Physics is Fun!

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A series of activities and experiments introducing concepts in physics and astronomy, aimed at grades 1-6.

Contents:

<u>Physics is Fun!</u>

1. <u>Electric and Magnetic Forces</u>

Begin with safety discussion. In particular, be careful not to pinch fingers with the magnets!

Background

What is a force? A force is simply a push or a pull, and there are different ways nature can give these pushes and pulls. We will look at two types of forces in this activity - magnetic and static electric forces.

Materials

- Magnets
- Paper clips
- Paper bowls with water
- Toy cars with magnets taped on top
- Empty aluminum cans
- Balloons
- Water bottle with a hole poked in the lid
- Plastic wand/rod
- Piece of wool

Magnetic Forces Activity

- Give each student a magnet and paper clip to play with. Can they lift the paper clip off their desk with the magnet?

- Using the magnets and paper clips, have kids explore if the magnetic force works through a desk, chair, their hand, etc. If you put two magnets together, does the force get stronger? Put the paper clip and magnet in a bowl of water. Does the magnetic force work through water?

- Give the students a matchbox car with a magnet taped on top. Using the magnet their hand, challenge them to propel the car both forward and backwards *without moving the hand holding the magnet.* Eventually, they will figure out they have to flip the magnet in their hand to change the direction of the force (to go from pushing to pulling), introducing them to the concept of the poles of a magnet. Similar poles repel (i.e. when the two north poles are aligned, the magnets will repel), opposite poles attract (i.e. when the north and the south poles of two magnets are aligned, the magnets will attract).

- If there is time, students can explore objects in the room that are magnetic. What do they notice about the objects the magnets stick to?

Electric Forces Activity

- Give the students a balloon and aluminum can and challenge them to move the can (lying on its side) without touching it. Eventually, they figure out to use the balloon's static electricity: for example, rubbing the balloon on hair builds up an electric charge on the balloon (they've pulled electrons off their hairs and put them on the balloon's surface!). This electric charge exerts a force (in this case, a pull) on the can.

- To explain the concept, demonstrate rubbing a balloon on your hair and watch the hair stick up. Why does that happen? We're made of tiny particles called atoms. Those atoms are made of tiny particles too. On the outside of the atom there are electrons. They have a special property called charge which allows the electron to exert a force on other particles that have charge. Some particles have positive charge and some have negative. When two positive or two negative charges are near each other, they repel. When opposite charges - a positive and negative - are near each other, they attract! The negatively charged electrons on the balloon are pulling on the positive charges in the aluminum cans.

- *Demo:* Using the water bottle with a pin hole in its lid, squeeze a steady stream of water from the bottle into a large bowl below. Note the water flowing straight down. Now rub an acrylic or plastic rod with wool, and bring the rod *near* the stream of water. Note how the water bends! See if the kids can figure out what force is causing the bending (static electricity). Put the rod in the stream of water and see if it still works. Why or why not? What else could be used to bend the stream of water? Try rubbing different objects in the room (e.g. a pencil, a marker, a glue stick, etc.! Let the kids get creative here!) with the wool and see which is able to bend the water.

2. Gravity, Black Holes, and Dark Matter

Again, begin with safety discussion - the steel balls in this activity are very heavy and can hurt toes!

Background

Have everyone stand up and jump in the air. What pulled us back to Earth? Gravity! Discuss gravity as a pull between any two objects with mass. The more mass something has, the stronger gravitational pull it will have. Do I “have gravity” (meaning, do I exert a gravitational pull on you)? Yes! Do you “have gravity”? Yes! Why don’t we smash together? Gravity is weak! The entire Earth is pulling on a paper clip, for example, to keep it on your desk or on the ground. All it takes is a tiny magnet I can hold in my hand to lift that paper clip up and keep it up. That means the force on the paper clip from a tiny magnet is stronger than the gravitational pull from the *entire Earth* on that paper clip*!*

Materials

- Balls of different masses
- Larger rubber sheets
- Heavy, dense steel balls (if possible)
- Paper plates
- Coins
- Tape

Objects Falling Activity

- Have the students work in groups of two or three. Each group has two balls of noticeably different weights (masses). The students will drop the balls from the same height at the same time, and determine which ball will hit the ground first. Have them record the results. They can also switch balls with other groups and try again.

