Acknowledgements

In the effort of our group, we dedicate to each child that he or she will understand the concepts of physics. Every little piece of information gives us the knowledge to seek more about energy. We thank Dr. Hademenos for his time to help each student of making a difference in a child's eye.

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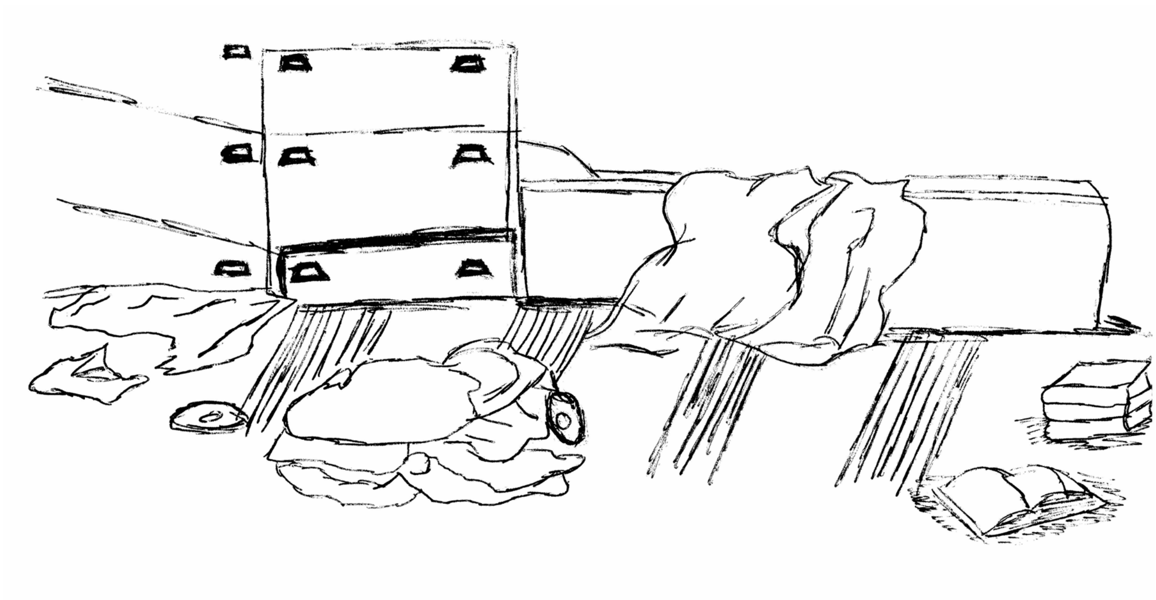
Chapter 1: Work



"I hate to waste any of this beautiful Saturday," Timothy tells his friends Earl and Pearl, "but I can't play until my room is clean."

"Then let's get cracking, Timothy," says Pearl. "We'll help."

"Thanks, guys," exclaims Timothy.

Timothy takes a look around his room and then starts to make a plan.

"Earl, grab an empty box from my closet, fill it with all of the books and magazines that are on the floor, take it to the bookcase, and put them in their place," pronounces Timothy. "Pearl, you take over the desk, putting all of the CDs in their cases, and throwing all of the trash away. And I will take care of the clothes on the bed."

Everybody nods their heads and get to work.

Soon everyone is busy. Timothy groups his clothes on the bed, separating them into socks, shirts and pants.

“I need 5 coat hangers,” says Timothy, as he made his way to the closet. In a flash, the clothes were put away.

“How’s it going, Pearl?” asks Timothy.

“I’m nearly done,” responds Pearl.

“How are you doing, Earl?” asks Timothy.

Earl carries a box of books across the room and drops them in a corner.

“I’m exhausted,” says Earl. “I can’t believe how much work I’ve done just in the past 15 minutes.”

“What do you mean?” asks Timothy.

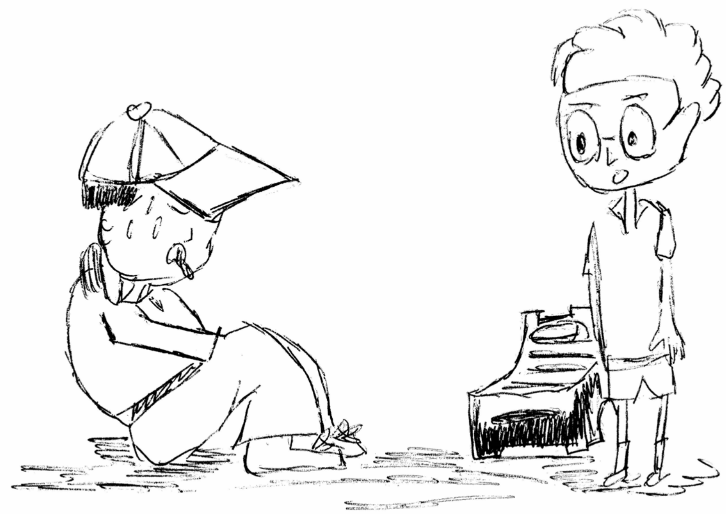
“Are you kidding me?” responds Earl. “I have been loading box after box full of magazines and books and carrying them across the room. See all of those boxes in the corner? That required work and I’m pooped.”

