



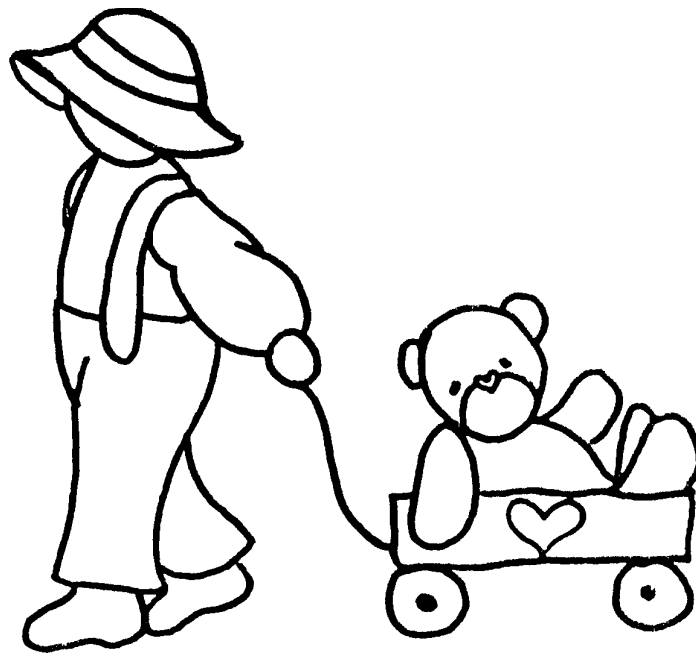
Applied Science

Our Technological World



SIXTH GRADE

PHYSICS



3 WEEKS
LESSON PLANS AND
ACTIVITIES

APPLIED SCIENCE OVERVIEW OF SIXTH GRADE

SCIENCE AND MATH

WEEK 1.

PRE: *Investigating critical thinking.*

LAB: *Exploring topology of a closed surface.*

POST: *Exploring how math and science are related.*

WEEK 2.

PRE: *Exploring how mathematical sequences are found in nature.*

LAB: *Exploring design.*

POST: *Designing an experiment.*

WEEK 3.

PRE: *Discussing how fibers become fibers.*

LAB: *Comparing and contrasting different fibers.*

POST: *Investigating fibers present in your home.*



PHYSICS

WEEK 4.

PRE: *Investigating matter and its interactions.*

LAB: *Exploring the nature of motion.*

POST: *Exploring the different laws of motion.*

WEEK 5.

PRE: *Exploring the motion of fluids.*

LAB: *Observing and recording motion of fluids.*

POST: *Investigating fluids in motion.*

TECHNOLOGY

WEEK 6.

PRE: *Investigating Bernoulli's principle.*

LAB: *Experimenting with different types of gliders.*

POST: *Exploring forces that affect gliders.*

WEEK 7.

PRE: *Exploring how design can overcome friction.*

LAB: *Investigating aerodynamic design.*

POST: *Comparing rockets and airplanes.*

BUILT ENVIRONMENT

WEEK 8.

PRE: *Exploring living requirements in space.*

LAB: *Observing toys in space.*

POST: *Designing a space station.*

APPLIED SCIENCE - PHYSICS (6A)

PRE

Students use the scientific method.

OBJECTIVES:

1. Investigating matter and its interactions.
2. Comparing the four fundamental interactions.

VOCABULARY:

electromagnetic
force
gravity
interaction
strong nuclear
weak nuclear

MATERIALS:

worksheet

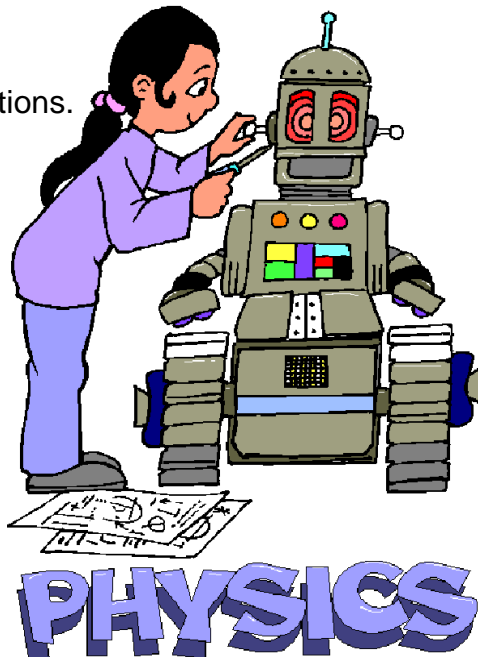
BACKGROUND:

