

Schedule of Events

TIME	EVENT	LOCATION
8:45	Lagoon Autopark (parking lot) opens	Main Gate
9:30	Lagoon Main Gates to rides opens	Main Gate
9:00 - 11:00	School & teacher registration	Main Gate
9:30 - 11:00	Contest registration & safety approval inspections	Davis Pavilion
10:00-11:00	Utah/Idaho FIRST Robotics Grudge Match—Semifinals	Davis Pavilion
10:00-2:00	Mindstorm Activities	Maple Terrace
10:00-2:00	Wind Energy Challenge MESA Contest Activities	Oak Terrace
12:00 - 1:00	Faculty and staff complimentary lunch	Canyon Terrace
2:30 - 3:30	Contest winners are posted as judging is completed Prizes may be picked up then.	Davis Pavilion
2:00-2:45	Utah/Idaho FIRST Robotics Grudge Match—Finals	Davis Pavilion
2:30-3:45	Mindstorm Competitions	Maple Terrace
3:30	Awards Ceremony in Davis Pavilion	Davis Pavilion
4:30	All rides close	
4:45	Park closes	
Sky Drop Contest		
10:00-11:30	Registration for the Sky Drop is open	Drop Site
11:30-1:30	Eggs can be dropped from the Sky Coaster. Line will close at 1:00, or as soon as the line is finished.	Drop Site
2:30	Winners will be announced as soon as the contest is judged.	Drop Site
Colossus' Colossal G-Forces Contest		
9:30-10:30	Contest registration & safety approval inspections	Davis Pavilion
10:30-12:30	Colossus open for measurements	Colossus
2:00	Entry forms due	Davis Pavilion
Physics Bowl Competition (Bighorn Pavilion)		
9:30 - 10:30	Contest registration	Bighorn Pavilion
10:30 - 11:00	Preliminary Qualification Round in	Bighorn Pavilion
11:00 - 11:45	Round of thirty-two	Bighorn Pavilion
1:15 - 1:45	Round of sixteen	Bighorn Pavilion
1:45 - 2:15	Quarter-final round	Bighorn Pavilion
2:15 - 2:45	Semi-final round	Bighorn Pavilion
2:45 - 3:00	Consolation round	Bighorn Pavilion
2:45 - 3:00	Championship round	Bighorn Pavilion
3:30	Scholarships and prizes awarded	Davis Pavilion
Physics Demonstration, Lagoon: Ride Design and Physics Day Logo Design Contests		
9:30 - 11:00	Contest registration & safety approval inspections	Davis Pavilion
11:00 - 3:00	Judging	Davis Pavilion
11:00-2:00	Meet with Judges by appointment as arranged during registration	Davis Pavilion
ARDUSAT		
10:00 - 2:00	Monitor G-Force wearing ARDUSAT's gear	Rocket
Student Workbook		
10:00 - 3:00	Workbooks Collected	Davis Pavilion
3:30	All entry forms due. Teachers can pick up solutions.	Davis Pavilion

All students who turn in their workbook to the table at Davis Pavilion by 3:30 can enter a random drawing to

Win Fabulous Prizes

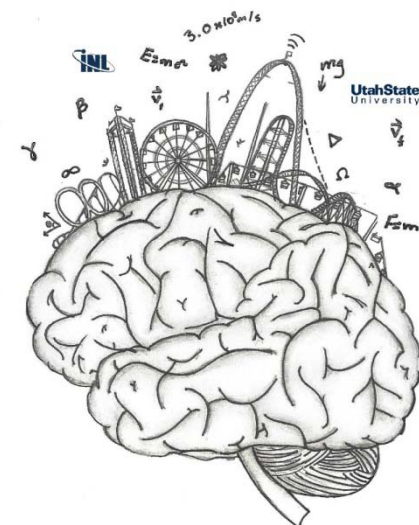


High School Student Workbook

USU PHYSICS DAY AT



May 15, 2015



THIS IS YOUR BRAIN ON
USU PHYSICS DAY AT



Artist-Taylor Kim
School-AMES High School
Advisor- Doug Hendricks

STUDENT _____

TEACHER _____

SCHOOL _____

WELCOME TO PHYSICS DAY AT LAGOON

Thank you for coming to Lagoon for a day of physics and fun!