- At the end of the experiment, record on the board the class’ results. Ideally (if the balls are dropped at exactly the same height and same time), the balls should land at the same time. *Although the gravitational force on the heavier ball is greater, it also takes more force to get it moving at the same speed as the smaller ball; these effects cancel such that all objects of any mass fall at the same rate!* Discuss the reasons why some groups may not have observed the objects hit the ground at the same time.

- Try this experiment with a ball and piece of paper. Why don’t they fall at the same rate? Air resistance! The force of the air on a flat, light object prevents it from falling as fast as it would just due to gravity (note that we did the experiment above with balls because their air resistance is negligible). If we could remove the air from the room, would the paper and the ball fall at the same rate? Yes! Check out these feathers and a bowling ball falling in a vacuum chamber: https://www.youtube.com/watch?v=frZ9dN_ATew

Curved Space and Black Holes Activity

- Albert Einstein (with some others) got really creative and decided to think of gravity in a different way: we can think of space as sort of "elastic" with a geometrical shape. A small patch of empty space will be "flat" like a sheet of paper (if we are thinking in two dimensions as opposed to three!). Massive objects like planets and stars and galaxies will cause space to curve (imagine how a bowling ball causes a trampoline surface to curve or sink in). The more mass an object has, the more space curves around that object (and causes nearby objects to fall toward it).

- Take a rubber sheet and have a few students hold it flat. Add steel balls of successive weights and observe what happens to the rubber sheet as heavier and heavier objects are added *(Careful that the balls don't roll off the sheet and onto someone's toes!!)*. What happens if a place a marble near the edge of the rubber sheet when a heavy ball is in the middle? It should fall right toward it, just like a heavy objects' gravity pulls objects toward it!

- Let's take this idea to the limit! Imagine squishing the entire Earth into the size of a marble and putting it on the rubber sheet - it would rip the rubber sheet! And anything that fell into the rip would no longer be able to roll around on the rubber sheet (i.e. space!). This is one way to think of a black hole. It is the ultimate limit of gravity - nothing (not even light) can escape its gravitational pull!

- A black hole is really just a lot of mass in a tiny space. The Earth (which is ~8000 miles across) would have to be squeezed into the size of a marble to make a black hole. The Sun (which is about 80,000 miles across) would have to be squished into a ball about 1 mile across to become a black hole!

- We observe black holes all over our universe, and most galaxies (including our own Milky Way) have a giant black hole in the center! But don't worry - there are none close to us and we are in no danger of ever falling in one.

If there is time, check out the following black hole movies:

- https://www.youtube.com/watch?v=e-P5IFTqB98
- https://www.youtube.com/results?search_query=black+hole
- https://www.youtube.com/watch?v=366_xfP_PtI (black holes colliding = ripples in space = gravitational waves!).

Dark Matter Activity

- In this activity, students will infer the presence of an object without seeing it, but by how it influences another object's motion (just like dark matter).
- Tape/glue three quarters to either side of the center of a paper plate, with hole punched in center.
- One person in the group will choose one spot to add an extra quarter.
- Tape another plate on top.
- Punch a pencil through the middle and see how the plate tilts (try rotating it). *Figure out where the extra quarter is (without seeing it)!*
- Try this several times with different configurations of the quarters. Can you figure out where the extra mass is without seeing it? How did you know? Is it easier to detect the quarters when they are near the center or the edge? Why?

3. Light

Begin with safety discussion. Don't shine lights in eyes. Careful with the motors.

Background

In this lab, students will relate the color of light to its energy and get a sense of how differently objects can appear when we look at them in different energies/wavelengths. They will first explore the colors/energies of the visible spectrum. After breaking white light into its color components using diffraction gratings, students will use motors and color wheels to get an understanding of why light appears white (when it is made up of many colors!). They will then use color filters to "de-code" color-coded messages, as well as make their own color-coded messages. Students will be able to see how filtering all but one color of the spectrum vastly changes how an object appears. If there is time, this concept will be extended to the non-visible spectrum.

Questions

Have you ever seen a rainbow? Where? What colors appeared in the rainbow? What does the color tell you about the light itself?

Materials

- Color Paddles (with diffraction gratings)
- Flashlights
- Motors
- Color wheels (a circular piece of paper divided up into equal “pie pieces” of different colors).
- Batteries
- Paper
- Crayons
- Picture sets or slides of astronomical objects observed in different wavelengths.

