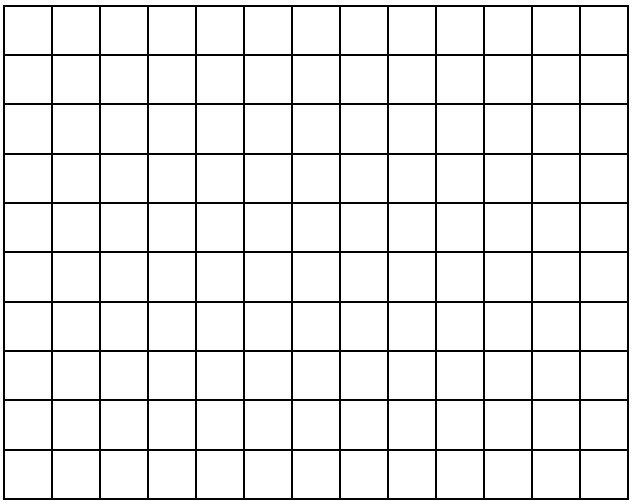

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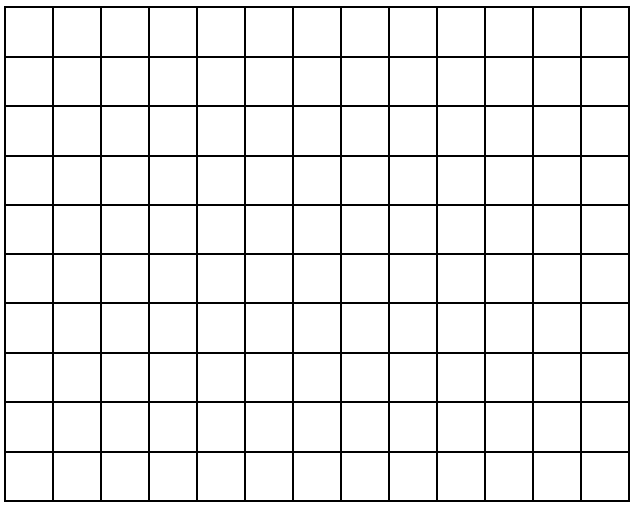

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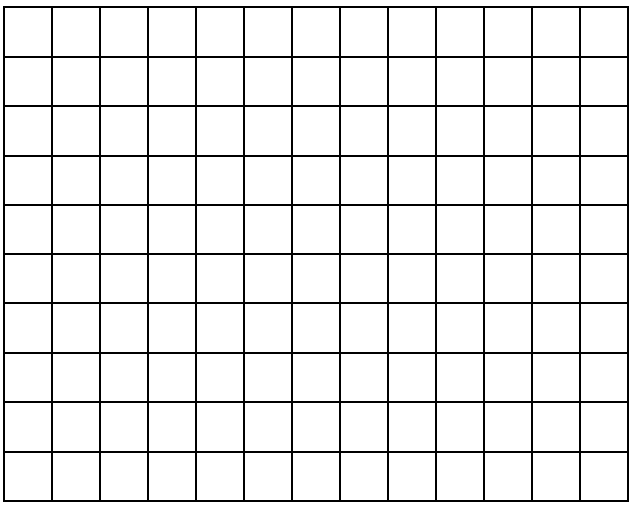


Ecosystems at Worlds of Fun

Worlds of Fun is themed into five areas from around the globe.
The sections are: **Americana**, **Africa**, **Europa**, **Scandinavia**, and **the Orient**.
Pick an area from above and then a country in that area.

My country is_____.

My country is located at _____ latitude and _____ longitude.

It has a population of _____.

The type of government is _____.

My country was founded in _____.

The most common religion in my country is _____.

My country is well known for _____.

My country is a leading producer of in the world_____.

What is the definition of an ecosystem?

What is the definition of a biome?

Explore and document a biome and an ecosystem for 3 areas of your country.

How have humans affected the ecosystems?

Help, I'm Lost!

George just got off the Mamba and cannot find his friends anywhere! An announcement has just come over the loud speakers, "If you or a member of your party have become lost or separated, please meet at the Grand Carrousel at the Main Entrance of the park." Use a map of Worlds of Fun to write out directions for George to find his way from the Mamba exit to the Main Entrance using the walkways and not walking on the grass. Be sure to note landmarks along the way as George might forget the path.