Are you really at rest, when you sit down? When sometimes dies, do the atoms and molecules that make up that organism stop moving? Can you ever stop the spinning of a proton, neutron, or electron? Does our galaxy hang in the universe with no motion? The answer to these questions are all "no". Motion including spinning, velocity, acceleration, momentum and other terms, reflect this movement that all substances, large and small, are experiencing all the time. It is this motion that physicists must understand in order to explain physical phenomena. Motion can be accomplished by physical or electromagnetic waves. The study of motion is traditionally thought of as "mechanics". It is from all these motions that energy is emitted. Energy is created when matter moves, and since all substances are moving, energy is always being made even when an object is at rest. Terms like heat, solar, light, and sound refer to different forms of energy.

Observing and then describing nature is difficult. Precise definitions are needed. If the observations create a pattern, scientists can develop a mathematical formulation, that would help predict results. Other scientists, then attempt to observe and verify the prediction, through experimentation. As each prediction is verified, an understanding of the physical world slowly evolves.

Objects interact with each other. Many books refer to fundamental forces in the Universe. However, the word "force" is a very common term that means many things to students. In our terminology we will refer to interactions. There are four known interactions that seem to "rule" how all substances react. These include:

1. **GRAVITY.** An interaction that is a mutual attraction between masses is called



gravity. Any two particles of matter attract one another with a force related to their mass and distance between the masses. Drop a ball or pencil. Ask the students what causes them to fall down? Gravity attracts objects to the ground.

2. ELECTROMAGNETIC. Use examples of light, electricity, and magnetism to show electromagnetic interactions. They will hopefully remember this from the 5th grade curriculum. Many other forces we encounter in everyday life, like friction or tension in a rope are physical waves and not electromagnetic. Electromagnetic forces arise from interactions of charged particles.

3. WEAK NUCLEAR. The interaction that holds atoms to other atoms including how compounds are held together.

4. STRONG NUCLEAR. The interaction that holds atoms together. Fission and fusion of subatomic particles are the processes by which these interaction can be released as useable energy.

In the Integrating Science, Math, and Technology program we use the commonly accepted four fundamental interactions: gravitational, electromagnetic, strong nuclear, and weak nuclear. Please recognize that these may change as scientists collect more data on how matter interacts. These interactions try to explain how matter lives in harmony with one another. Each of these interactions has their own method of producing energy, motion, and heat. When looking at the entire Universe, gravity is considered the weakest interaction, electromagnetism, weak atomic, and strong atomic increasing in strength respectively.

Gravitation is predictable in that we can calculate how objects will react in a gravitational world. Mathematical formulas model the consequences exquisitely. It is the weakest of the interaction, yet it is the interaction that has created the universe. Scientists do not know if gravitation moves in waves, or in discrete units as the other 3 interactions occur. Is gravity matter and how does it react? Does gravity bend space and time, and how did it create such a chaotic Universe? Sir Isaac Newton's mathematical formulation of gravitational interaction is still used today. He stated that gravity increases in proportion to the product of any two masses and decreases in relation to the square of the distance between them. Einstein reformulated the gravitational concept to show that space and time become warped within a gravitational field (general theory of relativity). All the consequences of relativity are still being verified. For instance, inertia and gravity (if you look at the movement within the universe) can be seen as equivalent. Gravity holds us to the Earth, but if a person was in a box, and accelerated up, the person would fall to the floor and remain there as long as the enclosed box continued to accelerate. Most of the answers in understanding the nature of gravity are experiments that will involve far reaches of the Universe.

Many physicists feel that the three interactions of electromagnetism, weak, and strong all have a common mechanism. The structure of matter is affected by these interactions, acting inside of the nucleus (neutrons and protons) and electrons. Actually, the structure of matter includes other particles such as muon, pion, kaon, sigma and several hundred more. Protons and neutrons emit quarks and electrons emit leptons.