“Well, you may be pooped, Earl,” says Timothy, “but technically you haven’t done any work at all.”

“What?,” Earl snaps back. “Just look at the sweat rolling down my face.”

Timothy wanted to laugh, but he understood Earl’s frustration.

“You’ve been a great help with my room,” says Timothy but work is a word that has many definitions and meanings. When speaking about work in terms of physics, technically you haven’t done any.”



“I don’t care about physics,” Earl shouts, “cause I’ve worked the whole time.”

“You’ve exerted yourself, that’s for sure,” says Timothy. “Work is done when a force is applied to an object, causing it to move in the direction of the force.”

Timothy looks for his chair, grabs it and sets it down in the middle of the room.

“When I apply a force to the chair, what will happen?” asks Timothy.

“Well, the chair will move,” responds Earl, a little calmer.

“In what direction will the chair move?” asks Timothy.

“In the same direction that you push the chair,” answers Earl.

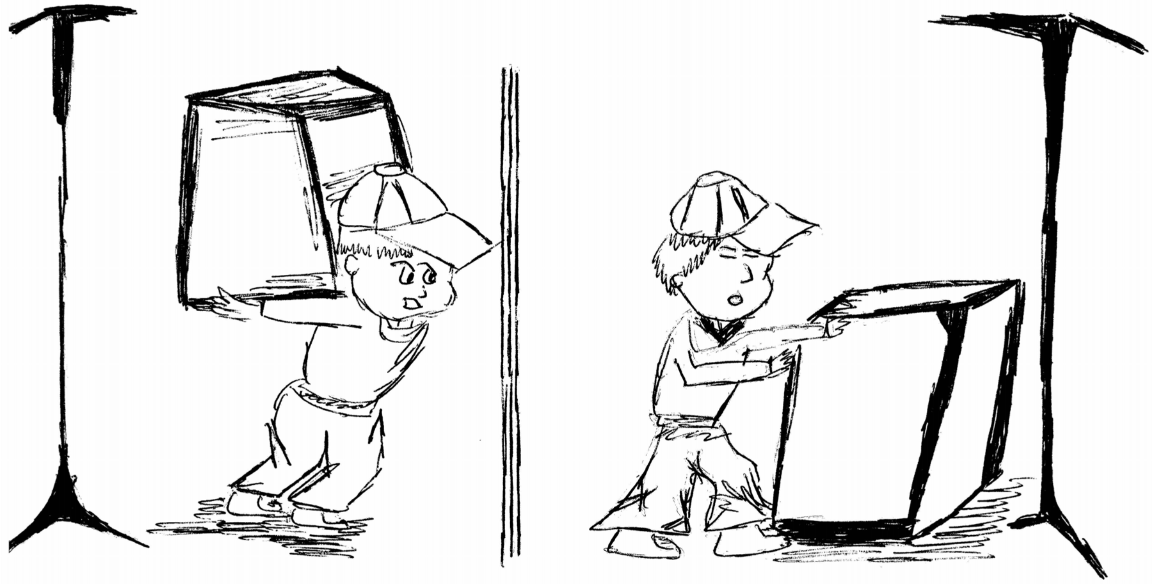
“Correct,” states Timothy. “When the force is in the direction of the motion of the chair, work has been done. But will exerting the same force on the chair always cause the chair to move?”

“I’m tempted to say yes,” answers Earl, “but you have that look in your eye when you ask your tricky physics questions so I’m not sure.”

“What would happen if I exerted the same size of force on the chair but in a downward direction?”

“It wouldn’t move,” says Earl.

“Absolutely,” exclaims Timothy. “In this case, no work was done because even though I exerted a force, the chair didn’t move.”



“Now, Earl, let’s return to the box of books” says Timothy. “When you carried the box of books, you were moving to the right but the force you were exerting on the box was upward because you were lifting the box. Therefore, you did not do any work. If you got down on your knees and pushed the box toward the right, work would be done because the force is in the direction of the motion of the box.”

“I see what you are talking about, Timothy,” says Earl. “I just wish there was a way to make work easier.”

“Well, there is, Earl,” responds Timothy. “They are called simple machines.”

“OHHHHH, I remember my science teacher teaching us about simple machines,” says Earl.

“Yes,” says Timothy. “There are six simple machines – lever, inclined plane, wheel and axle, screw, wedge and pulley – and all are designed to make work easier. In fact, one machine you could have used to make it easier for you to move the books to the upper shelves of the bookcase would be an inclined plane. Instead of lifting the box straight up, you could have pushed the box up an inclined plane, making the job easier for you.”

“So you see, Earl,” says Timothy. “When I said you had done no work, I meant it in terms of the physics definition. I could not have gotten the room clean in such a short time without your help. Thanks!”

“That explanation allowed me to rest.” says Earl. “The room is clean and I’m ready for the park. Let’s go!”

Try It Yourself Activity:
How Much Work to Raise a Book?

