GULF COAST EXPLOREUM SCIENCE CENTER

Teachers' Guide to Permanent Exhibits

Connections to classroom objectives
Instructions for students
Explanations of how exhibits work

GULF COAST EXPLOREUM SCIENCE CENTER

Thank you...

for choosing the Gulf Coast Exploreum Science Center as an exciting and innovative way to make science come alive for your students!

In addition to traveling exhibits and films in the IMAX® *Dome* Theater, the Exploreum features 53 permanent interactive exhibits, most with multiple access points to allow interactions for groups of students. The Exploreum also offers your students fully immersive experiences in science with the Ciba Lab (page 13) and Hearin-Chandler Virtual Journeys Digital Theater (page 17).

Please share this resource guide with your fellow teachers and the chaperones who accompany you on your field trip. It is our hope that the guide will help you to maximize your students' learning before, during, and after their experience with Exploreum exhibits.

As your Partner in Education, we are excited to provide our exhibits as a resource to encourage your students to explore the world of science with their hands and their minds ON!

Hands On HALL

Minds On HALL

How to Use the Teachers' Guide

This guide is designed to provide you with essential information about:

- How students should interact with each exhibit
- The basic science principles demonstrated by each exhibit
- Alabama Course of Study objectives addressed by each exhibit

It is organized by permanent exhibit gallery – Hands On Hall and Minds On Hall – and then by clusters of exhibits within each gallery.

Features of Exhibit Entries

What students do
A brief, step-by-step description of how students should interact with exhibits to learn the content they were designed to convey.

Science behind the fun
A description of the basic science principle addressed by the exhibit. This feature might be particularly useful for chaperones assisting you with the field trip.

Pulley Power
What students do: Hoist themselves up approximately 1 meter on 3 different chairs connected to 2, 3, or 4 pulleys. Feel how much easier the work is as the number of pulleys and ropes increase.
Science behind the fun: As the number of pulleys and ropes increase, so does the mechanical advantage of the chair. With higher mechanical advantage, the student feels lighter but pulls a longer length of rope to rise 1 meter.

Useful Icons

Look for the magnifying glass to provide a quick list of the exhibits featured in a particular cluster.

Follow the notebook to Teaching Tips that can help you to help students use exhibits properly.

Look for the pencil to indicate the Curriculum Connections for each grade addressed by each cluster of exhibits. These are connections to the Alabama Course of Study for Science unless otherwise noted.

Hands on HALL

Hands on Hall is the heart of the Exploreum, embodying a sense of adventure, exploration, and inquiry for students of all ages. Exhibits encourage students to work individually or together as they manipulate objects to discover fundamental principles of science in interactive and engaging ways.

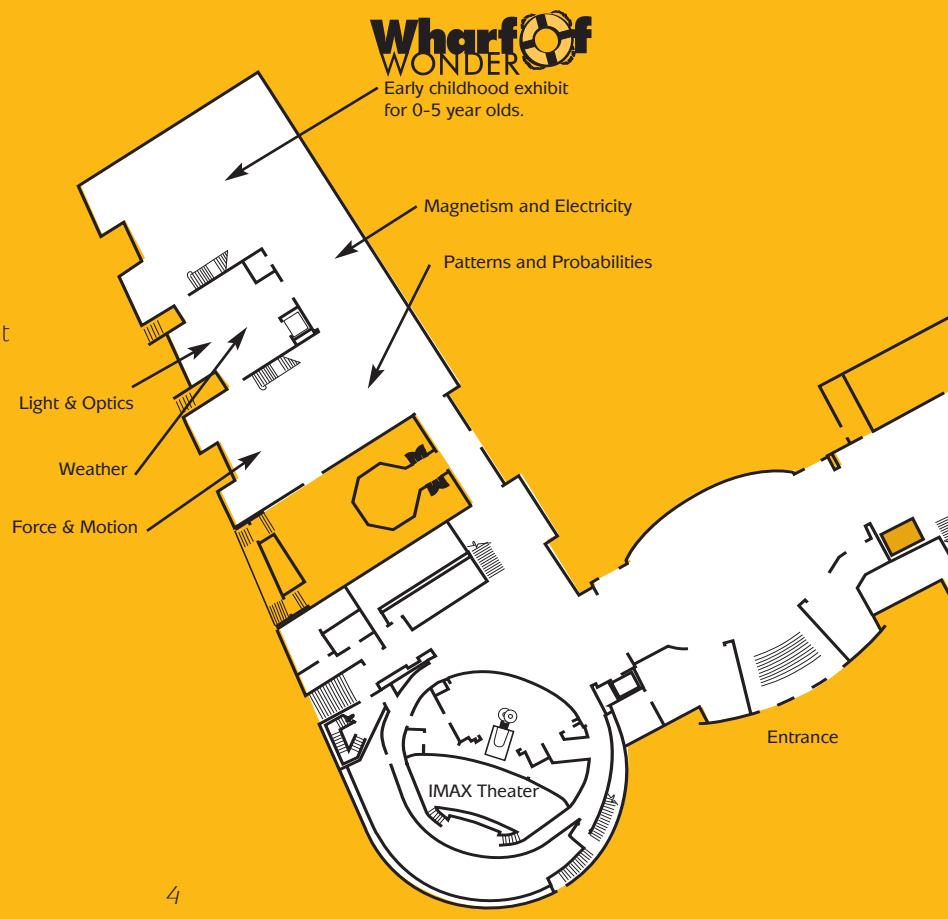
Magnetism and Electricity
Page 5. Explore electromagnets and build electric circuits.