There are four types of quarks. The up, the down, strange, and charm quarks can be emitted during decay. These quarks and leptons all decay into particles called gauge bosons. Electromagnetism emits photons from their quarks and leptons. Weak emits "W" and "Z" bosons from their quarks and leptons, and strong emits particles called color gluons from their quarks and leptons. All these gauge bosons share a common mathematical description and similar physical behavior. Confusing, yes! The concepts however aren't confusing, electrons, protons, and neutrons are the basic ingredients of matter, and the other particles are for "flavoring."

The interaction termed electromagnetism is the net electrical charge of particles which is conserved throughout any reaction. All chemistry and hence all biology is a direct consequence of electromagnetic interaction of atoms and molecules.

The weak nuclear interaction was recognized with the discovery of radioactive decay by Henri Becquerel in 1896. Particles easily "escape" from the atomic structure over time. The energy of the original particles is conserved with new particles called neutrino or sometimes antineutrinos.

Strong nuclear interactions act on particles called hadrons which include protons, neutrons, pion, mesons, and baryons. This interaction is one of the strongest per unit of space known.

PROCEDURE:

1. You may want to introduce each of these interactions discussed above by demonstrating them. These interactions have their own type of motion that may be particular to that force. Within each of these major interactions make reference to different forces.

2. Give students the worksheet as a classroom discussion or homework assignment. The worksheet for the students should help them to begin classifying events that they see everyday.

3. **ANSWERS:** 1. gravity; 2. strong nuclear; 3. electromagnetic; 4. gravity; 5. electromagnetic; 6. gravity; 7. gravity; 8. weak nuclear; 9. electromagnetic 10. gravity; 11. gravity; 12. gravity; 13. electromagnetic; 14. strong nuclear; 15. gravity; 16. electromagnetic; 17. electromagnetic; 18. electromagnetic; 19. gravity; 20. electromagnetic

APPLIED SCIENCE - PHYSICS (6A) PRE

In the following list of activities classify them with respect to which interaction would help explain the situation. Use the interactions of gravity, electromagnetic, weak nuclear, or strong nuclear.

1. an apple falling from a tree	
2. atomic bomb	
3. magnetism	
4. why rocks fall down and not up	
5. listening to the radio	
6. falling down from a bike	
7. Solar system motion	
8. radioactive decay of particles	
9. a balloon sticking to a wall after rubbing the balloon	
10. the Moon revolves around the Earth	
11. the motion of a comet	
12. weight	
13. friction	
14. protons and neutrons in a nucleus	
15. tidal action of the oceans	
16. x-rays	
17. television	
18. microwaves	
19. shape of galaxies	
20. light	

APPLIED SCIENCE - PHYSICS (6A)

LAB

Students observe the laws of motion.

OBJECTIVE:

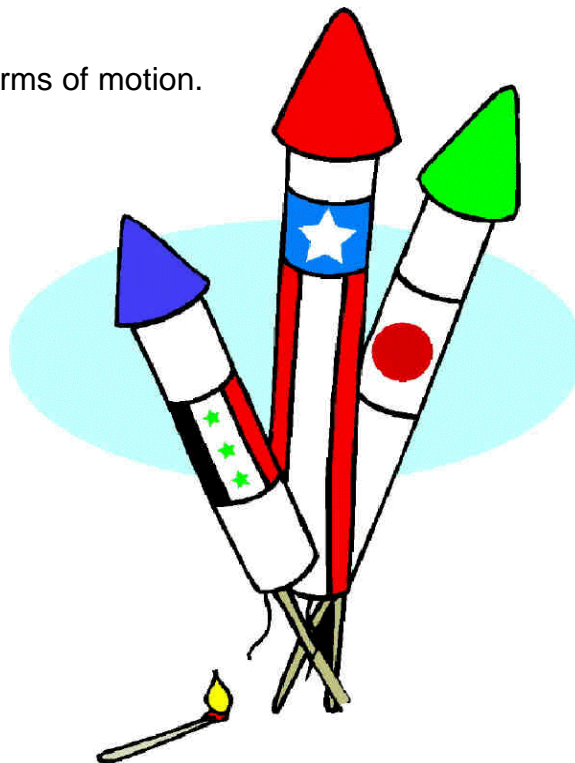
1. Exploring the nature of motion.
2. Observing and recording different forms of motion.