What you're trying to do

Work is required to lift any object such as a book. The work is defined as the force applied to the object (in this case, the force is equal to the weight of the book) multiplied by the distance in the direction of motion (in this case, the height the book is raised). The question to ask is: How can I raise a book 1 meter using the smallest amount of work? Your goal is to determine the angle of an inclined plane that will result in the smallest amount of work required to raise the book one meter.

Which inclined plane angle will allow you to raise a book one meter with the least amount of work?

This is where you make your hypothesis or an educated guess in an answer to the question: How can I raise a book 1 meter using the smallest amount of work? Will it be using an inclined plane with a large angle or without using an inclined plane at all?

What you will need

- A book (You may use any book but you may want to use a book that is hardbound and large such as a dictionary or a thesaurus.)
- Force meter
- String
- Scissors
- Meter stick
- Protractor
- Wooden board or plank
- Additional books of the same size
- Mass scale

What you will do

- Tie two pieces of string around the book – one piece around the height of the book and the other piece of string around the length of the book.
- Using your meter stick, measure a height of 1 meter and mark it with tape. Then place the hook of the force meter around the string at the top of the book and raise the book 1 meter. Look at the scale and record the reading of force on the force meter. Scales on a force meter are sometimes expressed in units of grams and in Newtons. Make sure you record your force value that is measured in Newtons (N).
- Now you are ready to create an inclined plane using the wooden board and books to elevate one end of the inclined plane such that the angle between the ground and the wooden board can be measured using a protractor. The elevated end of the inclined plane must be one meter above the ground. You will create inclined planes with angles of 30°, 45°, and 60° using as many books as needed.
- Now place the hook of the force meter around the same point and pull the book up the ramp. As you near the top of the inclined plane, record the force measurement in Newtons.
- Repeat the same measurements for the other inclined planes at the different angles.

What did you observe?
It is now important to create a graph from the data that you collected from your experiment. You will probably want to use a bar graph to display your results. If you are not sure about bar graphs or need help in creating the graphs, please look at the website below for help:

National Center for Education Statistics Create a Graph
http://nces.ed.gov/nceskids/createagraph/

- What do you notice from the graphs? Do you notice any trends or patterns?
- What do my results tell me about the work required to lift the book? Remember that work is the force exerted on an object over a distance. The force is the weight of the book and the distance is the height. But how is the inclined plane affecting the work required to raise the book? Is the angle of the inclined plane affecting the force exerted on the book? If so, how?
- How does the work required to raise the book vary with the angle of the inclined plane?
- How does the work on an inclined plane compare to just raising the book straight up without an inclined plane?

What do you think would happen if you…
- pulled the book by its side instead of at the top?
- pulled it up at a slower rate? At a faster rate?
- used a heavier book? A lighter book?
- used a different-shaped object instead of a book such as a wooden block or a glass bottle?
- used a wooden board for the inclined plane that was sanded? Painted?
- used smaller angles for the inclined plane? Larger angles?
- used a different type of string such as thread, twine, fishing line, rope? an elastic type of string such as a bungee cord?
- raised the book to a greater height?

If you had everything you needed in terms of materials and supplies, describe a method/procedure that you think would allow you to raise a book 1 meter with a minimum amount of work.

Chapter 2: Energy

Timothy was having trouble staying alert in math class and listening to Ms. Branmuffin explain a problem on the chalkboard. He kept putting his head on his desk and then jerked back up.

"Timothy," says Ms. Branmuffin when the bell rang, "I am concerned about you today. You're not acting like your normal, everyday, class genius kind of child. Is everything OK?"

"Yes, Ms. Branmuffin, I'm fine," answers Timothy. "I think I need some lunch."

"OK," says Ms. Branmuffin, patting his shoulder. "Get something to eat. Go on to lunch."

"Thanks, Ms. B." replies Timothy, already on the run.

Timothy runs to the front of the lunch line and is anxiously waiting his turn to get his food. Everything looks good to him. Chicken fingers, fries, macaroni and cheese, cherry cobbler, a roll with butter, chocolate milk and fried okra all find a place on his tray. Yes, even fried okra – and Timothy NEVER eats okra at home.

“That will be $2.75, please Timothy,” says Ms. Crocker, the head cafeteria person. “My, you must be really hungry today!”

“Like a horse,” Timothy nods.

Timothy takes his tray and sits next to his friends, Earl and Pearl.

“Hey, Timothy” says Stevie, from math class, “if you drop your head now, you’ll end up with cherry cobbler on your nose!”

Stevie has his laugh and sits with his friends.

“Timothy,” asks Pearl, “what was Stevie talking about?”

“It basically has to do with energy,” responds Timothy.

Pearl was left with a quizzical look on her face. “What do you mean energy? Pearl looks confused. “And what does energy have to do with keeping your head off of your desk?”

“Pearl,” responds Timothy, “for work to get done, there needs to be energy. In my math class, I couldn’t do any work because I didn’t have energy. Now, I have energy so now I can do work.”

“What energy?” asks Pearl. “All I saw was you gobbling down chicken fingers, fries, macaroni and cheese, fried okra, cherry cobbler and you did drink half of your chocolate milk – but when did you get energy?”