Weather
Page 5. Visit a newsroom with a weather station.

Forces and Motion
Pages 6-7. Magnify force with giant simple machines and discover forces that affect motion.

Light and Optics
Pages 8-9. Bend and reflect light and uncover the fundamentals of optics.

Patterns and Probabilities
Page 10. Connect math to your field trip with patterns and probabilities.



Magnetic Hotplates

Dancing Magnets

Circuit Lab

Magnetism and Electricity

Alabama Course of Study Connections
K: 5
2: 4
3: 4
4: 1
8: 11
Phys. Sci.: 10
Physics: 9

Magnetic Hotplates

What students do: Manipulate 3 knobs to turn 4 electromagnets under a "hotplate" on and off. Observe how the motion of metallic objects on the hotplate changes in response.
Science behind the fun: Four electromagnets underneath the hotplate turn on and off with different strength and in different order, depending on how students turn the knobs.

Dancing Magnets

What students do: Choose one of 4 songs to play. Observe the motion of metal shavings as they appear to react to the sound of the music.
Science behind the fun: The shavings are clustered around 64 electromagnets. The magnets turn on and off on a predetermined program.

Teaching Tip
A common misconception is that the shavings in Dancing Magnets react to the sound waves. Challenge your students to see the connection between Magnetic Hotplates and Dancing Magnets to avoid this mistake!

Circuit Lab

What students do: Create series and parallel circuits by combining 20 different components with large metallic connectors. Students can add switches, lights, fans, resistors, and batteries.
Science behind the fun: Plastic casing encloses wires that attach to the metallic connectors, allowing students to try many different possible connections.

WKRG TV-5 Newsroom

What students do: Read copies of the latest news, track current and historic hurricanes through the Gulf, and see themselves on a TV screen by role-playing the parts of news anchors and weather reporters.
Science behind the fun: Video cameras take an image of students in front of a blue screen. The image is filtered so that the background disappears. The image of the student's body is then superimposed upon the background of the TV studio or an image of weather maps or video.

Teaching Tip
Focus students' energy at the Weather Center by challenging them to point to weather patterns by using only their image on the TV as a guide.

Pulley Power
Giant Lever
1000:1 Giant Gear
Wheel Race
Ball Launcher
Flying Machine
Wheel Gyroscope
Briefcase Gyroscope
Gyroscope Table

Forces and Motion

Pulley Power

What students do: Hoist themselves up approximately 1 meter on 3 different chairs connected to 2, 3, or 4 pulleys. Feel how much easier the work is as the number of pulleys and ropes increases.
Science behind the fun: As the number of pulleys and ropes increases, so does the mechanical advantage of the chair. With higher mechanical advantage, the student feels lighter but pulls a longer length of rope to rise 1 meter.

Giant Lever

What students do: Pull one of two ropes attached to a giant lever – attached either 2 or 6 feet from the fulcrum. Feel how much easier it is to pull the lever the farther the rope is from the fulcrum and explore how to balance the force.
Science behind the fun: The mechanical advantage of the lever increases the farther from the fulcrum the rope is attached. It takes several students using the rope attached 2 feet away to match the magnified strength of one student using the rope attached 6 feet from the fulcrum.

Teaching Tip
Students often approach the Giant Lever like a tug-of-war and conclude that it is "rigged" so one side always wins. Challenge them to figure out a way to balance the force.