You are one of more than 7000 physics students from more than 100 schools from five states here to enjoy a fun day experiencing Amusement Park Physics first hand.

This Student Workbook is for use in one of many activities that you can participate in today:

- Student Workbook Physics Bowl Contest
- Colossus' Colossal G-Forces Contest
- Sky Drop (Egg Drop) Contest
- Physics Demonstration Design Contest
- Lagoon Ride Design Contest
- Physics Day Logo Design Contest

The Physics Department at Utah State University and the Idaho National Laboratory are running today's activities.

The contests are sponsored by Apogee, ARDUSAT, ASI, ATK Launch Systems, Boeing, Campbell Scientific, Eastern Idaho Regional Medical Center, Embry-Riddle, Exelis, Hill Air Force Base, Idaho Virtual Academy, IM Flash Technologies, Lagoon, Micron, Ophir-Spiricon, Parker Aerospace, Portage Environment, Rocky Mountain NASA Space Grant Consortium, Space Dynamics Laboratory, US Navy, USU College of Science, USU Emma Eccles Jones College of Education & Human Resources, USU Admissions Office, Utah Virtual Academy, and WiTricity.

More information about Physics Day is available at physicsday.usu.edu. If you have questions or would like to find out more about physics at Utah State University (www.physics.usu.edu), please stop by the Davis Pavilion. We will be glad to see you at Lagoon!

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GENERAL QUESTIONS

FILL IN THE BLANKS WITH THE TERMS IN THE GLOSSARY ON PAGES 4 & 5

Insert questions here.

FERMI QUESTIONS

Enrico Fermi was one of this country's greatest physicists.. among his accomplishments were the 1938 Nobel Prize for nuclear and particle physics and the title "Father of the Atomic Age" for his role in building the first nuclear reactor. He had a rare talent as both a gifted theorist and experimentalist. One of his legacies is the "Fermi Question," an insightful question requiring both an understanding of physics principles and estimation skills.



Enrico Fermi
1901-1954

The Fermi Questions given below require information gathered for this workbook, estimation, and some clever thinking.

1. Estimate the length of Cannibal and explain your reasoning.
2. What fraction of the weight of the moving parts (car and riders) of Cannibal do the passengers comprise? What fraction of the total weight of Cannibal do the riders account for?

Hints: How many riders are there? What does an average person weigh? How many cars are there? How big (long, wide, and high) is each car? What fraction of each car is air and what fraction is the rest? What is the average density of the stuff the cars are made of (see page 5 for common densities)? Use the same logic for the cars on the whole Cannibal ride.

LAGOON PARK MAP



AMUSEMENT PARK PHYSICS GLOSSARY

Here are some physics concepts that you will encounter today. Most of them should be familiar to you after the exciting physics class you've been in this year.

ACCELERATION: Time rate of change of velocity (either speed or direction) of motion.

ACCELEROMETER: A device to measure acceleration.

AIR RESISTANCE: Force resisting motion of a body through air due to the frictional forces between the air and body.

AMPLITUDE: The maximum height of the wave above or below zero level.

ANGULAR ACCELERATION: Time rate of change of angular velocity.

ANGULAR VELOCITY: Time rate of change of angular position.

CENTRIPETAL FORCE: A force on an object pulling or pushing the object towards the center of its curved path.

CONSERVATION OF ENERGY: Basic tenet of physics stating that energy can neither be created nor destroyed in any process, though it may change form.

CONSERVATION OF MOMENTUM: The total momentum of a system is constant whenever the net external force on the system is zero.

ELASTIC COLLISION: A collision in which kinetic energy is the same before and after the collision.

FORCE: A push or pull. The time rate of change (direction and magnitude) of momentum.

FREQUENCY: The number of waves that pass a particular point in one second.

FRICTION: A retarding force that resists the motion of a body.

G-FORCE: Ratio of the magnitude of acceleration on a body to the acceleration of gravity at sea level on Earth ($g = 9.8 \text{ m/s}^2$).

GRAVITY: Attractive force between two bodies, proportional to their masses.

IMPULSE: Product of the magnitude of a force on a body times the time over which the force acts on the body.

INELASTIC COLLISION: A collision in which kinetic energy decrease as a result of the collision.

INERTIA: Tendency of a body to remain at rest or in uniform motion in a straight line.