That food is energy – chemical energy to be exact,” responds Timothy. “We have to have chemical energy like food to help us do our best work at school. I forgot to have breakfast this morning and I was running out of energy during math class. So I put my head down on the desk.”

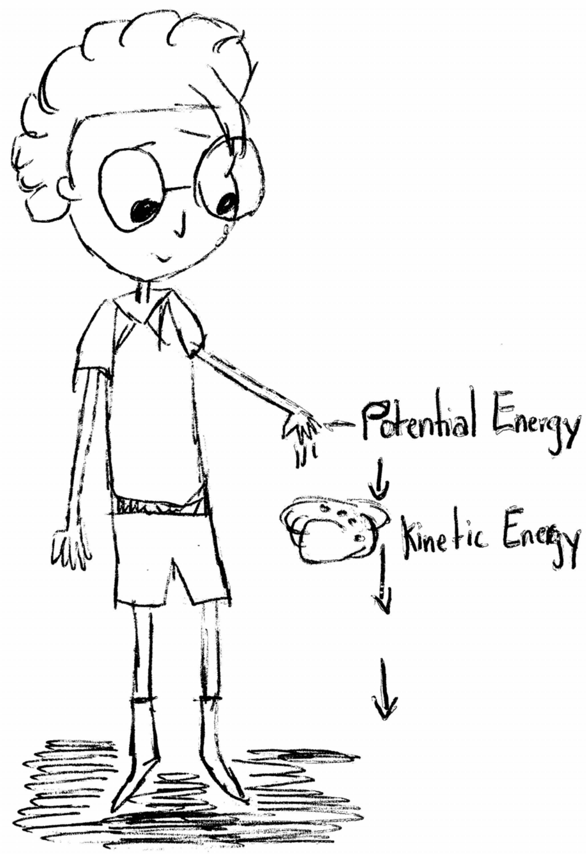
“I thought energy was gasoline,” Pearl says.

“The gasoline in our cars is another important example of chemical energy,” responds Timothy. “Gasoline helps our car to move down the road – or do work. Energy also exists as sound energy, light energy, electrical energy, magnetic energy, solar energy, and nuclear energy. For example, an object may have energy because of its position. This energy is called potential energy.”

Earl holds up his roll. “I have, in my hand, pure energy,” as he uses his mad scientist laugh.

“There’s another kind of energy called potential energy,” Timothy said, grabbing the roll from Earl.

“This roll has potential energy just because of its position. The larger the distance is between the roll and the floor, the more potential energy the roll has. If I raise the roll up even higher, it has more potential energy. Now, when I drop the roll, it will be moving. The longer it has to go, the faster it becomes and any object that is moving has another type of energy called kinetic energy. Any object or thing that moves, just like this roll when it is dropped, has kinetic energy. Any object that has either potential energy and/or kinetic energy has mechanical energy.”



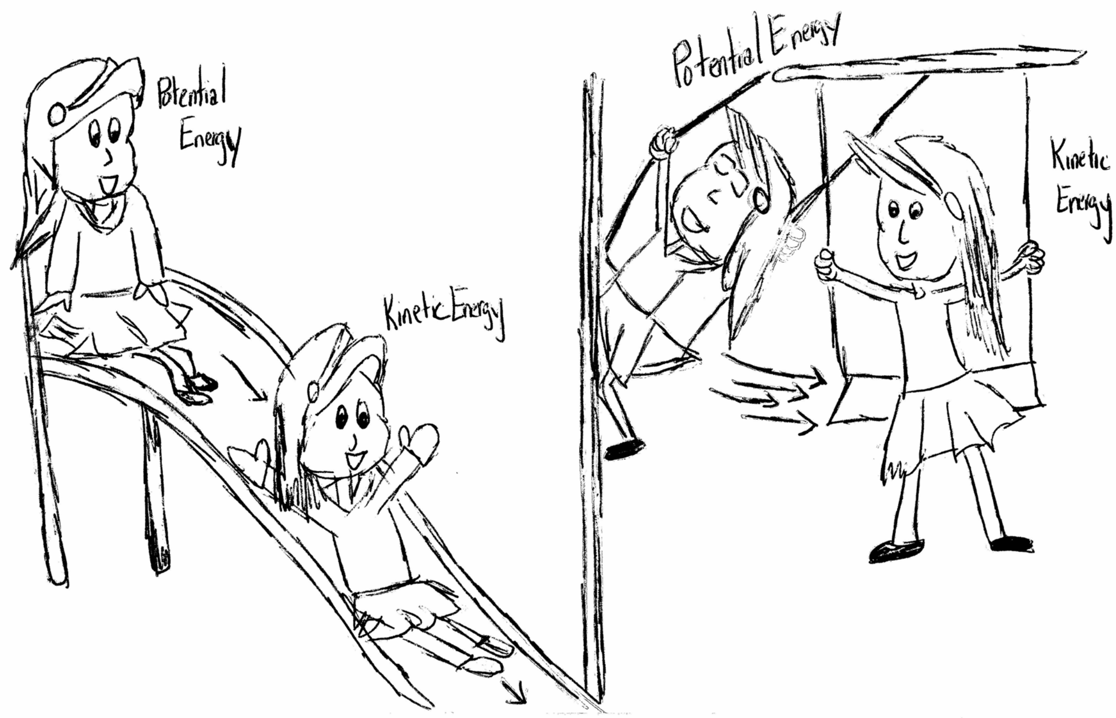
“Don’t drop my roll. I want to eat it,” Earl grabs air as Timothy moves the roll out of his way.