Procedure

- Using the diffraction grating (clear plastic) on the color paddle and a flashlight, have the kids “break” white light from a flashlight into its component colors - in other words, make a rainbow! Each color of light is a wave of different energy, with bluer light having more energy and redder light having less. This energy also corresponds to the wavelength of light - the shorter wavelengths have more energy, while the longer have less . When you pass the light through the diffraction grating (which is a piece of plastic with tiny little cuts), it bends the light - but higher energy light (blue) is bent less than lower energy light (red), so it spreads the white light out into all of its component colors!

- If white light is made of all of the colors of the rainbow, why does it look white? Have the kids break up into groups of three or four. Give each group a motor, a color wheel and a battery. Challenge them to turn the multi-colored color wheel into a single color (they will eventually figure out to attach it to the motor and get the motor spinning by hooking it up correctly to the battery). As the color wheel spins, it appears to be one color! This is analogous to why the colors of the rainbow - oscillating as waves and all mixed together - appear white to our eyes.

- Have the kids take out the color filters on the color paddles. Have them put a color over the flashlight and shine the flashlight on your desk. These filters only allow one color/energy/wavelength through and block out all of the others. *If there is time, you can try to “recombine” the colored light by crossing the beams* *of your flashlights (with different color filters over them). See if you can "make" white light this way.*

- Now let's work with just the red (lower energy light) and blue (higher energy light) color filters. Have the students look around the room through the red or blue filter. What color is the desk? The teacher? Your arm? How about the rainbow made with the diffraction grating? The students should record their observations. Again, the color filter blocks out all energies or wavelengths of light *except* that color. *Question: When you put the red and the blue filter together and look through that, will you see purple? No! You should see (almost) nothing (i.e. black). Why?*

- Have the students do the following: take out a piece of white paper and a red and blue crayon. Write a message in red and color over it in blue (not too darkly). Write a message in blue and color over it in red (don't worry if you're able to see the message). Now observe each message with the red and blue color filters. Which filter allows you to read the first message? The second? If there is time, use other colors to make color-coded messages and observe them with the various color filters. Record your observations. *Questions**:** Imagine living your life with only the red filter over your eyes. What color would the sky appear to you? How about the ocean? In some ways, we are living with a filter over our eyes - we can only see a tiny fraction (just a narrow range of colors or energies) - of the light that exists. What other kind of light do we know of?*

- Have the kids come up with types/energies of light our eyes cannot see. For example, those who've had the misfortune to break a bone probably got an X-ray - x-rays are high energy light our eyes cannot see (they can penetrate our skin and muscles, but not our bones!). Have they used a cell phone? Cell phones use radio light - very low energy light with a long wavelength to transmit signals, because it can travel through buildings and mountains. Have they used a microwave to heat up food? Microwaves are another type of low energy light our eyes can't see - a microwave oven shines this type of light on our food and it jiggles the water molecules in the food and heats it up!

- We're lucky that we can build cameras and telescopes that "see" light our eyes cannot see, so we can get pictures of objects in the universe in other wavelengths - gamma-rays, X-rays, ultraviolet, infrared, microwave, radio (in addition to the visible light our eyes can see). Looking at objects in other wavelengths/energies/colors of light helps us learn so much more about what they are and how they work!!

- Look at the pictures of objects observed in different wavelengths (see slideshow *MultiwavelengthPics)*. How do they differ?

4. Sound

Begin with safety reminder as always.

Background

We're all familiar with sound, but what is it? In the previous lab, we learned about light as waves of energy. Sound is another type of wave, called a pressure wave, which you can think of as "squishes" and "stretches" of the air (*it helps to demonstrate this concept with a slinky - as you slosh it back and forth between two hands, you can see parts of the slinky that are squished and parts that are stretched, much like a sound wave).* We can make sound waves by vibrating things (our vocal cords, a piece of glass, a drum surface, etc.). Ask the students what they think determines the "pitch" of a sound (the high-ness or low-ness) of a sound. If it has only a short distance between the squished and stretched parts (a short wavelength), how is it different to a sound wave with the squishes and stretches really spread out (a long wavelength)? Longer wavelength sounds are lower in pitch, while shorter wavelength are higher. We'll explore more properties of sound below.