VOCABULARY:

gravitational attraction
gravity
interactions
motion

MATERIALS:

yo-yo
balls
balloons
force machines
orbiter
gyroscope



BACKGROUND:

Students have learned that there are 4 fundamental interactions that occur in our Universe. Emphasize that we don't fully understand any of the interactions. New data may change what is known. Physicists are in search for clues that will help understand our very existence. Scientists have long been looking for a Grand Unified Theory (GUT) to see if the 4 fundamental interactions are somehow connected. Physicists feel confident that electromagnetism, strong and weak nuclear are somehow related, but gravity acts separately and is difficult to describe.

In the overall picture of how and why our universe even stays together, there seems to be a link between gravity and motion. All substances, large and small, move. This motion could have been created through gravitational attraction of masses. Motion is complicated, there are many different forms, for many reasons. It is different types of motion that students will explore in lab.

It is important to get students to think about a universe that is full of motion from the smallest atom to the largest galaxy. Remind students that even as you sit still, we are moving. The Earth rotates on its axis, and revolves around the Sun. Our Solar System revolves within our galaxy and our galaxy is moving also.

Many scientists and mathematicians speculated about motion, but it was Sir Isaac Newton, a physical scientist and mathematician that lived in England from 1642-1727, who formulated his 3 laws of motion. He stated very simply his 3 laws of motion, which model

what happens on Earth. You may remind students that Newton is the person who many say discovered gravity when an apple hit him on the head. That story is a little exaggerated, but it was Newton's genius that unlocked many questions.

Newton's Three Laws of Motion are called First, Second, and Third Law of Motion,

FIRST LAW: An object that is in motion continues in motion in a straight line, at a constant speed, unless a force acts upon it. If it is at rest, it continues in a state of rest unless a force changes its direction. A body that resists change in motion is called inertia.

SECOND LAW: If an unbalanced force acts upon an object, the object will be accelerated. (Force = mass x acceleration.) Note mass is equal to the quantity of matter in a body and weight is due to gravity upon a body. The greater the mass the greater the force must be for acceleration. Gravity of the earth attracts objects in the air to the ground.

THIRD LAW: For every action there is an equal and opposite reaction. Forces always occur in pairs. For example pick up a book, the book is exerting down and your arm is pushing it up.

The post lab activity will summarize what they observed and provide students with a new set of vocabulary. The objective of the lab is to observe motion and to begin formulating ideas.

PROCEDURE:

Follow the lab sheets and have students carefully record their observation. There are 6 different stations that the students need to observe, so there isn't much time to play with the materials. Have the students work in groups of 3 or 4. They will need their lab sheet from the post lab.

1. **YO-YO.** Have students observe how a yo-yo works. Some students may be able to illustrate how you use a yo-yo. Don't be surprised if many students don't know how to work one.

2. **BALLOONS.** You may want to tie a string from a chair to a door top. The longer the string the more students can observe the reaction of the balloon. We suggest that you have a balloon with the straw attached to the top already. Use tape to keep the straw on the side of the balloon. Students then will just have to blow the balloon up and let it go.

3. **FORCE MACHINE.** Place the force machine on a flat stable surface. Remind students not to be rough with this toy because the strings easily get tangled.

4. **BALL.** Just place a small ball for the students to throw into the air. Be very specific about how and where you want them to throw it to avoid any breakage.

5. **ORBITER.** Place the Orbiter for students to follow directions from their lab sheet. Protect the toy so it doesn't get squished.

6. **GYROSCOPE.** Place the gyroscope, string and plastic pedestal on a flat surface. If you want to get fancy, you may want to put out other items that the gyroscope can balance on. See the written material on the gyroscope container.

APPLIED SCIENCE - PHYSICS (6A)

PROBLEM: How many different types of motion are there?