“How can the roll have potential energy *and* kinetic energy?” asks Pearl.

“Simple,” exclaims Timothy. “Energy is a conserved quantity. Conserved means that energy can change its form but not its amount. The amount of energy I have in the beginning is the same amount of energy I have at the end. This is called the Law of the Conservation of Energy. It says that

Energy can neither be created not destroyed, only transformed.

“When I suspend this roll one-meter high above the tabletop, it has potential energy because of its position. When I drop the roll, the roll begins to move faster and faster until it hits the ground. Just before it hits the ground, the roll has kinetic energy because it is moving. The roll didn’t make the kinetic energy itself. It was transformed from the potential energy it had before the roll was released.”


Potential Energy
Kinetic Energy
Potential Energy
Kinetic Energy

Earl jumps up and gets the roll before Timothy could make it a demonstration.

“Believe it or not,” Timothy goes on, “the park is full of this law.”

“Really?” responds Pearl.

“Absolutely,” proclaims Timothy. “When you are at the top of a slide, you have potential energy which is transformed into kinetic energy at the bottom of the slide. The higher the slide is, the more potential energy you have which means you will be going faster at the bottom of the slide and have more kinetic energy at the bottom.”

“I love the slides.”

“Do you like the swings?” asks Timothy.

“Yeah,” Earl says, his mouth full of roll.

“When you are at the top of the swinging motion, you come to a stop and have potential energy. At the bottom of the swinging motion, you are going fast which means the potential energy you had at the top has been transformed into kinetic energy at the bottom.”

Just then, the bell rings to let the students know that lunch was over and it is time to go back to class.

“Well,” says Timothy, “now that I have filled up on energy, I am ready to go do work again and this time it is my absolutely favoritest class ever – SCIENCE.”

Earl looks at him with a puzzled look.

“Did you just say *favoritest*?” asks Earl. “Is that even a word?”

“Yes, I did” responds Timothy. “And that’s probably why English is NOT my favoritest subject ever.”

Try It Yourself Activity:
Golfing with Swinging Energy

What you're trying to do
Energy exists in many forms but cannot be created. However, because it is a conserved quantity, energy can be transformed into different forms. One such example of the conservation of energy is the conversion of potential energy into kinetic energy performed by a pendulum. A pendulum is an object attached to one end of a string with the other end of the string secured to a flat surface. You will be creating a pendulum with a golf ball as the object which, when released, will strike another golf ball situated on an inverted paper cup. The question to ask is: What is the effect of the length of string and angle of release of the golf ball pendulum on the distance that the stationary golf ball travels? Your goal is to determine which length of string and release angle that will result in the largest flight distance.

Which length of string and release angle will result in the largest flight distance?
This is where you make your hypothesis or an educated guess in an answer to the question: What are the factors involved in the flight distance of the stationary golf ball? Will it be a short string length or a large release angle?

What you will need
- Two golf balls
- Meter stick
- Paper cup
- Scissors
- Small screw eye (This is a small screw with the top part in the form of a circle or eye. This can be purchased at any home supply store.)
- String
- Hammer
- Ruler
- Protractor

What you will do
- Take the screw eye and lightly tap it with a hammer into one of the golf balls. Screw the eye completely into the golf ball until only the eye extends from the surface of the golf ball.
- Using a ruler (or meter stick), measure 25 cm, 50 cm and 1 m lengths of string and cut them into separate lengths. Starting with the 25-cm length of string, tie one end around the screw eye and secure the other end to a secure surface such as a tabletop. Make sure the table is tall enough to accommodate a swing of the 1-m length of string.
- At the bottom of the swing, invert the paper cup and place the other golf ball on top of it. Make sure that when the pendulum is released the swinging golf ball strikes the other golf ball that is on the cup. Draw the 25-cm pendulum back an angle of 10° measured with the protractor and then release the ball, striking the one on the cup.
- Measure the distance that the stricken golf ball travels from the paper cup with the meter stick.
- Repeat the process by increasing the release angles to 25° and 40° before releasing the

golf ball pendulum and then measure the flight distance of the stricken golf ball.
- Then replace the 25-cm length string with the 50-cm length string followed by the 1-m length string and performing flight distance measurements for the three release angles.

What did you observe?

It is now important to create a graph from the data that you collected from your experiment. You will probably want to use a bar graph to display your results. If you are not sure about bar graphs or need help in creating the graphs, please look at the website below for help:

National Center for Education Statistics Create a Graph
http://nces.ed.gov/nceskids/createagraph/

- What do you notice from the graphs? Do you notice any trends or patterns?
- What do my results tell me about the effects of string length and release angle on the flight distance of the golf ball?
- Which string length resulted in the largest flight distance of the golf ball?
- Which release angle resulted in the largest flight distance of the golf ball?