Materials

- Paper cups with a small hole (made by a needle) in the bottom
- Fishing line
- Glass jars (ideally of equal size)
- Water
- Balloons
- Hex nuts

String Telephone Activity

- Students will work in groups of two with this activity. Give each group two paper cups (with a tiny hole in the bottom) and a fishing line. Challenge them to make "telephones" with the materials (they will figure out to thread the fishing line through the hole on the bottom of the cup - from outside to in - and tie a knot. The knot will be inside the cup and the fishing line will connect the two cups). If done right, even a whisper can be heard well through these telephones. Ask them to explain why they work. Have them try the telephone with the string slack and taut. Which transmits the sound better? Why? Have them grab the fishing line and try it - does it still work? How about around a corner? What does it sound like when you pluck the fishing line?

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Musical Glasses Activity

- Have the kids fill up 4 or 5 glasses to different water levels. Then have each group tap the glass with a spoon in turn. Ask them to identify the lowest and highest pitch sounds. How does it correspond to the amount of water in the glass?

Screaming Balloons Activity

- If there is time, put different sized hex nuts in some balloons (one hex nut per balloon) and blow the balloons up. Swirl the balloons around and listen. Does the size of the hex nut change the sound? How about the speed of the swirl? Have the kids try.

5. Solar Systems and Beyond

Begin with safety discussion. Never ever ever look at the sun with your eyes unprotected!

Background

Ask the kids if they can name the objects in our solar system. Go through the planets of the solar system in turn including the asteroid belt and Oort cloud. Remind them that all of these objects orbit our nearest star - the sun! In this active, outdoor lab, students will play the role of objects in our solar system and learn a bit about what keeps the planets orbiting the solar system. If there is time, students will get the opportunity to observe the sun with eclipse glasses!
Finally, students can design their own planetary systems, and share with the class.

Materials

- Tennis ball attached to a string

- Large outdoor space
- Eclipse glasses
- Paper and markers or crayons

Be the Solar System! Activity

- Assign each student to "be" an object in our solar system - i.e., the sun, the planets (even pluto), asteroids, comets. Have the sun stand in the center of a large field and line the kids up in order according to their roles (Mercury closest to the sun, then Venus, Earth, the Asteroids, Jupiter, Saturn, Uranus, Neptune, Pluto and Comets).

- When you yell "go", have the students run around the sun "in orbit" - staying their respective distances from the sun but running around it in a circle - for about 1 minute. Then yell "freeze". Did they stay in their orbits (is everyone in more or less the same relative positions they were at the beginning)? The kids find it highly amusing that "Mercury" sometimes migrates out past "Pluto" in this game.

- Back inside, ask the kids what actually keeps the planets in orbit. What keeps the planets in orbit? Gravity! Demonstrate this by throwing a tennis ball with a string attached to it (and holding on to one end of the string). When you throw the ball, the ball will go around in a circle. The string plays the role of gravity - our planets want to go flying off, but the pull of gravity from the sun is keeping them going around in a circle!

A Year on Pluto Activity

- Remind the students that a year is defined by how long it takes the Earth to orbit the sun once. Share with them the length of years on other planets (e.g. 88 Earth days for Mercury, 248 Earth years for Pluto). Give their ages on different planets (e.g. an 8 year old on Earth would be 33 years old on Mercury and 13 years old on Venus and 4 years old on Mars and not even close to 1 on Pluto!).
- Remind the students that a day is the time it takes a planet to spin around once on its axis. How long is Earth's day? Compare this to the other planets: Mercury's is 1392 hours, Jupiters is only 10 hours (have them imagine a 10 hour day - 5 hours dark, 5 hours light). Venus takes 116 Earth *days* to rotate around once! Note that the size of the planet or how far it is away from the sun has almost nothing to do with how long its day is.

Observing the Sun Activity

- If the weather permits, students can observe the sun directly with eclipse glasses. They should put the glasses on while looking at the ground, look up at the sun with them, and then look back at the ground to remove them. *Never look at the sun with your plain eyes or even with sunglasses, as this could result in blindness!!* Are any sunspots visible (small, dark spots on the sun due to intense magnetic activity)? Have them discuss their observations back in class.

Beyond our Solar System Activity

- Have the students consider whether there are other planets outside our solar system (orbiting stars other than our sun). There are thousands that have been observed, but billions out there! Ask them to consider if there is life on any of these other planets.

- Have each kid design his/her own planetary system. Consider the following:
    - How many planets are in your system? How many stars do the planets orbit?
    - What are they made of (i.e. rock like Earth, gases like Jupiter and Saturn or some other thing entirely)?
    - How hot is your planet(s)? Does it have an atmosphere? Does it have water?
    - Does it have a moon or several moons?
    - How long does it take your planet to *a)* spin once around (a day) and *b)* orbit its star (a year)?
    - What types of life do you have on your planet? Plant life? Animal life? What do they eat and drink? How long do they live? Are they intelligent life forms that use tools and communicate in some way? Describe and/or draw in as much detail as possible.
    - What will you name your planets?