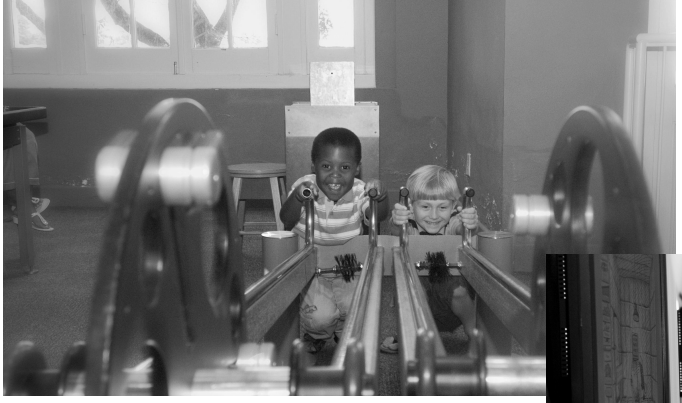
1000:1 Giant Gear

What students do: Turn a small wheel connected to 3 different gears to try to turn a large wheel. It takes 1000 turns of the small wheel to turn the large one once.
Science behind the fun: The wheels are attached to a system of 3 gears above the exhibit. Each gear has 100 teeth on its outside and 10 closer to its center. As the gears turn, teeth on the outside engage with teeth on the inside of the next gear, weakening the original force.

Wheel Race

What students do: Manipulate weights between the center and perimeter of 2 different wheels. Observe the effects of different weight distribution on the wheel's speed down a ramp.
Science behind the fun: When weights are closer to the center, the wheels have less angular inertia to overcome and therefore build more momentum and go faster.

Teaching Tip
Students often affect the outcome of a Wheel Race by pushing the wheels as they go down the ramp. Encourage them to make the wheels go faster by changing the weight distribution.



Alabama Course of Study Connections
K: 4
1: 3
2: 4
3: 4, 5
4: 4
5: 4
8: 8, 9, 10
Phys. Sci.: 7
Physics: 1, 2, 4

Ball Launcher

What students do: A tennis ball and a bowling ball sit at opposite ends of a u-shaped plastic tube. Students lift the bowling ball (with the help of a pulley), causing air to rush into the tube, and then drop the bowling ball. They observe the motion of the tennis ball in reaction to the change in air pressure caused by the bowling ball.
Science behind the fun: When the bowling ball is dropped, the air pressure in the tube increases and forces the tennis ball out the other end. If the bowling ball was lifted high enough, the tennis ball is launched to the ceiling and caught by a net.

Flying Machine

What students do: Control the movement of 3 propellers attached to 3 arms that rotate around 3 separate axes. Observe the effects of combined force on motion.
Science behind the fun: As the propellers move faster, they cause the motion of the arms to increase. As they continue to move, inertia causes the arms to resist changes in motion caused by changing the action of the propellers.

Teaching Tip
The Flying Machine is located on the ceiling of Hands On Hall and controlled by three handles mounted on a table. Make sure students look up!

Wheel Gyroscope

What students do: Spin a bicycle wheel mounted on a frame. Pick up the wheel by two handles and stand on a rotating platform. The platform moves in reaction to the movement of the wheel.
Science behind the fun: The inertia of the spinning wheel causes it to keep moving. When students stand on the platform, it rotates in the opposite direction in reaction (Newton's Third Law) to the movement of the wheel.

Teaching Tip
Sometimes students stand on the platform at the Wheel Gyroscope and spin it themselves. Help them to explore other causes of motion by using the spinning wheel.

Briefcase Gyroscope

What students do: Start a wheel inside a briefcase spinning and then pick the briefcase up and try to move it.
Science behind the fun: The wheel inside acts as a gyroscope. The angular momentum of gyroscopes causes them to have high stability. Therefore, the briefcase resists motion and actually moves opposite to the direction students intend.

Gyroscope Table

What students do: Explore the motion of gyroscopes by balancing different top-like spinning objects on tightropes and stands.
Science behind the fun: The angular momentum of gyroscopes causes them to have high stability. The stability causes the spinning objects to stand when spinning; loss of stability causes them to fall when they are not spinning.

Stroboscope
Light Lab
Digital DJ
Laser Harp
Star Trace
Upside Down and Backwards
Head on a Platter
Kaleidoscope
Mineral Cave
Shadow Wall
Shadow Writer
Magic Wall

Light and Optics

Stroboscope

What students do: Control 2 variables: the rate at which a strobe light turns on and off and the spinning rate of a disc on which the light shines. Observe the effects of different levels of the variables on the image visible on the disc.
Science behind the fun: A spinning design on a disc appears as a blur. When the strobe light shines on and off, the brain interprets the images it illuminates on the disc and fills in what it does not see to create the appearance of a static image. The right combination of spinning rate and strobe rate creates a static image for each disc at this exhibit.

Light Lab

What students do: Use 15 different convex and concave lenses and filters to bend, filter, and combine white light from a central source.
Science behind the fun: The concave lens brings beams of light together, while the convex lens separates a single beam of light. The filters allow only one wavelength of white light to pass, resulting in the transformation of white light to colored light.

