Tubularastic Roller Coaster

Summary

Through these activities students will observe and understand the effect of gravity on objects.

Materials

Tubulartastic Roller Coaster

- *I Fall Down*

  Set of keys
  A child's block
  Jar of honey or molasses or both
  Penny
  Individual key
  Button
  Roll of mints
  Lego block
  Apple
  Paper clip
  Tipsy cup
  Banana
  Feather
  Sponge
  Bar of soap
  Rubber bands
  Weight scale
  Science journal
  Clear vinyl tubing
  Science Journals
  Poster Board
  Marbles or balls of:
  Cork
  Wood
  Plastic, etc.
  Crayons
  Colored pencils
  Markers

Tubulartastic Body Coasters

Five or six feet of clear flexible one inch diameter vinyl tubing, one for each student partnership, or one per group (see back ground information)
Marbles of different materials (see above), for each partnership or group
Science Journals, one per student

Additional Resources

Books

- *I Fall Down*

  , by Vicki Cobb; ISBN; 0-688-17842-1

Media

- *Gravity is Attractive*

  , by Science FUNdamentals Item #70962902524

- *Magic School Bus Gains Weight*
  by Scholastic
- *Squibs*
  , by Ignite Learning ASIN#BOOOBJNUKM

Background for Teachers

Gravity is a force that many of us take for granted. We cannot see it, touch it, or smell it so how can this force affect us in our day -to-day lives. When introducing the subject of gravity, the teacher needs to talk about where this concept came from. Discuss Newton and his laws of physics with the students. Newton observed an apple falling from a tree. He developed new ideas about gravity and motion. Gravity is an unseen force that affects all matter. Matter makes up everything and it's the amount of stuff in a material body.

It may also be beneficial to talk about Galileo and Aristotle and how their ideas were different but they each had the right idea about gravity. Gravity not only affects our planet but the whole universe. The adding of this information will help in establishing a science base as well as introducing students to important scientists from the past.

Terms from the State Science CORE that students need to know when talking about gravity are: distance, force, gravity, weight, motion, speed, direction, and simple machine.

When preparing for the *Tubularastic Roller Coaster* activity you need to make sure that the diameter of the balls is small enough that it will fit in the tubing. If you get a small diameter of tubing, then the balls need to be smaller. You could also use balls such as shot, found at sporting good stores. If using shot, the tubing needs to be about 3/4 in. Be sure to check that the balls roll freely in the tubing. Marbles will probably be your best bet, since you can find marbles of different materials and weights just make sure the balls are all the same diameter. You may want a piece of tubing for each student or use one piece of tubing per group of students, use whichever works best for you.

Intended Learning Outcomes

1. Use Science Process and Thinking skills.
2. Manifest Scientific Attitudes and Interests.
3. Understand Science Concepts and Principles.
4. Communicate Effectively Using Science Language and Reasoning.

Instructional Procedures

Making a Science Journal:

Before beginning this activity you may want to have students make a journal. Journals are important tools for students as they do science. A journal provides students with a place to record predictions as they do the activities. The student can write important vocabulary that you want them to know and they can refer to their journals and the notes they have taken. Taking notes will help them develop a tool for gathering important information and then taking that information and writing summaries. The journal can also be used to record the data that will be used later on by the student to create a graph. Journals are important throughout all the subjects.

Invitation to Learn

Begin to read the book, *I Fall Down* by Vicki Cobb. As you read relate the things in the story to real life. For example, when the boy in the story throws the items up in the air you will do the same thing with your students. When he throws the keys, you will throw the keys you have, when he throws the block, you will throw the A block, etc. Then when it comes to the page where the boy is to take a spoon full of honey or molasses do the same thing but allow the students to watch it close up and hands on. This could be done as a whole group activity or you could break the students into groups and they can do the same things that the character is doing in the book, whichever way you would

rather do it is fine. Continue to read the book, using the items that are in the book. Ask questions along the way like why did the things fall back to earth? Why didn't the items stay in the air longer? Have them also make predictions along the way as well. Some students will be familiar with gravity. So use these students to your advantage. This will be a good time to have students write predictions in their journals, then check to see if their predictions were correct.

Tubulartastic Roller Coaster

Here are the steps for making a quick and easy student journal:

- Take two 1/2 x 11 pieces of white copy paper or another type can be used. Fold both pieces in half hamburger style.
- Take one piece of paper and cut a 1/4 inch slit on the folded part of the paper at each end of the fold.
- Take the other piece of paper and on the fold cut a slit on the fold but do not cut the edges of the fold. The slit should be almost the whole length of the fold, however leave about a 1/4 to 1/2 inch not cut on the edges of the fold.
- Now take the piece of paper that has the larger slit and open the slit. Put the other paper with the slits on the edge into the large slit on the other piece of paper.
- Manipulating the paper through the hole, pull the paper smooth so that the folds line up with each other, and straighten them out. They should line up to form a book.
- You can add more pages by just cutting paper like the first page above and pulling it through the longer slit page. You can also add lined paper or graph paper, just use the same method as above.
- You may add a cover by gluing a construction paper to the first page or any other type of paper you choose.