What do you think would happen if you…

- used a smaller length of string? A larger length of string?
- used different types of strings such as thread, rope cord, or chain?
- used smaller release angles? Larger release angles?
- used a different size of ball for the pendulum, e.g. a marble, ping pong ball, baseball, or softball? A different-shaped object, e.g. a wooden block or plastic egg?
- used a different size of cup?
- used a different size of ball for the stationary object, e.g. a marble, ping pong ball, baseball, or softball? A different-shaped object, e.g. a wooden block or plastic egg?
- applied a force to the pendulum object prior to release?

If you had everything you needed in terms of materials and supplies, describe a pendulum that you think would cause the stricken stationary object to travel the farthest.

Try It Yourself Activity:
Using Mechanical Energy to Go the Distance

<u>What you're trying to do</u>

Mechanical energy describes the energy of an object due to its location (potential energy) or its motion (kinetic energy). In this lab, both potential energy and kinetic energy will be used to propel a marble as far as possible using a ramp. The question to ask is: What characteristics of a ramp will allow a marble to roll as far as possible from the ramp? Your goal is to determine which angle and length of ramp will result in the farthest rolling distance from the ramp for a marble.

<u>Which angle and length of ramp will result in the farthest rolling distance for a marble?</u>

This is where you make your hypothesis or an educated guess in an answer to the question: What are the factors involved in the maximum rolling distance of a marble released from a ramp? Will it be a 50-cm wooden ramp created using 3 books or a 1-m wooden ramp created using 9 books?

<u>What you will need</u>

- One small marble
- Pack of small Popsicle sticks
- Glue
- Meter stick
- Two wooden planks (1 50-cm in length and 1 1-m in length)
- Nine large books (They should be the same book and large, e.g., a dictionary.)

<u>What you will do</u>

- For each wooden plank, glue Popsicle sticks down the two edges to create a bumper so that as the marble rolls down each ramp, it stays on the ramp and does not veer off the ramp's side. Allow 30 minutes for the glue to dry.
- Find a clear hallway or area where a marble can roll for several meters. Create a ramp placing the 50-cm wooden plank on 3 books.
- Place the marble in the center at the elevated end of the ramp and release it. The marble will roll down the ramp and continue forward down the hallway. Letting the marble roll undisturbed, note where the marble lands and, with a meter stick, measure and record the distance from the base of the ramp to the marble stopping point.
- Then, using the same 50-cm wooden plank, create a ramp using 6 books followed by 9 books. Repeat the trials with your marble and record the rolling distances.
- Repeat the same trials using the 1-m wooden plank and the three different ramp heights constructed from 3 books, 6 books and 9 books. Record the rolling distances.

What did you observe?
It is now important to create a graph from the data that you collected from your experiment. You will probably want to use a bar graph to display your results. If you are not sure about bar graphs or need help in creating the graphs, please look at the website below for help:

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- What do you notice from the graphs? Do you notice any trends or patterns?
- What do my results tell me about the effects of ramp height and size on rolling distance?
- Which angle resulted in the largest rolling distance for the 50-cm ramp? 1-m ramp?

What do you think would happen if you…
- used a larger marble? Smaller marble?
- used different types of marbles (e.g., steel balls)?
- used a longer ramp? Smaller ramp?
- used a ramp of a different surface textures? Of a different material?
- used more than 9 books to create the ramp? Less than 3 books?
- pushed the ball down the ramp rather than simply releasing the marble?

If you had everything you needed in terms of materials and supplies, describe a method/procedure that you think would allow the marble to travel the maximum rolling distance from the base of the tabletop.

Chapter 3: Power

Timothy, Earl and Pearl look forward to the weekend, but as they leave the school, Timothy says, "Uh oh, I forgot something very, very important."

"What, your calculator?" asks Pearl.

"No," says Timothy, "something even more important than that. I forgot my science textbook. I have got an assignment to do and a lab to perform over the weekend. I have got to go back in to get my book. It's in my locker upstairs. Come on, let's go."

Timothy, Earl and Pearl turn around. They run down the hall and up the two flights of stairs where Timothy's locker is. Earl and Timothy run up two steps at a time, but Pearl takes her time, walking leisurely one step at a time.

When they meet up at the top of the stairs, Timothy is out of breath and takes a minute to rest. Earl and Pearl look at each other, a little worried to see their friend so tired and out of breath.

"Timothy," asks Pearl, "are you OK?"

"Yeah, I'll be fine," says Timothy.

"What's the problem?" asks Earl. "We both ran up the same stairs in the same way and reached the tope at the same time but I feel fine."

"The answer is simple – power" answers Timothy. "You had more power than I did."

“I have been working out and eating right, says Earl, as he flexes his muscles, “except for the macaroni and cheese and chocolate milk. My muscles are getting bigger – look. Pretty soon, I’ll need to get new clothes.”

“That’s not what I mean,” says Timothy. “I’m talking about power. You had more power than I did and, actually, there is a simple reason why you had more power.”

“Why?” asks Earl.