Digital DJ

What students do: Interrupt four different lasers to hear one of 200 different sound clips. Choose and combine different sound clips to hear an original, logical sequence.
Science behind the fun: Four diodes direct lasers downward to sensors about 1 meter away. The sensors detect the interruption of the laser, which triggers the playing of the sound clip.

Laser Harp

What students do: Play different musical sounds at a harp with no strings, only lasers.
Science behind the fun: Where the strings would be, there are 20 lasers directed toward sensors below. When students interrupt the lasers by plucking where the strings would be, the sensors detect the interruption and transfer the signal to an electrical signal that plays a musical note.

Star Trace

What students do: Use a metal pen to trace a star whose sides are 4 inches in width without hitting the metal border. The exhibit is designed so that students can only see the star through its reflection in a mirror.
Science behind the fun: The task is more difficult than it looks because things look backward in the mirror. Students use the right side of their brain, which controls nonverbal, intuitive activities.

Teaching Tip
It is possible to complete the Star Trace without looking at the mirror to do it. If students do this, encourage them to contrast their tracing with and without the mirror.

Upside Down and Backwards

What students do: Look through a small hole and try to lace a shoestring on the other side.
Science behind the fun: When students look through the hole, a series of mirrors inside the exhibit reflect light from the shoestring so it appears upside down and backwards. This exhibit demonstrates the function of the right brain as the center for figuring out the position of things.

Alabama Course of Study Connections
K: 6 (Math)
1: 2, 8 (Math)
2: 3, 8 (Math)
4: 3
5: 4, 5, 10
7: 3
Physics: 7

Head on a Platter

What students do: Students put their heads through a hole in the back of the exhibit so that they appear in the front of the exhibit as just a head on a bed of greens on a table.
Science behind the fun: Mirrors on the front of the exhibit reflect light from the shapes on the exhibit to create the illusion of a table with four legs, open underneath.

Kaleidoscope

What students do: Use blocks of different shapes and colors to create a unique design. Manipulate two hinged mirrors to display different images without changing the original design.
Science behind the fun: Light from the blocks is bent and reflected by the mirrors to create new images.

Mineral Cave

What students do: Shine ultraviolet light on eight different rock formations and observe their fluorescent glow.
Science behind the fun: These rock formations are among the most interesting on Earth. They appear dull in white light, but substances on the rocks' surfaces reflect ultraviolet light to reveal their fluorescence.

Shadow Wall

What students do: Create an image on a wall with their shadows when a light flashes inside the exhibit. Observe that the shadow appears to remain on the wall long after the light is gone.
Science behind the fun: The wall is covered with phosphorescent paint, which absorbs light and then re-radiates it slowly. The students' shadows block the absorption of light on the wall, resulting in the parts of the wall reached by the light continuing to glow after the light is gone.

Shadow Writer

What students do: Write messages or draw pictures on a phosphorescent wall using a pen with an illuminated tip. The images remain for a short while but soon disappear.
Science behind the fun: The phosphorescent surface absorbs light from the pen and slowly reflects it after the light source is gone. When the light has been completely reflected, the writing or drawing disappears.

Magic Wall

What students do: Hold a white screen up to a single hole in a dark covering over a window. Pull the screen slowly away from the window and observe the upside-down image of the outside on the screen.
Science behind the fun: When the light from objects outside the window travel in a straight line through a small hole, the light crosses and reforms as an upside down image on the other side.

Teaching Tip
Students might get frustrated at the Magic Wall by holding the screen up to too many holes. Help them to see the image by choosing a single hole along the window.

Safe Crackers
20 Questions
Coin Toss
One in a Million
Chances Are
Roll the Dice

Patterns and Probabilities

Alabama Course of Study Connections
Note: The following connections are to the Alabama COS for Mathematics.
2: 14
3: 13
4: 16
5: 15
6: 11
7: 13
8: 14

Safe Crackers

What students do: Develop and implement a plan to test different sequences of codes to open 3 safes. One safe has 6 possible codes, one has 24, and one has 120.
Science behind the fun: The correct sequence of codes sends an electrical signal to open each safe. The number of possible codes depends upon the total numbers in the code: 3, 4, or 5.

Teaching Tip
Students might take a random approach to Safe Crackers. Encourage a more systematic approach by helping them to start with all possibilities starting with a 1.

20 Questions

What students do: Think of an animal, mineral, or vegetable and then answer a computer's questions about the object. The computer will "figure out" the answer within 20 questions.
Science behind the fun: The computer asks a series of Yes-No questions. With each answer, the number of possibilities is cut in half. This allows the computer to start with 1,048,576 possibilities and narrow it down to 2 with only 20 questions.