Instructional Procedures

- Model for the students (This part of the activity is done as a whole class): Have the students sit around so they can see clearly what you are doing. You can do this activity outside but keep in mind, the tubing works best when it is warm or at room temperature. If the tubing is cold, it does not work as well. Show the students the piece of 10 feet tubing. Ask, "What do you think I am going to do with this piece of tubing?" Wait for responses, hopefully someone will link it to gravity. You can write responses on the board or a piece of chart paper.
- Then show them two marbles of different materials (e.g., one steel, one wood, etc.) Tell the students that you are going to take these two marbles, one is made of steel the other of wood, (or whichever two marbles you decide to choose) and put them in the tubing-- each marble at different ends--and send them down the tubing, at the same time, until they reach each other. Place the tubing so it is higher on both ends with the center, about two feet of it, on the floor, with the poster board or butcher paper underneath the tubing that is on the floor. You will need to have a student holding up each end of the tubing as you do this activity.
- Ask the students, "What is going to happen when I release the marbles?" Wait for responses. Again you may write on the board, if desired. Then tell the students, "Each one of you, with a different color or crayon, marker or colored pencil, will predict where you think the two marbles will meet in the tubing." Try to give each student a different color if possible. "You are going to take your crayon and make a line or mark where you think the two marble will meet."
- Allow the student to do this. Have the two students that are holding the ends of the tubing switch with other students so they can predict as well. Ask some of the students, "Why did you mark it at that spot?" Once every student has marked their spots, have them write their predictions in their journals. "I think the marble will meet right in the middle of the tubing, etc. Then pose this question, "Which marble will get to the center of the tubing first?" or "Will they meet in the center at exactly the same time, or will the heavier marble get there first? Will the lighter marble take longer to get there?" You can have them discuss this, but then have them write it in their

journals.

Once all the writing in their journals is complete, and you have discussed their thinking, send the balls down the tubing. Depending on the tubing and size of the marbles they should reach the middle about the same time. Ask, "What happened? Why did the marbles do what they did?" Have them discuss their reasoning, and look to see who made the correct prediction. Ask the student why he/ she chose that spot to make their mark.

Tell the student that the forces of gravity act upon everything. So although the weights of the marbles are different, gravity pulls them down. Just like we read in the book, *I Fall Down* by Vicki Cobb.

Now try sending them through again, this time asking the students to really watch the marbles go through. Ask more questions, "Can you see how the balls move through the tubing. If the marbles seems to slow up, there maybe some friction inside the tubing to stop the marbles from falling quickly. Explain this to students that although when we drop objects of different weights, sometimes friction or air resistance can affect the objects. Refer to the video, *Gravity Attraction and Squibs* that talks about friction and air resistance that you can share with your students; it's a great video that shows examples.

Next, select two different marbles and have the students predict again where the two marbles will meet in the tube. Put down a different piece of butcher paper and again have the students mark on the butcher paper where they think the marbles will stop. Pose the same questions and see if their answers have changed. If they have changed their thinking ask them why they changed their predictions from the first activity? Again have the two students holding the tube switch with other students so they can predict. Write, again in their journals, how they predicted and why.

Send the marbles through the tube. Check the results on the butcher paper. Repeat this activity again until you have paired all the marbles up so the students can predict. If you have four marbles then you will have four separate predictions.

After you have run all the marbles down the large tubes you can extend the activity. Take another piece of tubing of the same length. Align the two tubes next to each other. Line them up so one end is about two to three feet off the group, the rest of the tube should be laid out flat on the floor. Tell the students they are now going to have races with the marbles. Decide which two you would like to race first. Again, it is a good idea to race two marbles of different materials and weights.

The students predict in their journals which marble will win. Try this again until you have raced all the marbles.

Bring all the students back to their desks for a class discussion, or you can leave them around the tubes. Discuss all the things that they just took part in. What happened to the marbles as they came down the tubes? Were all the marbles rolling at the same speed? Why? When we put the marbles in both sides of the tube, was there a difference in having the marbles race down separate tracks? Explain your thinking. Ask any further questions you would like to pose, to get their minds thinking about how gravity works.

After the discussion, have students reflect in their journals, encourage them to draw pictures, or use other ways to express what they have learned.

Tubular Body Coasters

Explain to the students that they will be put into partnerships. Each pair will get a smaller piece of tubing (like they used in the other experiment). They will also receive some marbles of different weights and materials. Now model for them how they will wrap the tubing around their arm. Hold one end toward your head and the other one wrapped around your arm, ending at your hand. Their task is to use the tubing and make different types of human roller coasters. They will be predicting in their journals, what they think will happen before they add each marble

to the tube.