6. States of Matter and Making Comets

Begin with safety discussion. Dry ice is frozen carbon dioxide and at a temperature of almost 100 degrees below zero. It is extremely dangerous if it touches skin or eyes - can "burn". Students must wear safety goggles and gloves at all times when deal with dry ice.

Background

Students will make a realistic replica of a comet, using dry ice, water, and organic materials. Students combine, water, dirt, ammonia, corn syrup and mix well (all elements of real comets). They then add dry ice (frozen carbon dioxide), mix and shape. What emerges after a few minutes is an oddly-shaped, very accurate replica of a comet.

"Comet" means "long-haired star" in Greek, but they are not at all stars - they are pretty much just dirty snowballs! You may notice we'll put some strange ingredients in our comet, like dirt and sugar. The dirt is made of silicates which are one of the ingredients of actual comets. But what about sugar? And the smelly ammonia? Scientists have observed actual sugar molecules in the solar system and this is one of the components of comets. So is ammonia (in fact, the atmospheres of Jupiter and Saturn are full of ammonia). These ingredients are called "organic" molecules because they contain carbon, oxygen, nitrogen and/or hydrogen (this is not the same as the "organic" food you might buy - that means pesticide-free), and are some of the building blocks of life. Do you think comets could play a role in the creation or destruction of life on planets? How?

Safety Discussion on Dry Ice

Dry ice is awesome and fun, but also dangerous. It is frozen carbon dioxide (the stuff you exhale with every breath, but frozen), and is at a temperature of about -100 degrees Celsius (that's 100 degrees below the temperature water turns to ice!!). This means touching it with your bare skin for even a second can leave you with bad burns that require medical attention. Please keep the safety goggles and gloves on for this experiment!

Something special about dry ice (and the reason they call it "dry") is that it *sublimates* at room temperature. That means that instead of melting, it skips the liquid phase and goes directly from a solid to a gas phase (the ice instantly "boils" and turns to steam).

Materials

- Safety goggles
- Insulating, waterproof gloves
- Buckets
- Heavy duty trash bags
- Hammer or mallet (to crush dry ice)
- Cooler (to hold dry ice)
- Water
- Dirt
- Corn syrup or molasses

- Ammonia
- Dry Ice
- Mixing spoons

Procedure

- Students should work in groups of 4 and everyone should have gloves and safety goggles on!

- Have one or two careful people crush up the dry ice with a hammer (keep it in a heavy duty bag as you crush it).

- Line your bucket with a garbage bag.

- Add 2 cups of water, and then ¼ cup of dirt and stir.

- Add a dash of corn syrup.

- Add ⅛ cup of ammonia.

- Add 2 cups of crushed dry ice.

- Stir for 30 seconds (careful not to rip the garbage bag!), and then let sit for 1 minute.

- Now carefully lift the garbage bag and (through the garbage bag), shape the material inside into a ball as best you can. Be careful to let the steam from the dry ice escape so the bag doesn't pop!

- After a minute or two, pull out your comet (with gloves on!). Don't worry if it's not a perfect ball - real comets aren't either!!

Questions: Do you think comets could play a role in the creation or destruction of life on planets? How? *Supplement with pictures of real comets!*

7. Down the Plank - Exploring Friction

Background
We all have a sense of what friction is. When we stand on ice, we slip. When we stand on a gritty rock, we don't slip and can even scramble up the rock. The more friction something has, the more "grip". This activity explores the concept of frictional force, and how it relates to the mass of an object (the heavier something is, the more it "grips" the surface) and the material it's made of.

Materials
- A wooden plank that can be used as a ramp
- Wooden blocks of about the same size, but various grain (some smooth, some rough grain)
- Wooden block of the same grain but very different weights (sizes).
- Other varied objects that slide (but don't roll; for example, a textbook, a mousepad, etc.)
- A lazy susan (or flat, circular surface that rotates).

Procedure
- Lay the plank flat on the ground and put a block of wood on the plank near one end.

- Lift up the end of the plank (the side on which the block of wood is resting) very slowly. Continue to lift it higher and higher until the block of wood begins to slide down the plank. Measure the angle of the plank when the wood began to slide down the plank.