Coin Toss

What students do: Predict how many times in 5 trials a coin toss will result in heads or tails, and then test the prediction by pushing a button to flip an actual coin.
Science behind the fun: A coin toss is a random event, with a 50-50 chance of landing on heads or tails. The more coin tosses the students conduct, the closer the ratio of tosses will be to 1:1.

One in a Million

What students do: Roll a cylinder filled with 999,999 blue beads and try to locate the 1 yellow bead inside.
Science behind the fun: The exhibit provides a meaningful illustration of what "one in a million" really means.

Chances Are

What students do: Spin a wheel of probability to find out how likely several different events are in real life, including a shark attack, winning the lottery, and being born a genius.
Science behind the fun: Mathematicians can calculate the probability of almost any event by considering its likelihood in the past and the factors that affect its occurrence in the future.

Teaching Tip
If students simply spin the Chances Are wheel, suggest that they try to predict what kinds of events might match the probabilities written around the outside of the wheel.

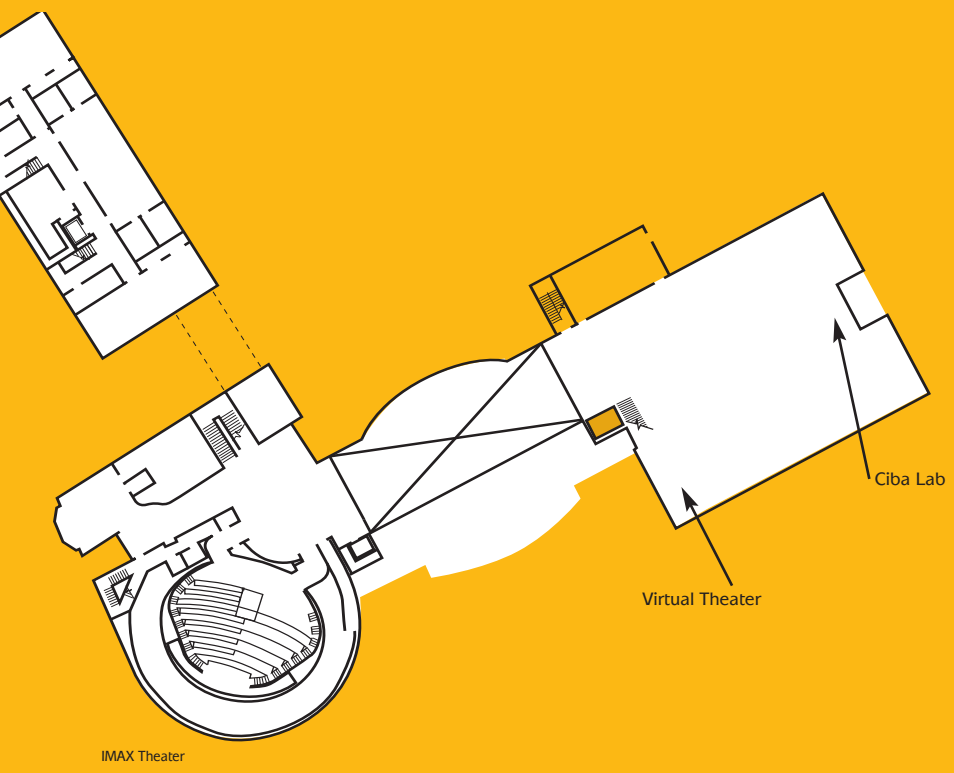
Roll the Dice

What students do: Roll a pair of 6-sided dice to determine the probability of any numeric sum on the face of the dice, from 2-12. Observe that some outcomes are more likely than others.
Science behind the fun: There is only one combination of numbers that results in a total of 2 (1+1) or a 12 (6+6). As numbers move up from 2 or down from 12 toward 7, the number of possible combinations to produce the number increases.

Notes

Minds On HALL

Minds On Hall extends the Exploreum experience to manipulation of variables, design, and engineering. Using high-powered computers, exhibits challenge students to apply what they know about science to virtual environments that they create. They also perform experiments with extended exposure to scientific instruments and procedures in the Ciba Lab.



Ciba Lab
Page 13. Conduct experiments and see demonstrations of the wild side of science.

Virtual World
Pages 14-15. Design components of virtual worlds and see the body through the eyes of a computer.

Chem World
Pages 16. Control electricity and explore properties of liquids and gases.

Micro World
Page 17. Visualize microscopic details of the world around us.

Hearin-Chandler Virtual Journeys Digital Theater
Page 17. Explore images produced by digital data sets and control the journey through them.

Demonstrations

Six experiment stations

Chemistry, Physics, and Biology topics

Topics change every month

Ciba Lab

in partnership with Ciba Specialty Chemicals

Alabama Course of Study Connections Ciba Lab topics change monthly. In a typical school year, topics address an average of 4 objectives for each grade, K-8, and each of the core areas of study for grades 9-12.