PREDICTION:

PROCEDURE:

Go to the appropriate stations and answer the questions below. Be careful not to break any of the toys.

YO YO.

1. Can you make the yo-yo go up and down? _____
2. Watch each student in your group and describe the motion of their yo-yo. You can give more than 1 chance. Record your information below.

NAME	DESCRIBE MOTION OF YO-YO

BALLOON. First, stretch out the balloon. Blow it up and hold onto the mouthpiece so no air escapes. Put a piece of thread through a one inch piece of straw. Then tape the straw to the balloon. Now tie one end of the string to a chair and hold the other end. Release the balloon and watch it move along the string. Try tilting the string upwards.

Describe the motion:

FORCE MACHINE. Pick up the amount of balls on the data chart and record what happens when you let the ball or balls go.

NUMBER OF BALLS	DESCRIPTION OF MOTION
1 ball	
2 balls	
3 balls	

BALL. Toss a ball at least 3 meters into the air. Describe the motion.

ORBITER. Place your fingers in the handles. Wind the string up by flipping wrists in a circular motion. Pull hands out rapidly. Alternate outward and inward. Describe the motion.

GYROSCOPE. Hold the frame firmly in your hand. Thread the cord through the small hole near the top of the spindle. Turning the wheel carefully let the cord wind around the spindle from hole to hub and back again. Now pull the cord away from the gyroscope with a quick, strong motion. Describe the motion.

CONCLUSION: Describe the different motions you observed?

APPLIED SCIENCE - PHYSICS (6A)

POST LAB

Students look at lab materials again.

OBJECTIVES:

1. Describing motion.
2. Exploring the different laws of motion.

VOCABULARY:

acceleration
centrifugal
centripetal
friction
rotate

MATERIALS:

lab sheet from previous lab



BACKGROUND:

Students may have had trouble describing some of the motions that were observed during lab. The words below are very crucial to understanding motion, take care that students understand the scientific terms, which may be different from the common usage of the words.

Rotating and spinning both refer to an object that turns on its axis. The yo-yo, gyroscope, and orbiter can be described in part as rotating on an axis.

Centripetal force is an inward force or center seeking force that causes an object to follow a circular path. Centrifugal force is an outward force, the reaction to centripetal force. You are sitting in the center of the rear seat of a car. The driver suddenly turns left rounding a corner, with tires squealing, in a wide circular arc. You find yourself sliding across the seat to the right and you remain jammed against the right interior wall of the car until the driver straightens. Centrifugal force pushes you outward, but the wall of the car pushes you inward an effect of centripetal force.

Speed is a basic property, and defined as a body that travels a certain distance in a given time. An automobile for example, travels so many miles per hour. Speed is simply the ratio of distance traveled per time (speed = distance/time).

When we describe speed and the direction of motion we are specifying velocity. If we say that a body moves at a rate of 40 miles per hour to the north, this is velocity. Constant velocity implies constant speed and direction. A car on a circular track may have a constant speed but the velocity is changing.

Any change of speed or velocity is called acceleration, In a car, acceleration would be called "pick-up." It is the rate of change, which refers to a decrease or increase of speed.

PROCEDURE:

1. Go over the previous lab materials in more detail, using the information provided below.

YO-YO - The string is not tied to the axle but looped around it. Yo-yo reaches the bottom and the yo-yo keeps rotating. The yo-yo keeps spinning (sleeping) until you "wake it up" by tugging on the string causing it to climb. The yo-yo rolls down, the string with a constant acceleration as stated in Newton's second law of motion.

FORCE MACHINE - For every action there is an opposite and equal reaction. When you lift one ball the energy is released when it hits the other balls. The energy goes through the balls and emerges when the last ball releases the energy. Theoretically the balls should go forever, but the energy will dissipate because of friction.

BALL - Throwing the ball up toward space can be explained by Newton's first and second laws. The ball is thrown and will continue unless friction and gravity didn't force it down. The second law of motion explains the speed that a student throws it. Notice that the motion of the ball at the beginning will be different because each student will accelerate the ball differently.

BALLOON ON STRING - The balloon going backwards illustrates that for every action there is an equal and opposite reaction. The balloon loses air that reacts by moving along the string.