“Power,” explains Timothy, “is how fast work is done. Everyone who climbs stairs does work against the force of gravity. The time it takes to perform the work of climbing the stairs is power. The longer it takes someone to climb stairs, the less power that is required. The quicker one moves up the stairs, the larger amount of power that is required.”

“But we both ran up the same stairs in the same amount of time and you’re bigger than me,” wonders Earl. “How could I have exerted more power than you?”

“Earl,” responds Timothy, “you just answered your own question.”

“What?” says Earl.

“When we both climbed up these set of stairs, we were both doing work against gravity because gravity acts downward and we were moving upward. When you do work against gravity, you are in essence lifting your own weight up the stairs to the height of the staircase. Because I am bigger than you, I have more weight to carry up the stairs which is why I got tired quicker than you.”

“Oh,” exclaims Earl.

“Great,” replies Timothy. “Now let’s go to my locker and *get* my science book so we can *get* out of here.”

“I’ve got an idea, Timothy,” says Pearl. “Let’s see who has the most power going down the stairs. I bet I’ll win.”

Try It Yourself Activity:
Who's Got the Greater Power?

What you're trying to do

Power is a measure of the rate at which work is done or work done over a given time period. The quicker work is done or the work that is done over a shorter time frame, the more power that is required. The question to ask is: Who among your volunteer friends will have the greatest power when ascending a flight of stairs? Your goal is to determine whether gender (boys or girls) and age impact the power that is generated in ascending a flight of stairs.

Which gender and age will result in the greatest amount of power generated while ascending a flight of stairs?

This is where you make your hypothesis or an educated guess in an answer to the question: Which factor will result in the greatest amount of power generated while ascending a flight of stairs? Will an older person generate more power ascending a flight of stairs than a younger person? Will a boy generate more power ascending a flight of stairs than a girl?

What you will need

- 9 volunteers (in addition to you) that will leave you with a group of 5 boys and 5 girls each varying in age (e.g., boy and girl that are age 8, boy and girl that are age 10, etc.)
- Stopwatch
- Ruler
- Weight scale

What you will do

- Find a staircase with one and preferably two flight of stairs either at school, at home (if you have a 2-story house), or around an apartment complex. (WARNING: Make sure that when you do this experiment, that an adult is watching over you [either a teacher at school, your parent at home or at an apartment] to make sure you are safe.)
- With your ruler, measure the number of inches high of one step. Then count the total number of steps in the staircase. Multiply the number of inches in one step by the total number of steps and this gives you the total height that you will climb once you reach the top of the stairs. Convert to units of feet by dividing your number by 12 because 12 inches is equal to 1 foot. You will now have the height of the stairs in feet.
- Using the weight scale, ask each of your volunteers to measure their weight in pounds. Multiply the weight in pounds by the height of the stairs in feet. This value will be the work that you will perform in climbing the stairs.
- Now ask each volunteer to stand at the bottom of the staircase. You will say: "On your mark, get set, GO!" At that time, you will start the stopwatch and your volunteer will ascend the staircase, making sure to use each step as quickly as possible. Once the volunteer reaches the top of the staircase, stop the stopwatch and record the time. So, in your data table, you will record the work performed by the volunteer and the time in which the work was performed. Dividing the work performed by the time gives you the power generated by that volunteer to ascend the staircase.

- Repeat the same measurements for each of the remaining volunteers, making sure to record all measurements in your data tables and note all observations in your notebook.

What did you observe?

It is now important to create a graph from the data that you collected from your experiment. You will probably want to use a bar graph to display your results. If you are not sure about bar graphs or need help in creating the graphs, please look at the website below for help:

National Center for Education Statistics Create a Graph
http://nces.ed.gov/nceskids/createagraph/

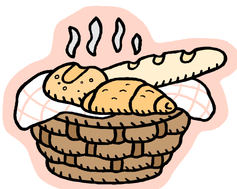
- What do you notice from the graphs? Do you notice any trends or patterns?
- What do my results tell me about the power generated in ascending a staircase?
- Did the boys generally exert more power than the girls?
- How did age impact the power generated in ascending a staircase? Did the older volunteers generate more power than the younger volunteers? Did the older boys generate more power than the younger boys? Did the older girls generate more power than the younger girls?

What do you think would happen if you…

- had more volunteers? Had more boy volunteers? Had more girl volunteers?
- had a wider range of age of volunteers?
- had volunteers that ate a meal before their trial as opposed to volunteers who did not eat prior to ascending the staircase?
- and your volunteers ascended a staircase that was higher? A staircase with larger steps? A staircase with smaller steps?
- and your volunteers ascended a staircase in large strides (two or three steps at a time)
- used stairs that were carpeted?
- used a staircase that was outside as opposed to indoors?

If you had everything you needed in terms of materials and supplies, describe a method/procedure that you think would allow you or a volunteer to generate the largest amount of power in ascending a staircase.