Put the students into pairs, I use pop cycle sticks with the students' names on them. I pull a stick with a students name on it then the next stick I pull is their partner. I continue until everyone has a partner. Or I also have pop-cycle sticks that have paired stickers on them, for example I have two sticks that have a sticker of a yellow smiley face, two sticks that have a purple smiley face, etc. Stickers work great but I also use sticks that have colored circles on the bottom of the sticks, the student finds the other person who has a yellow circle, or blue square etc. You can use whatever works best for you.

Explain to the students that one student will become the holder, and the other student will be the one to put marbles in the tube. Tell them this is similar to what they did when the whole class used the larger tubing, however the tubing is smaller. Then the students will switch roles, so that each one will be able to be the human roller coaster.

Give each partnership a five to six foot piece of clear vinyl tubing and a set of marbles of different materials and weights. They can start exploring with the tubing and marbles. First, one student holds the tube while the other student drops one marble down the top of the tube. Before they begin, have them predict in their journals. What do you think the marbles will do? Ask about each of the marbles the steel marble. The wood marble, etc. "How can you make each marble go down the tube? How can you make the marble go down the tube to the end? They will use their bodies to move the marble through the tube. What did you do with your body to make the marble move?

Now make a loop in the tube. Just like on a roller coaster, curve the tube steeply downward into the loop to make the ball go faster. You may have to show the students how to do this part. Try this with each marble and write down the results in their journals. Which marble went down the fastest? Which marble was the slowest? Why did this happen? Tell the students that gravity is pulling the ball. It gives the ball enough momentum, or forward motion, to go around the loop. Note to teacher: Gravity pulls everything toward the center of the earth. Drag pulls against gravity. The straighter and steeper the drop, the faster the ball will roll. Tell the students "That's what makes roller coasters so fun!"

Ask them, if it makes a difference if you raise the other end up instead of going straight down your arm? Try different ways to loop the tube, around your neck, around your waist; let the students explore. You will be amazed at how many ways they can manipulate the tubing. As they are doing this, also remind them to try each marble of different materials.

How does the marble travel through the tube? Other questions to pose as the students are exploring, are what happens if you change the direction of the tubing, at a slope, around your waist, etc?" "What happens to the marble of steel, wood, etc? You may think of other questions so please use them.

Extensions

Have the advanced students do more research on Newton, Galileo, Aristotle, and DaVinci compare their theories on gravity. How are they the same and the difference? Which one of the three came the closest to what we know about gravity today? Have them present the information to the class orally, by power point, etc.

Design and draw a tubular roller coaster.

Have students write about a time they rode a roller coaster or write what they think it would be like to ride a roller coaster.

Those students who need special adaptations can be teamed up with a student who they are more comfortable with, a student who perhaps has worked with them in previous partner activity, or team three students together to help with the special need students.

Watch *Magic School Bus Gains Weight* and go to

http://teacher.scholastic.com/activities/index_grades35.htm to find some activities.

Family Connections

Allow students to check out the tubing to take home and teach their families what they learned about gravity.

- The Fly Away Moon Activity pdf

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Assessment Plan

Science Journals
Discussion questions
Write reflection in journals
Answer the questions from above in journals

- Galileo's Gravity pdf

Bibliography

Research Basis

Ozgun-Koca, S. A., (2001). *The graphing skills of students in mathematics and science education*, Retrieved January 27, 2007 from http://www.stemworks.org/digests/EDO-SE- 01-02.pdf

Making representations in math and science plays a very important role in education. Graphs can summarize complex information very effectively. . Although graphs are explicitly taught in mathematics classrooms as an end in themselves, many subject areas such as science or social studies utilize graphs to represent and interpret relationships. So being able to read or make graphical representations is a crucial skill for every student to learn. However, many researchers detected that many students lack graphing skills. The best way for our students to know graphs is to use them in every subject possible. Technology is a great resource for helping teachers in graphing activities. This article gives some great web sites for teachers to use in teaching the subject of graphing.

Haury, D. L. (2001). *Teaching science through inquiry*. Retrieved January 26, 2007 from http://www.stemworks.org/realmshomepage.html

The move in science education has moved from "learning about" science to "doing" science. Students at all grade levels should have the opportunity to use scientific inquiry and develop the ability to think and act in ways associated with inquiry, including asking questions, planning and conducting investigations. This means using appropriate tools and techniques to gather data, thinking critically and logically about relationships between evidence and explanations, constructing and analyzing alternative explanations, and communicating scientific arguments. The article talks about using the World Wide Web as an important tool for achieving success in science, not only for teachers, but students as well. Although experiencing science with hands on is the most critical part of learning science, the web can greatly enrich and extend inquiry approach to science teaching. The article introduces two approaches to using the World Wide Web, (a) through accessing data sets constructed by science projects or agencies, and (b) through collaboration with other school groups to produce data sets (network science projects). It lists many web sites for use in gaining more inquiry into science education.

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