What students do:

Students become chemists, biologists or physicists as they roll up their sleeves to perform experiments or take part in demonstrations. The Lab combines the best of hands-on experiences with current science, interaction with Exploreum science mentors, and opportunities to engage with science for more time and in more depth than a typical science exhibit allows.

Interactive Demonstration Area

- Students in Grades K-3 participate in a lively, interactive, and memorable demonstration of the fundamental principles of science.
- Up to 45 students at a time observe fundamental principles of science as part of curriculum-relevant demonstrations.
- Several students typically have the opportunity to help conduct the demonstration, creating an even more memorable experience.

Minds-on Science Experiments

- For students in Grades 4 and higher, the lab benches of the Ciba Lab operate as 6 of the most engaging exhibits at the Exploreum.
- Each lab bench is a hands-on science experiment that students complete individually or with a group.
- Experiments all contribute to understanding of a common theme and are designed to be conducted as a set. However, students may choose to do any combination of any number of experiments.
- Each experiment takes approximately 4-6 minutes for students to set up, conduct, draw conclusions, and clean up.
- Exploreum staff are available to assist with all parts of the experimental procedure.

Teaching Tip

Topics presented as demonstrations or experiments in the Ciba Lab change regularly and are always relevant to the school curriculum. Check www.exploreum.net for a current schedule of topics.

Virtual World

Virtual Roller Coaster

What students do: Design a roller coaster, complete with hills, loops, and corkscrews, at an interactive computer workstation. Test the design by running a simulation of the roller coaster on the computer and in a virtual reality theater.
Science behind the fun: No roller coaster component can be higher than the first hill because the potential energy stored at the top of that hill is the most that the roller coaster ever has. Friction and gravity slow the coaster down at each component until it stops.

Teaching Tip
Designing a roller coaster takes about 3-5 minutes. To increase student exposure to the exhibit, encourage students to work as a team to develop a roller coaster at one computer workstation.

Virtual Fishtank

What students do: Design a fish using touch-screen controls at a computer workstation. Variables manipulated in fish design include fear, hunger, social behavior, swimming depth, and affinity for light. "Release" the new fish into a virtual tank (a 52" plasma screen) and observe its interactions with other fish.
Science behind the fun: Survival depends on how a fish's characteristics help the fish to interact with other fish in the virtual tank. Students should observe the other fish in the tank to see which characteristics might help their fish to find food and avoid being eaten!

How Cool Are You?

What students do: Stand in front of a large screen with a camera that detects infrared radiation mounted on top. Observe infrared images of their bodies projected onto the screen, which show the hot areas (which appear yellow and white) and the cool areas (which appear blue and purple).
Science behind the fun: Infrared radiation has just a bit more energy than radiation detected by our eyes. We can't see it, but we feel it as heat. The camera can detect the heat from this radiation. Inside, it converts what it detects to an image with different colors, so we see differences in heat as colors on the screen.

Teaching Tip
Challenge students to predict which parts of their bodies will be warmest. They might be surprised to find that the top of their heads are among the hotter spots.

Magic Planet

What students do: The Magic Planet is a digital video globe – a digital display on a spherical screen. A touch screen interface allows students to choose what is displayed on the Magic Planet, be it the hurricanes of 2005, the earth's tectonic plates, or any planet in the solar system. The touch screen also displays pertinent text that describes each Magic Planet image or animation. Easy to use controls allow visitors to explore at their own pace by altering the speed and direction of the Magic Planets display
Science behind the fun: The Magic Planet helps to improve the way your students understand the dynamic systems that make up our planet and beyond. Using images from NASA, NOAA, and industry, students are treated to some of the most intuitive displays of complex data gathered over years of detailed research.

Teaching Tip
The globe is not actually a touch screen. Your student will use the touch screen interface next to the globe. The Magic Planet will respond to your students' choices.

Alabama Course of Study Connections
K: 4, 8
1: 3, 5, 8
2: 4, 6, 7, 11
3: 4, 12
4: 3, 4, 5, 10
5: 4, 9
6: 1, 2, 3, 10
7: 1, 3
8: 8, 10, 12
Phys. Sci.: 7
Biology: 12, 16
Physics: 2, 6

Liquid Crystal

What students do: Change the color of this specially designed wall just by leaning against it with their hands.
Science behind the fun: The material used on this wall contains liquid crystals, which change their shape when their temperature changes (for example, from body heat). When their shape changes, they reflect different wavelengths of light, resulting in different colors observed by the eye.