ORBITER - The orbiter can rotate on its axis (the string), but the plastic fins are pulled outward by centrifugal force and inward by centripetal force. The speed of the axis determines the shape. The faster the spin the greater the tendency to go outward.

GYROSCOPE - A gyroscope is a wheel mounted so it can freely rotate in any direction. Once the wheel is spinning the mount can be turned in any direction and the wheel will continue to spin in the same plane. Unless an outside force stops the gyroscope it can continue, even if it looks like it should fall down.



APPLIED SCIENCE - PHYSICS (6B)

PRE LAB

Students observe demonstrations of how fluids move.

OBJECTIVES:

1. Exploring the motion of fluids.
2. Defining a fluid.

VOCABULARY:

density
fluid
pressure

MATERIALS:

glass of water
spray can (i.e. air freshener)
tube of toothpaste
piece of wood and container of water
a bottle with water that you can drill a hole in the bottom
Internet



BACKGROUND:

A fluid, unlike a solid is a substance that can flow. Fluids can be of two types liquids or gases. The difference between a liquid and a gas is the positioning of the molecules. In gases the molecules are much farther apart than a liquid. This does not prevent either substance from flowing. Unlike solids where mass and the amount of force exerted on the mass controls the motion, fluids move in response to density and pressure.

The following are some of the fundamental principles that will be observed in lab. You may want to use examples to illustrate these principles. In lab, we will not ask students to figure out which principle applies to the different stations, because often there is a combination of principles at work. The lab will center around observing how fluids move. Stress to students that pressure within the fluid helps move it. The key objective is to introduce that fluids have motion just like solids, not to memorize the different principles.

Pascal's Principle. A change in the pressure applied to an enclosed container is transmitted without change throughout the fluid and acts in all directions.

Archimedes' Principle. A body immersed in a fluid will be buoyed up by a force equal to the weight of the fluid that it displaces.

Bernoulli's Principle. The pressure in a fluid decreases with increased velocity of the fluid. (The faster the liquid moves, the lesser is the pressure in that liquid.)

PROCEDURE:

1. Ask students to describe how they think fluids move. You may want to discuss what a fluid is. Students may not realize that anything that “flows” is a liquid. Most of their experience is with water, so the idea that toothpaste is a fluid is not familiar with them.

2. Demonstrate the following principles to students.

Pascal's Principle

An example would be when you squeeze one end of a tube of toothpaste. This principle is also the reason behind the Heimlich maneuver, in which a sharp pressure increase applied to the abdomen is transmitted to the throat, thereby ejecting any food particles that was lodged in the throat. The hydraulic pump is also an example.

Archimedes' Principle

An example would be a piece of wood floating on water. The wood will continue to rise out of the water until the force acting on it has decreased to a point equal to its weight. The piece of wood would be in equilibrium as it floats. Bubbles rising in the water would also be an example.

Bernoulli's Principle

A vivid example would be if the pressure of swiftly moving air inside the tornado is lower than that of the stagnant air in the house. The air inside the house blows the roof off. Liquid initially at rest in a container exerts a pressure on the sides. The pressure is reduced if there is a break at the bottom of the container. This type of motion is important to understand how lift occurs in airplanes. Bernoulli's Principle will be highlighted in a later activity.

3. Ask students again if they have any experience with fluid movement, and see if the list will grow. You may want students do a search on “fluids” on the Internet, to see if they can find more examples of fluids.

APPLIED SCIENCE - PHYSICS (6B)

LAB

Students experiment with fluids.

OBJECTIVES:

1. Identifying motion in fluids.
2. Observing and recording motion of fluids.

VOCABULARY:

fluid
motion
pressure

MATERIALS:

Applied Science - Physics (6B) or
hand boilers
density timer
gliders
puddle jumpers
tour of bubbles
pipe with small ball
tornado tube
sand timer
wave machine



BACKGROUND:

Motion in fluids is different from motion in solids. Gravity affects solids much more than fluids. However fluids are influenced by density and pressure. For examples, ask students how a straw works? Many of the students will say that you "suck" up the soda. However, the pressure in the straw is reduced and allows the weight of the atmosphere to press the liquid up into the straw. Would a student be able to use a straw in an open container in space? No, there is no atmospheric pressure, so containers have to be sealed to work. It is difficult for students to realize that pressure will cause such movement.