KINETIC ENERGY: The energy of a body associated with its motion.

BORED? PHYSICS ON YOUR PHONE physicsday.usu.edu



Angry Birds – Projectile motion, acceleration, force, and many more fun physics principles tested with this series of games.

Coaster Physics – Build and ride your own roller coaster. See real-time potential and kinetic energy, speed and acceleration, and the g-forces felt during the ride.

Convert Units for Free – Feet to meters, miles per hour to kilometers per hour? Convert many units with this application.

Flashcards+ – Build your own flashcards or use premade decks to keep on top of your physics game.

Footsteps – Pedometer Free – Use this to measure your own velocity or get velocity of rides using distance per unit time.

IBPhysics Definitions – Test your physics definitions using the innovative flashcard style application.

Roller Coaster RushFREE– Use the accelerometer to gain speed, get points, and master each level.

Paper Toss – Throwing paper into the trash has never been so fun especially with a blowing fan and other obstacles.

SPARKvue– Acceleration data application. Measure and log each x, y, or z axis individually or all three at the same time.

Tone Generator – Produce a wide range of tones for fun or to test the hearing of those around.

Vernier Video Physics (\$4.99) – Real-time video analysis of motion. Plot and chart the positions as well as determine the velocity.



Angry Birds – Projectile motion, acceleration, force, and many more fun physics principles tested with this series of games.

Angular Velocity – Up for a challenge? Try this app to test your physics reasoning abilities. Tilt the phone to control gravity and to swing your way through each level.

Sound Meter – Walk around Lagoon and determine the loudest locations. Displays waveform and frequency spectrum.

Cardio Trainer – Use this to measure your own velocity or get velocity of rides using distance per unit time.

Unit Converter – ConvertPad – Feet to meters, miles per hour to kilometers per hour? Convert many units with this application.

Flash Cards – Build your own flashcards or use premade decks to keep on top of your physics game.

Grav-O-Meter – Measures real-time acceleration felt and logs the maximum.

Instant Heart Rate – What is your heart rate before and after the ride? Test it out to see!

Paper Toss – Throwing paper into the trash has never been so fun especially with a blowing fan and other obstacles.

Smart Measure – Use the built in camera to measure the distance and height of objects.

Surveyor – Use the built in camera to measure the distance of objects.

True Tone – Produce a wide range of tones. Test this out with the Audalyzer application to see what cool designs can be generated.

QUESTION TITLE

Put text and pictures here.

AMUSEMENT PARK PHYSICS GLOSSARY

LONGITUDINAL WAVE: A wave that vibrates or oscillates in the same direction that the wave pattern is moving (example: sound wave).

MASS: The amount of material a body contains. A quantitative measure of the inertia of a body.

MEDIUM: stuff that a wave travels through (i.e. air, water)

MOMENTUM: The product of mass times velocity.

NEWTON'S LAWS OF MOTION: Physical laws governing the motion of bodies (at speed much less than the speed of light) expressed in terms of force, mass, and acceleration.

POTENTIAL ENERGY: Energy of a body associated with its position.

POWER: Rate of work done per unit time.

SPEED: The magnitude of velocity.

TRANSVERSE WAVE: A wave in which the vibration or oscillation is perpendicular to the direction that the wave pattern is moving (example: stadium wave football cheer).

VELOCITY: The magnitude and direction of the time rate of change of position.

WAVELENGTH: The distance between successive crests or troughs of a wave.

WEIGHT: A force proportional to the mass of a body. Measurement of the gravitational attraction of a body to the Earth.

WEIGHTLESSNESS: A condition under which a body feels no net force proportional to its mass.

WORK: Product of the magnitude of force on a body times the distance through which the force acts.

Useful Conversion Factors

1 m = 3.28 ft

1 hr = 3600 sec

1 m/s = 3.6 km/hr = 2.24 mi/hr

1 g = 9.8 m/s² = 32 ft/s²

1 in = 2.54 cm

1 km = 0.621 miles

1 kg = 2.2 lbs

1 N = 0.225 lbs

1 Cal = 1 kcal = 1000 cal = 4184 J

Common Densities (g/cm³)

air 0.001

water 1

aluminum 2.7

iron 7.9

lead 11

plastic 0.9

wood 0.9

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