Virtual Reality HoloPod

What students do: Walk onto a platform and stand in front of a blue screen wall. Observe their image on a computer monitor combined with the image of a new environment: under water, on a "GravBall" court, playing drums, or painting. Interact with objects on the monitor by moving around the platform.
Science behind the fun: A camera detects students' movement and inputs it into a computer, which converts movement to electronic signals. Those signals are used to change the program, with the result that students can "interact" with the images on the screen.

Warped Reflections

What students do: Stand about 12-15 feet from a large screen with a camera mounted on top of it. Control the image they see by using a button to "warp" it in different ways: Their image can become jittery, symmetrical, disjointed, too wide or too skinny.
Science behind the fun: A computer manipulates the images it receives from the camera to give the illusion that the screen is a warped mirror.

Recollections

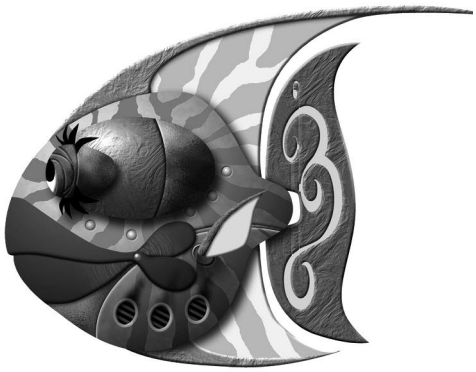
What students do: Dance, walk, jump...move in just about any way between a video camera and a reflective background. Observe multicolored images of their shadows that appear to be reflections on a screen in front of them.
Science behind the fun: Students cast a shadow on retro-reflective materials, which have a high rate of reflection. The video camera detects the shadows and inputs the images into a computer, which adds color and then projects an array of images on the screen from behind the exhibit.

Virtual Dancer

What students do: Design a dance by choosing the number of dancers, dance style, and sequences of dance steps in a computer program. Observe their choreography in a computerized simulation of the moves they've created.
Science behind the fun: The computer-rendered images in this exhibit are wireframe models, which recreate objects and their motion from the inside out. The computer program can make models – and their surface, texture, color and shadows - move by changing the position of the parts of the wireframe underneath the model.

Stop Frame Animation

What students do: Create a scene, snap a digital picture of it, and make slight changes to create the next scene in a logical sequence. Watch the scene during computerized playback of the pictures.
Science behind the fun: The computer at this exhibit combines images in quick succession to create the illusion of movement of the objects in the images during playback.



Are YOU Electric?
Electric Company
Simple Heater
Viscosity
Boyle's Law
Charles' Law

Chem World

Alabama Course of Study Connections
K: 1
2: 1
4: 1
5: 2, 3, 4
8: 11
Phys. Sci.: 5
Chemistry: 7, 8
Physics: 9

Are YOU Electric?

What students do: Create an electric current by touching two copper and two aluminum hand-shaped plates in different combinations. A voltmeter registers the strength of the current when the right combination of plates is touched.
Science behind the fun: When students touch a Copper plate, salt from the sweat in their hands removes electrons from the metal. If their other hand is touching the Aluminum plate, electrons move to the Aluminum, passing through the voltmeter, showing an electric charge.

Teaching Tip
Ask one student to touch the copper and one the aluminum. If those students touch hands, the voltmeter registers a charge, demonstrating that all parts of a circuit must be connected.

Electric Company

What students do: Touch the plastic square on the table and observe the voltmeter register an electric charge. A greater charge is generated the warmer the student's hand is.
Science behind the fun: Heat from the student's body makes one side of the thermoelectric panel in this exhibit hotter than the other. The heat is converted to electricity as it passes through to the other side of the panel, which is designed to convert heat to electricity.

Simple Heater

What students do: Start a reaction that uses heat (by pushing a blue button) or one that releases heat (by pushing a red button). Feel the air around a specialized panel become hot or cold as a result of the reaction.
Science behind the fun: Pushing the blue button sends electricity from the bismuth metal inside the panel to the copper metal inside the panel, causing a reaction that uses heat. Heat is drawn from the air, making the air feel cooler. When the red button is pushed, electricity goes in the opposite direction, and heat is produced, making the air feel warmer.

Viscosity

What students do: Pump air into five tubes filled with five different liquids using a bicycle-style pump. Feel the resistance of each liquid and observe bubbles rise at different rates through them.
Science behind the fun: Viscosity is a measure of the "thickness" of a liquid. Liquids with a structure of large, complex molecules are "thicker" and therefore more resistant to the movement of air. The higher the viscosity, the fewer bubbles are formed and the longer they take to rise.

Boyle's Law

What students do: Compress air by pushing down on a plunger on top of a tube. Feel the plunger become harder to push as air pressure increases. Observe the pressure increase as volume decreases.
Science behind the fun: Boyle's Law states that at constant temperature, the pressure and volume of a gas are inversely proportional: as pressure increases, volume decreases.