The principles that influence motion in fluids also influence motion of gases in the same way.

PROCEDURE:

1. This goal of this lab is to see if students remember the principles that you demonstrated in the PRE LAB. Students do not have to know the physics behind the principle, just to begin to recognize these principles all around us. These toys are not the only items that show fluids moving. You may want to exchange other items, if you do not

have these available.

2. The following helps guide students inquiry using each of the items listed in materials.

TOUR OF BUBBLE - Have the students flip the tube over when the bubbles stop moving. As the students are doing the lab make sure they observe the shape of bubbles and how they move. Air is trapped on one side and when you flip it over the air, since it is lighter will rise through the denser liquid. This illustrates Archimedes's principle, which explains why bubbles rise.

SAND TIMER - Have the students flip the tube over when the timer inside reaches the top. Students should try to decide if the sand in the timer has anything to do with the movement. It does not, the timer is actually just a bubble, which illustrates Archimedes' principle as in the Tour of Bubbles.

DENSITY TIMER - Have the students watch one liquid displace the other liquid as you keep flipping this density timer. One liquid is heavier than the other and falls through, but it also displaces the less dense liquid and pushes it upward. This is Pascal's principle in action. The stream of liquid continues as drops when all the air is pushed up. As the air is pushed up it makes it look like a volcano, because the air is the least dense of all so it moves quickly through both liquids.

WAVE MACHINE - similar to Density Timer

TORNADO TUBE - You must get two containers (plastic liters from soda). Fill one of the bottles $\frac{1}{2}$ to $\frac{3}{4}$ full of water. You may want to put a little bleach to prevent bacterial build up and food coloring (to look better). Demonstrate to the students a few times how to swirl the top of the bottom and the water will rush down. The connection, where the two bottles are joined, increases the fluid velocity. The pressure is then released once the water goes through the constriction and slows down. The vortex that pushed the liquid through the tube is maintained. This is an example of Bernoulli's principle, but this one is difficult to fully understand. Remember these exercises are to just show students different types of fluids.

TORNADO BOTTLES - This also illustrates Bernoulli's principle.

BIRD GLIDER - Students should throw the glider and see what happens. Have the students take the nose piece off and have them throw it. Notice that the motion is circular without the nose cone. Bernoulli's principle is at work.

PUDDLE JUMPER - Hold the puddle jumper firmly at the back of your left palm with your right fingertips. Make sure your fingers are straight and rigid. Keep your thumbs down. Always point the puddle jumper away from yourself and others. Tilt the puddle jumper forward, away from yourself at an angle. The puddle jumper will fly in the direction the stick is pointing the propeller. Keep it pointed forward while you spin it so it flies forward when

you let it go. You must spin the puddle jumper counter clockwise. Launch it with only one stroke. Always push your right hand forward. Squeeze the stick and roll it forward to spin the propeller. Keep squeezing all the way down your left hand as you spin the stick. Spread your hands apart to release the stick as you roll past your left fingertips. Lift is the force that pushes the puddle jumper upward through the air. When you spin the propeller the energy is stored as momentum by the mass or weight of the propeller. It will continue to climb higher and higher until it is overcome by the forces of friction and gravity. Bernoulli's principle contributes to the lift.

TIMES UP - Have the students turn the item and watch the particles move. The particles are lighter than the liquid. The principle is like the density timer, except one of the mediums is not liquid. The liquid is heavier than the particles and falls through, but it also displaces the less dense particles and pushes them upward. This is Pascal's principle in action.

HAND BOILER - A student should hold the hand boiler in the palm of their hand. They should hold the bottom chamber, but not squeeze it. The liquid will move upwards and looks like it is boiling, but it is not. The heat of a warm hand will affect the molecules of the liquid and make them expand. This changes the pressure in the bottom chamber. The pressure then forces the liquid to rise first and then the air that is trapped in the chamber also will rise. When the air moves into the liquid it makes it look like you are making it boil. This is an example of Pascal's principle with the air in the tube acting like a fluid. CAUTION: This toy is made of glass, students should handle with care.