- Do the same for the other blocks of wood of the same size, but of different grain/smoothness. Note how high (or to what angle) the plank has to be lifted to get each block to slide. *The smoother, finer grain blocks should slide before the rougher ones. These have less frictional force because of their finer grain and so don't grip the wood as well.*

- Take the two (or more blocks) that have the same grain but different weights and repeat the above experiment. Note how high the plank has to be lifted to get each block to slide down. *Even though these blocks are of the same material and therefore have the capacity to grip in the same way, the heavier block is harder to get sliding. It has more friction. The frictional force is not only related to the material properties but also how much force is directed down onto the plane of rest (normal force). The heavier block has a bigger normal force, and therefore can "grip" the plank better.*

- Try other objects (that don't roll) on the plank to get a sense of the frictional force they exert. *Note that objects that roll are exerting a static frictional force - they do not slide or slip down the plane and are always static at the point of contact!*

- ***BONUS***: If you have a lazy susan available, try putting flat objects (of varying materials) on the lazy susan and spinning it. Which objects slide first? How does it relate to:
  - The material of the object?
  - How fast you spin the lazy susan?
  - Where you place the object on the lazy susan (i.e. closer to the center or further away)?

8. Feats of Strength - Exploring Torque

Background

This is a short, easy activity to demonstrate the concept of torque (a measure of the force you apply to an object that can pivot or rotate). Have you ever been on a see-saw with a friend heavier or lighter than you? Was it difficult to go up and down evenly because one person always crashed down too hard? Have you ever tried to lift something very heavy off the ground and felt frustrated you couldn't do it? We will see in this lab that the further we apply the force from the pivot point, the easier it is lift heavy things, teeter-totter with a large friend, etc..

Materials

- A long plank
- A stable raised bar or other object on which to place the plank so it can act as a see-saw
- Objects such as rocks or other heavy and variable weight objects to place at the end of of the plank

Procedure

- Set up a plank over the raised bar or rock so it goes up and down in a stable way.

- Place a heavy object in a safely near the end of one plank.

- Press down on the plank right near the pivot point (where the rock is). Now move your hand out a bit away from the pivot and do it again. Continue to move your hand out toward the edge of the plank. Does it get easier to lift the heavy object as you go out? *The amount of torque you can apply to a system is not only the force you push with but that multiplied by the distance from the pivot point. The further away you are from the pivot, the more torque is applied and the easier it becomes to lift the object!*

- Continue to do this with objects of different sizes and with your hand pressing in different locations away from the pivot point.

- Think about how this concept is useful in your everyday life. For example, have you ever come across a very heavy fire door? Try pushing it open near the hinges. Then try again near the middle and finally at the opposite end of the door. What's easiest? Think about trying to lift a heavy boulder. Now imagine you could roll the boulder on the end of a plank which has a pivot in the middle (like a see-saw). Now could you lift the boulder? How? Think about two kids on a teeter-totter. One is heavy and one is light. How would you use this concept to even out the forces each kid puts on the teeter totter and make the game more fun for both kids?

9. Float or Sink - Exploring Density

Background

Density is just how "tightly packed" the atoms and molecules that make up a material are. If two objects are the same size, but one is much denser than the other, which will weigh more? Of course the denser one has more matter or "stuff" inside of it than the other. Density just means the mass of an object divided by its volume. This activity illustrates the concept of density and compares various objects' densities to that of water.

Materials

- Tub of water
- Rocks
- Plastic toys
- Wood
- Other random small objects

- Glass of water
- Oil
- Tin foil
- Pennies

Procedure

- Gather the objects to be put into water, and guess which ones will float and which ones will sink. One by one, place the rocks, toys, wood, and any other object in the tub of water. Note which float and which sink. *The objects that float are less dense than water, meaning they have less matter per volume than water does and water can support them. The objects that sink are more dense.*

- Pour water in a glass and then oil on top. Then pour oil in the glass and water on top. Which one is on top of the other? *What does that say about the two liquids densities? Oil is less dense than water so should always float on top.*
- Construct a small boat out of tin foil.

- One by one, place pennies on the tin foil until the boat sinks. How many pennies does it take to make the boat denser than water? *Think about a giant cruise liner boat made of heavy steel floating on the water. Which is more dense - the boat or water? The boat has to be since it floats. But how is that since it's made of heavy steel which definitely sinks? It's hollow and full of air which makes the entire object less dense than water.*