Charles' Law

What students do: Increase or decrease the temperature in a tube of gas held at constant pressure by turning a knob. Observe the volume increase as temperature increases.
Science behind the fun: Charles' Law states that at constant pressure, the temperature and volume of a gas are directly proportional: as temperature increases, volume increases. As molecules heat up, they have more energy and move faster. Therefore, they need more space (volume) within which to move.

Alabama Course of Study Connections
Microworld
5: 5, 7
7: 1, 2, 4
Biology: 4

Microworld

Light Microscopes

What students do: Use the Wentzscope, Stereo Microscope, and Compond Microscope to take a closer look at objects and organisms.

Science behind the fun: Each of these microscopes uses a series of lenses to magnify an image that is illuminated by a light source behind it.

Teaching Tip

The Wentzscope has the lowest magnification but is the easiest to use, with samples already mounted. More advanced students can place specimens in the proper position to be viewed at higher magnification at the Compound Light Microscope.

Video Light Microscope

What students do: Examine everyday objects at high magnification. Observe minute details in objects – such as pennies or pencils or their own skin – that they encounter every day.

Science behind the fun: The Video Light Microscope uses a camera with a magnifying lens to view objects placed on a table in great detail. Objects must be well lit to be detected by the lens.

Hearin-Chandler
VirtualJourneys
DIGITAL THEATER

The Hearin-Chandler Virtual Journeys Digital Theater is a 45-seat theater with a 10-foot high, 35-foot wide screen and three state-of-the-art projectors. Newly installed technology immerses your students in fascinating stories and creates unforgettable experiences. The digital data is used by scientists as diverse as astronomers and archaeologists. During the 15 minute interactive presentation, students help Exploreum staff decide on a path to follow through crystal clear digital images created by the data and projected on the screen in front of them. One of only four museums with this technology, the Exploreum allows your students to journey to places that would be off limits without these data sets.

Teaching Tip

Past virtual journeys have toured through the human body, tombs of ancient Egypt, and the solar system. Data sets available change regularly. Check www.exploreum.net for current features and their connections to school curriculum topics.

Cassiopeia Theater

The Cassiopeia Theater shows science features in high definition right on the exhibit floor. Each feature lasts 15-60 minutes and plays on a continuous loop. Up to 12-16 students can sit at the exhibit and many more can stand as they watch all or part of in-depth simulations and demonstrations of up-to-the-minute science topics from sources such as NASA, NOAA, the Discovery Channel.

Additional Resources

All additional resources are available at the Teachers' Resource Center at www.exploreum.net.

Exploration Journals
Exploration Journals – which are like scavenger hunts – help students to focus on science content at exhibits. There are 3 Journals available for each cluster of grades, K-2, 3-5, and 6-8. The journals ask students questions based upon their experience with exhibits. (K-2 Journals are designed for chaperones to use to help students at exhibits.)

Exploration Guides
Exploration Guides are miniature versions of the Teachers' Guide to Permanent Exhibits that focus on a specific science theme (Life Science, Physical Science, and Design and Engineering). Each Exploration Guide includes suggested exhibits to visit aligned with the theme, as well as ideas for previsit and postvisit lessons.

Ciba Lab Video Collection
The Ciba Lab Video Collection provides close-up views of demonstrations available during field trips as well as some that are available only at www.exploreum.net. The videos can be a good way to extend the Exploreum experience into the classroom. Additional Resources
All additional resources are available at the Teachers' Resource Center at www.exploreum.net.

Getting the Most Educational Value from Your Exploreum Field Trip

Five ways to ensure an enjoyable and educational experience for your students:

1) Let students know what to expect before the field trip.
- Show them a map of the exhibit halls and where to find exhibit clusters
- Make a list of exhibits to visit before arriving at the Exploreum
- Clearly convey all school and Exploreum rules for field trips

2) Allow students some time for free exploration, and some time for a more guided experience.
- Free exploration of exhibits helps students choose areas of interest
- After some time for free exploration and orientation to exhibits, guide students to exhibits of your choosing that help meet your educational goals for them

3) Follow-up with an activity related to the field trip back at school.
- Field trips provide excellent advance organizers or motivational experiences
- Learning from field trip experiences is greatest when topics discovered are re-examined in school
- Choose one area of the field trip – perhaps one exhibit – for follow-up

4) Help students to see connections between the field trip and school.
- Choose an exhibit for follow-up that is related to your current topic of study
- Allow students to discuss and explain parts of the field trip that were familiar to them because of their work in school

5) Remember that Exploreum staff are here to help create a smooth experience.
- Let the Exploreum staff know what we can do to help you and your students
- Exploreum staff are here to help logistically and educationally

Notes

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