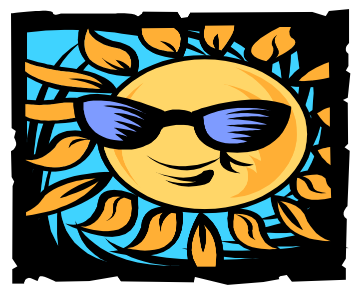
Forms of Energy



Chemical Energy

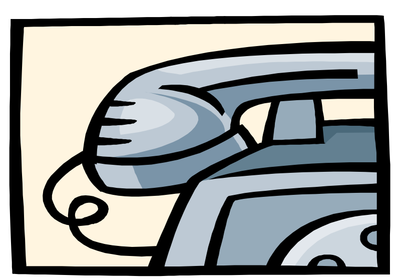
Mechanical Energy

Solar Energy



Thermal Energy (Heat)

Sound Energy



Mission Possible Project on Energy:
Rube Goldberg Project

Objective: You will accomplish a simple task using at least 3 simple machines in 5 different steps in 60 seconds.

Rules:

- You must use three of the six simple machines: inclined plane, lever, pulley, screw, wedge, and wheel and axle. You may use any of the three machines. For more information about simple machines, please consult the following website: http://www.edheads.org/activities/simple-machines/index.htm

- The task is a simple action such as raising a flag, popping a balloon, or breaking an egg. You may choose any task that you prefer, but the task must be the final step in the process and be a task that can easily be observed and measured.

- You must use materials that are found around the house – things that your parents might consider as being junk. You may not use any kits or games such as Mousetrap for your project.

- You may not use any material or resource that poses any danger to you or observers such as fire, chemicals that are flammable, poisonous, and dangerous if it is spilt or makes contact with any part of the body. If you need to cut wood, ask someone to help you with a saw or power tools. If you need to use a glue gun, make sure someone in supervising you and do not forget to unplug the glue gun.

Helpful Hints:

It is best to think about your task and the steps that will eventually lead to the task before you begin to build. Research and find out information about simple machines, paying special attention to those that might be able to help you accomplish your task.

Sketch a diagram of what your Rube Goldberg project will look like, beginning with the end and working backwards, including tasks that can easily be done and tested.

Be careful if you use items such as dominoes and thick liquids such as honey, chocolate syrup, or molasses. Dominoes can be very frustrating to set up and keep up while honey and chocolate syrup are very hard to clean up and sticky to the touch.

Make sure you test, test, and test again. Science is based on trial and error and this project is no exception. Do not get frustrated – you will eventually be successful.

Where Can I Learn More About Energy?

These are 10 excellent websites for hands-on activities and ideas for projects. You can also perform Internet searches using key terms found in the vocabulary to find examples of activities and projects related to energy.

Activities Integrating Mathematics and Science (AIMS)
http://www.aimsedu.org/Activities/overview.html

Exploratorium: Hands-On Activities
http://www.exploratorium.edu/explore/handson.html

Exploring Planets in the Classroom
http://www.spacegrant.hawaii.edu/class_acts/

HighTech Productions.com
http://www.hightechscience.org/activities.htm

NASA Students Grades 5 - 8
http://www.nasa.gov/audience/forstudents/5-8/index.html

Internet4Classrooms
http://www.internet4classrooms.com/science_elem.htm

Access Excellence
http://www.accessexcellence.org/

Busy Teacher's Website K-12: Elementary
http://www.ceismc.gatech.edu/busyt/ele.shtml

Science Resources on the Net
http://www.uvm.edu/~jmorris/Sci.html

The Reference Desk
http://www.martindalecenter.com/

Useful Words for Energy

Atomic energy: energy contained within the atom of chemical elements

Chemical energy: energy as a result of chemicals. Examples of chemical energy includes food which provides energy of living things and gasoline which provides energy for automobiles and other means of transportation such as buses and boats.

Conservation of energy: energy can neither be created nor destroyed, only transformed. The amount of energy one has at the beginning of an event or activity is the same amount of energy one has at the end of the event or activity.

Electrical energy: energy as a result of moving electrical charge or electrons. Electrical energy is used to operate many appliances such as televisions and radios.

Energy: the ability to do work. Energy exists in many forms including: chemical energy, mechanical energy (kinetic energy and potential energy), thermal energy, sound energy, solar energy, light energy, atomic energy, and nuclear energy.

Kinetic energy: energy as a result of motion. Any moving object has kinetic energy.

Light (radiant) energy: energy contained within electromagnetic waves or light. Sources of light energy include visible light waves, radio waves, infrared waves, ultraviolet waves, microwaves, x-rays and gamma rays.

Mechanical energy: a term that describes the combined kinetic energy and potential energy of an object

Nuclear energy: energy contained within the nucleus of an atom

Photosynthesis: the process in which plants convert sunlight into chemical energy of food needed to survive and grow

Potential energy: energy as a result of position. Any object raised or suspended a given height above a surface has stored energy known as potential energy. As the object drops, the potential energy decreases as it is transferred into kinetic energy.

Power: the rate at which work is done by an object or work done by an object divided by the time required to perform the work

Solar energy: energy as a result of sunlight

Sound energy: energy contained within sound waves

Thermal energy: energy as a result of heat

Work: force exerted on an object over a given displacement (or distance in a given direction)