1.

2.

3.

4.

5.

6.

7.

8.

9.

10.

This activity is 2 pages

Small Experiments

Use the provided observation sheet to complete one or more of the following classroom experiments.

1. SteelHawk

Materials: A foam stomp rocket and protective eye gear

Place a foam stomp rocket on the stand. Place your protective eye gear onto your face. Stomp on the launch mechanism, making certain that it points at the ceiling. What do you observe? Try again, this time stomping with a different amount of force.

2. Finish Fling

Materials: A marble and a cup

Place a marble onto the table and put a cup over it. Move the cup in a circular motion to make the marble spin around on the inside of the cup. Observe the motion of the marble. Now, with the marble moving, lift the cup off the table and observe the motion of the marble.

3. Zulu

Materials: A penny and a balloon

Take a penny and place it inside the neck of the balloon until it is completely inside the balloon. Blow up the balloon and tie it off, penny inside the inflated balloon. Move the balloon to make the penny spin around the inside of the balloon. Observe the path of the penny. What path would the penny take if you were to pop the balloon as the penny spins around the inside?

4. Autobahn

Materials: Four coins of the same size

Take four similar coins and make a stack of them on the table, one on top of the other. Take another coin of the same denomination and quickly flick it across the table, striking the stack squarely. Observe what happens.

5. Sea Dragon

Materials: Several marbles and a slotted ruler

Place several marbles into the slot in the center of the ruler so they are touching one another. Take another marble and slide it down the slot so it rolls into the marbles resting on the ruler. What will happen when that rolling marble strikes those stationary in the slot? Try it with two marbles rolling down the groove and striking the stationary marbles. What would happen if you used marbles of obviously different masses? What would happen if you rolled one marble from each side simultaneously into the group of stationary marbles?

6. The Grand Carrousel

Materials: A spool of thread, a CD or DVD, and a balloon

Attach the base of a thread spool to the flat side of a CD or DVD. Take one balloon and inflate it. Do not tie it off at the neck, but instead twist the neck so no air escapes. Stretch the mouth of the balloon and place it over the spool that is attached to the CD. What will happen as you place this onto the table and release them, as the balloon untwists so the air escapes. Push the CD across the table and observe. What would happen if you used a balloon of a different shape or size?

7. LeTaxi

Materials: A pull-back car

Place the pull-back car on the table. Pull it back, then release. Observe. What would happen if you pulled the car back just a little and then released it? What if you pulled it back further.

8. Detonator

Materials: Two soft balls

Take a ball into each hand. Hold them at the same height above the floor and release them simultaneously. The BOTTOM of each ball should be at the same level before you drop them. Which one will reach the floor first? Observe. You might need to try a few times before you are able to drop them at precisely the same time from the same height.

9. Cyclone Sam's

Materials: A balloon

Blow up a balloon. Do not tie it off. Let it go. What happened when you released the balloon? Observe and explain.

10. Flying Dutchman

Materials: Three people and a towel

This station will require three people working together in a very cooperative manner. Two students hold a towel at the ends so that it is outstretched. The other student takes the egg and tosses it toward the towel. Hopefully it lands in the towel. If not, use the towel to clean up the mess. What will happen when the egg hits the towel? Observe and explain.

11. RipCord

Materials: A silk scarf, a table, a saucer, and a cup

Place a silk scarf onto the table so that there is10cm of the scarf hanging over the table. Place the saucer and cup on top of one another onto the scarf. What will happen to the cup and saucer if you quickly pull the scarf out from underneath them? Pull in a quick downward motion. Observe and explain.

12. Mamba

Materials: A string, medium to large beads, and a beaker

Carefully put a string of beads into a beaker. Don't just throw them in. Instead, place them into the beaker, starting with one end and feeding them into the beaker until they are all in. Then hold the beaker upright in the air at eye level with one hand and hold the end of the line of beads in the other hand. Drop the beads in your hand over the edge so that they fill fall to the floor. Observe what happens to all of the beads.

Observation Sheet

A. List materials used:

Prediction of what will happen BEFORE you try:

Observations:

Attempt to explain the reason or reasons for your observations.