PIPE - Students should blow into the pipe and try and balance the ball so it looks like it is floating. Bernoulli's principle is being demonstrated. The movement of the air (fluid movement) causes pressure to be greater under the ball and less on the top of the ball. This pressure lifts the ball.

APPLIED SCIENCE - PHYSICS (6B)

PROBLEM: How are fluids influenced by motion?

PREDICTION:

PROCEDURE: Go to each of the stations and follow your lab sheet.

TOUR OF BUBBLE. Flip the tube until bubbles start rising. Describe what you see. Take note of the bubble size, shape and speed. _____

SAND TIMER. Flip the tube until the timer moves upward. Describe what you see. What is causing the timer to move upwards?

DENSITY TIMER. Flip this 5 minute timer over and observe the motion. Make sure you flip it over when each chamber has just one colored liquid. Describe what happens to both liquids. Describe the speed and size of the drops as they fall.

TORNADO TUBE. Put the bottle with the water upwards and swirl the top bottle. A water funnel (vortex) will appear. Describe the motion. What is the reason for the vortex?

TORNADO IN A BOTTLE. Twirl the bottle in a circular motion very quickly. Describe the motion. What is the reason for the tornado? _____

BIRD GLIDER. Secure the nose piece and throw the glider. Take the nose piece off and throw the glider. Describe the difference in motion. Why do you think this is occurring.

PUDDLE JUMPER - CAUTION: NEVER POINT THE PUDDLE JUMPER AT YOUR FACE OR ANY OTHER PERSON. Hold the puddle jumper firmly at the back of you left palm. Keep it pointed forward while you spin it so it flies forward when you let it go. Describe the motion. What makes the jumper fly?

TIMES UP Describe the motion. Why do the particles float to the top?

HANDBOILER - THIS IS GLASS, DO NOT SQUEEZE. Place the handboiler in the palm of your hand and gently hold. Describe what happens. Why does it look like it is boiling?

PIPE - Blow gently into the pipe without putting your mouth to the pipe. Describe what happens.

WAVE MACHINE - Move the wave machine side by side? Describe what happens. Which other toy is this wave machine similar to?

CONCLUSION: How many ways do fluids move?

APPLIED SCIENCE - PHYSICS (6B)

POST LAB

Students use air pressure to “suck” an egg into a bottle.

OBJECTIVES:

1. Investigating fluids in motion.
2. Demonstrating how air moves because of changing pressure.

VOCABULARY:

expand
pressure

MATERIALS:

boiled egg
paper
match
bottle with an opening a little smaller than the diameter of the egg



BACKGROUND:

The atmosphere is mainly composed of the gases oxygen, nitrogen, and carbon dioxide. Air molecules are constantly in motion, bumping into each other with a certain force. When air is heated, the molecules move faster and hit each other with a greater force, hence the air expands. The weight that the air exerts is called atmospheric pressure. Atmospheric pressure decreases the higher you go up in elevation. This is why some people might feel more tired at the top of the mountain than at sea level. Oxygen is less abundant the further you go from the surface of the Earth.

PROCEDURE:

1. You may want to go over the LAB materials to make sure students observed this motion of fluid. Many students will want to play with the materials and may prevent going into detail on each of the items. Use this post lab to complete the material. If you have completed the lab we suggest that you demonstrate other "fun" examples of fluids in motion. The case of the "dieting egg" can illustrate how pressure not only moves objects, but can actually force objects through an opening.

2. You may want to do this experiment with your students and then challenge them to repeat it. Remind students to do this experiment with an adult present.

3. You will need a peeled boiled egg, a bottle with an opening just large enough to prevent the egg from falling through, a small piece of paper and a match. Set fire to a small piece of paper. Place the paper into the bottle and quickly place the egg on top of

the bottle. The egg will plop into the bottle!

4. The fire heated the air inside the bottle causing the air to expand and with some of the air molecules escaping from the top. With less air in the bottle (decreased pressure) than the outside (greater pressure) the egg is pushed into the bottle. Students cannot see the motion of the air, but it is occurring.