Cyclone Sam's Vortex

What you need:

- A glass jar with lid
- Water
- A tablespoon of dishwashing liquid

Activity:

Fill the jar with water, nearly to the top. Leave about a 2cm gap for shaking room.

Squirt in a tablespoon of dishwashing liquid.

Shake the jar vigorously in a circular motion then set it down. You should see a cyclone forming in the center of the jar.

Why is it so?

A tornado forms when cold and hot air combine and spin very quickly. Inside the jar, the fluid on the outside starts spinning before the fluid at the center. When you set the jar down, you see the fluid on the outside slowing down as the fluid on the inside continues to spin. What you are seeing is the formation of a vortex: the water spins rapidly around the vortex due to centripetal force.

A centripetal force is an inward force that directs an object or fluid towards the center of its circular path.

Vortexes found in nature include tornadoes, hurricanes and waterspouts.

Worlds of Fun Railroad

Useful to Know:
• Number of cars per train _____
• Number of seating rows per car _____

Ride Data:
• Eli's Track Length: 5300 feet
• Empty Train Weight: 29.4 tons
• Weight of locomotive & fuel: 22.4 ton
• Maximum number of passengers per car is 78

A group of students decide to take a relaxing trip on the Worlds of Fun Railroad. They begin their journey at the Train Depot. An approximate plot of their distance travelled vs. time is presented above.

1. How long after they are seated does the ride begin? _____

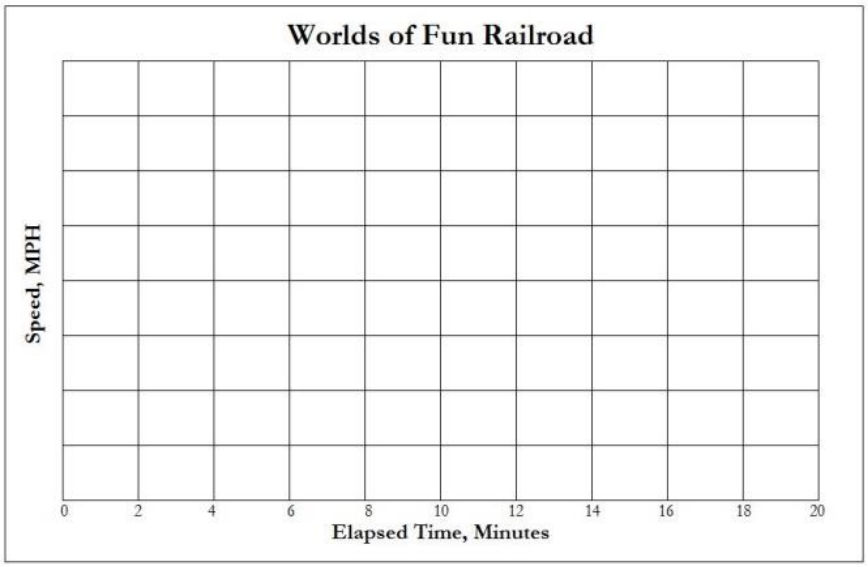
2. How long is the train stopped at the Train Depot? _____

3. How long does it take to get from leaving the Train Depot and returning? _____

4. What is the average speed of the train while it is in motion from the Train Depot and back, in miles per hour? _____

5. What is the average speed of the train over its entire ride cycle, from getting on and off the train, in miles per hour? _____

6. Make a graph of speed vs. time for one lap of the Worlds of Fun.



Worlds of Fun Railroad

1. Let's take a closer look at the acceleration and forces involved with the Worlds of Fun Railway. While leaving Train Depot, it was determined that it took 42 seconds to accelerate to a speed of 90mph. What was the rate of acceleration of the train?

_____

_____

2. Find the total mass, in kilograms, of the empty train and it's locomotive and fuel.

_____

3. Use the information above, and F=ma, to determine the minimum amount of force needed to accelerate the train.

_____

4. Remember, this calculation does not take friction into account. If friction were accounted for, would the total force be greater, or less than what you calculated above? _____

5. On the way out of the Train Depot, it was determined that the train took 48 seconds while accelerating to a speed of 3 meters per second. Is this acceleration larger or smaller than the one found for the train leaving the Train Depot?

_____

6. Observe the train to determine the number of seating rows per car, and the number of cars per train. Use this information, and an average weight of 150 lbs per passenger, to determine the maximum mass of the people that the train can carry. Though mass and weight are not quite the same thing, you may use 1 kg ≈ 2.2 lbs to determine mass from weight.

_____

7. Determine the total mass, in kilograms, of a fully loaded Worlds of Fun Railroad train including its locomotive and fuel.

_____

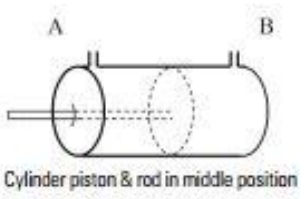
8. Use the acceleration you calculated for the train leaving the Train Depot, and the mass of the fully loaded train, to find the minimum force needed to accelerate the train.

_____

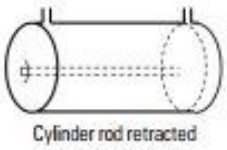
_____

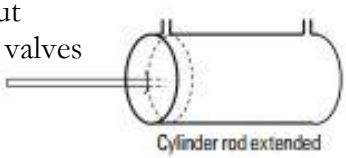
Worlds of Fun Railroad

While the Worlds of Fun Railroad runs on propane, other locomotives run on coal.
1. The chemical potential energy of coal becomes thermal (heat) energy as the coal burns in the locomotive. The heat boils water to make pressurized steam, which also has potential energy, but there is still something else that must happen before the potential energy of the coal is transformed into the kinetic energy of the train in motion.



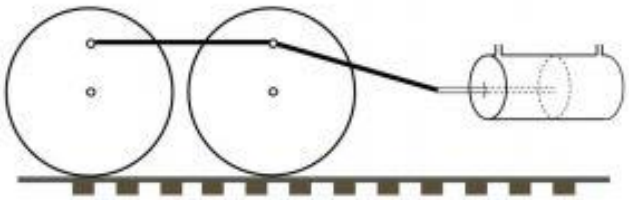
The drawings at the right show a cylinder in various positions. A cylinder is a tube containing a piston which moves in response to pressurized fluid pushing on it. A rod extends through one end of the cylinder so the motion can be used outside of the device. The fluid (steam is a fluid, but steam isn't a liquid!) is put into one or the other side of the cylinder through a port, which is selected by valves (not shown) that help control the motion.





To which port would steam have to be added in order to cause the cylinder rod to be retracted? _____

To which port would steam have to be added in order to cause the cylinder rod to be extended? _____



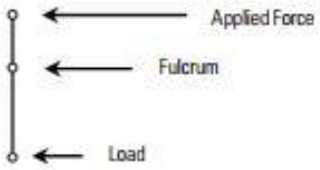
2. Consider the simplified engine drawings to the right.

In the drawing to the right, if the cylinder extends, which direction will the wheels turn (clockwise, or counter clock-wise)?
_____
Will the locomotive move to the left, or to the right as a result? Draw an arrow to indicate the motion.

Which side of the cylinder must have pressurized steam applied to make this happen? Draw some steam molecules in this area to illustrate. Show with an arrow where the steam is entering.

_____

If steam is entering one side of the cylinder to push the piston and rod, what is happening to the gas on the other side of the cylinder is it being compressed, or is it exiting somehow (hint - listen to the locomotive as it begins to pull the train. The Mean Streak crossing area is a great place to listen to the engine as it takes off. Why does it sound the way it does?
_____



3. Use F=ma to determine the minimum amount of force needed to accelerate the train.
_____

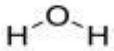
4. What class lever is shown to the right?_____
How does this lever relate to the simplified engine drawing above? Label which part of the engine drawing (track, wheel axle, cylinder) corresponds to each of the parts of the lever (force, fulcrum, load).

_____

Worlds of Fun Railroad

The Worlds of Fun Railroad was first established in 1973. Since then, it has utilized the power of steam produced by propane and water in order to pull the railcars. The Worlds of Fun locomotive used 600 gallons of propane and 750 gallons of water in a 12 hour time period. In order for the steam to drive the locomotive, the pressure of the boiler must be 180 psi. Can you finish these problems from for a round trip to and from the Train Station? This journey takes 7 minutes of motion and 8 minutes of resting. If you get stuck, keep cho choo choooing along!

1. What kind of energy does coal have? _____

2. Water ,  is boiled by the heat of coal burning. What phase is water transitioning from and to?

_____

_____

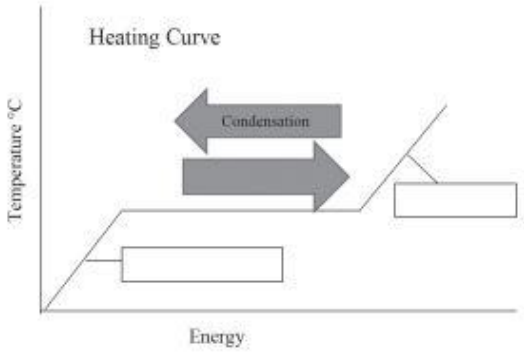
3. Is this a physical or chemical change that occurs? _____ Draw three water molecules connected together.

4. How much water would the locomotive use during twenty minutes of operation (roughly the time of one round trip from the Train Depot and back)? _____

5. Middle School Challenge: Identify and label the following in the Heating Curve shown;

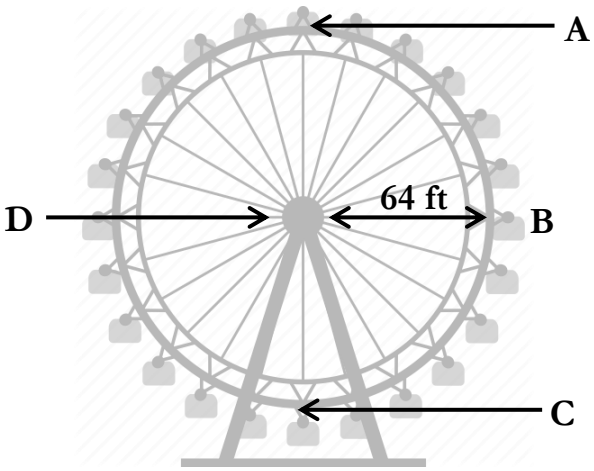
a) Phase and corresponding temperature (in each textbox)

b) Phase Change Process (in the arrow)



6. Conclusion (Fill in the Blanks) In order to make the Worlds of Fun Railroad operation, there are several energy transformations that must take place. First, coal has _____ _____ energy. When the coal is burned, it produces _____ energy. The heat causes water to boil, which breaks intermolecular forces resulting in a change of _____ that results in steam production. The steam is allowed into a _____ which has a rod that moves the wheels of the locomotive. When the locomotive is moving, it has _____ energy.

Skyliner



Types of Angles

1. What angle and how many degrees do Point A, Point D, and Point C make?

2. What angle and how many degrees does Point A, Point D and Point B make?

3. What is the distance from point A to Point C? What is this called?

Area of Skyliner (Hint: π times radius squared)

4. Find the Area of the Giant Wheel.

Circumference

5. If you do one full rotation, how far have you traveled?

6. If you do a half rotation, how far have you traveled?

7. Pythagorean Theorem (____+____=____)

8. What is the distance from Point A to Point C? (Hint: look at what shape it would make!)

Detonator

Use the diagram below

1. How far does the Detonator drop its passengers?

_____

_____

2. How long (seconds) does it take to drop? (Use your stopwatch or cell phone as a timer from the ground, not on the ride. Safety first.)

_____

_____

3. Vertical Change (Drop Side): (Ending Point – Starting Point) / Time (Seconds)

_____

_____

4. Vertical Change (Thrust Side): (Ending Point – Starting Point) / Time (Seconds)

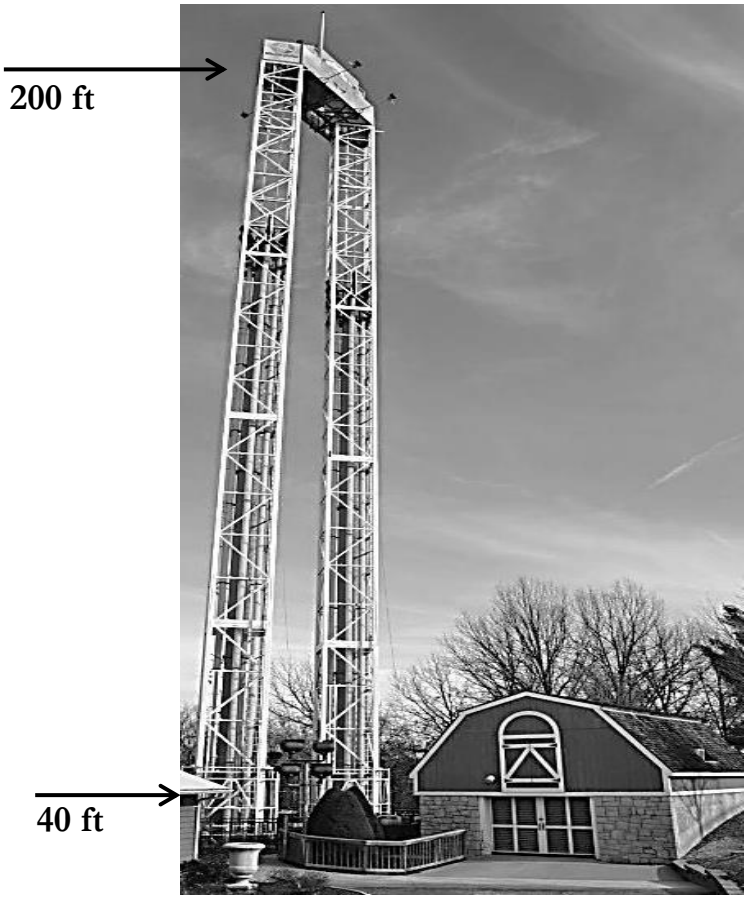
_____

_____

5. Are the two sides the same or different? Explain?

_____

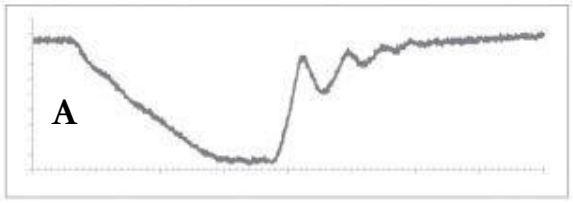
_____

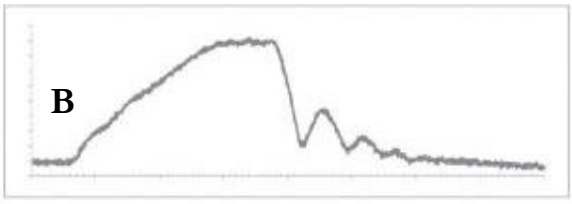


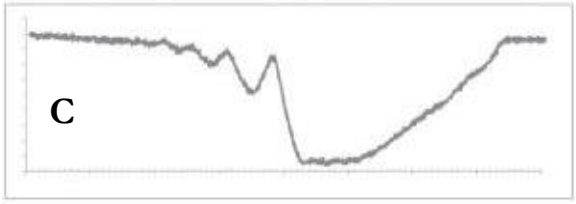
Detonator

Ride Data:
- Height: 225 ft
- Vertical Distance Traveled: 150 ft
- Maximum Speed: 45 mph

Watch the drop side of Detonator in operation. Then answer the questions on this page. When you're done, reward yourself with a ride!







1. Which of the graphs shown at the right is the most reasonably correct depiction of vertical position vs. time for a ride on the drop side of Detonator?_____ Draw a rectangle around the correct choice.

2. The horizontal scale of each graph is in seconds (minor tic marks), with a major tic mark every ten seconds. Assume that the origin (0,0) is at the lower left.

3. At what time does the car begin its long climb up the tower? _____

4. How long does it take for the car to ascend the tower?
_____

5. How long does the car stay at the top of the tower before it descends?
_____

6. Describe the motion of the car as it ascends the tower - does the velocity change much during the ascent, or is it relatively steady?
_____
_____

7. What is the average speed of the car during the ascent? _____

8. How long does it take the car to make its first drop from the very top? _____

9. Does the position graph intercept the vertical axis at a height of zero, or is there an offset?
_____

10. On the graph, clearly label the region when the Detonator car has the most gravitational potential energy. Then, clearly label the region where the Detonator cart has the most kinetic energy.