# Step Away From The Textbook!

## Energy & Electricity

- Energy & Conservation
- Work & Simple Machines
- Electrical Conductors
- Electromagnets
- Circuits

Activities, Parodies, Games, Jokes, Review Sheets, "3-D Templates", Cold Reading Passages, and much more!


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# STEP AWAY FROM THE TEXTBOOK!



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For information or comments, contact:

**Homecourt Publishers**
2435 East North St., #245
Greenville, SC 29615-1442
*benbache@homecourtpublishers.com*
***www.homecourtpublishers.com***
**(864) 877-5123**

Managing Editor - **Ben Bache** **benbache@homecourtpublishers.com**
Lead Editor – **Alissa Torzewski**

Thank you to **Joann Wood** for contributing ideas, inspiration, and original work to this project.

Additional contributions made by **Nancy Rechtman** and **Audrey Cook**

Cover illustration by **Zach Franzen**.

# Table of Contents

***"A teacher who is attempting to teach without inspiring the pupil with a desire to learn is hammering on cold iron."***

**—Horace Mann** **(1796-1859)**
***"The Father of American Public Education"***

# Section 1

## Check out some of my... Personal Favorites

*Over the next few pages I will share some of my personal classroom secrets that are sure to engage and excite your students!*

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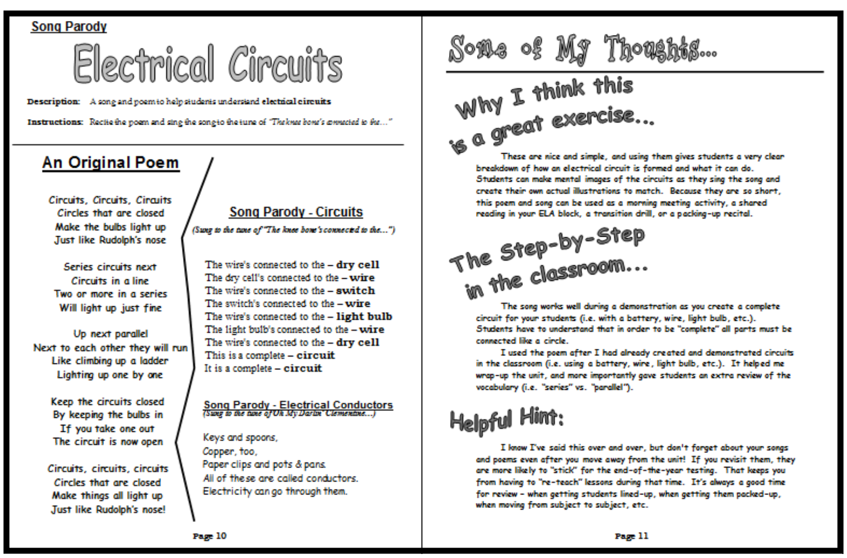
### *Here's how it works:*

The left-hand page includes the song parody, activity, poem, game, etc. for you to share with your students.



Song Parody

Electrical Circuits

**Description:** A song and poem to help students understand **electrical circuits**

**Instructions:** Recite the poem and sing the song to the tune of *"The knee bone's connected to the..."*

**An Original Poem**

Circuits, Circuits, Circuits
Circles that are closed
Make the bulbs light up
Just like Rudolph's nose

Series circuits next
Circuits in a line
Two or more in a series
Will light up just fine

Up next parallel
Next to each other they will run
Like climbing up a ladder
Lighting up one by one

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By keeping the bulbs in
If you take one out
The circuit is now open

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**Song Parody - Circuits**

*(Sung to the tune of "The knee bone's connected to the...")*

The wire's connected to the – **dry cell**
The dry cell's connected to the – **wire**
The wire's connected to the – **switch**
The switch's connected to the – **wire**
The wire's connected to the – **light bulb**
The light bulb's connected to the – **wire**
The wire's connected to the – **dry cell**
This is a complete – **circuit**
It is a complete – **circuit**

**Song Parody - Electrical Conductors**

*(Sung to the tune of Oh My Darlin' Clementine...)*

Keys and spoons,
Copper, too,
Paper clips and pots & pans.
All of these are called conductors.
Electricity can go through them.

Page 10

Some of My Thoughts...

Why I think this is a great exercise...

These are nice and simple, and using them gives students a very clear breakdown of how an electrical circuit is formed and what it can do. Students can make mental images of the circuits as they sing the song and create their own actual illustrations to match. Because they are so short, this poem and song can be used as a morning meeting activity, a shared reading in your ELA block, a transition drill, or a packing-up recital.

The Step-by-Step in the classroom...

The song works well during a demonstration as you create a complete circuit for your students (i.e. with a battery, wire, light bulb, etc.). Students have to understand that in order to be "complete" all parts must be connected like a circle.

I used the poem after I had already created and demonstrated circuits in the classroom (i.e. using a battery, wire, light bulb, etc.). It helped me wrap-up the unit, and more importantly gave students an extra review of the vocabulary (i.e. "series" vs. "parallel").

Helpful Hint:

I know I've said this over and over, but don't forget about your songs and poems even after you move away from the unit! If you revisit them, they are more likely to "stick" for the end-of-the-year testing. That keeps you from having to "re-teach" lessons during that time. It's always a good time for review – when getting students lined-up, when getting them packed-up, when moving from subject to subject, etc.

Page 11

The right-hand page includes my personal commentary, including the reasons I've had success with this exercise, any key directions, and other tid-bits that might be helpful.

******The exercises on the next few pages are great to use for this topic area, but you can easily modify them to use for other topics and even subject areas. The simple format and extra notes that are provided will really help with this!***

**Read-Aloud Story**

# Conservation of Energy

**Description:** A story about a library book and its adventures with different **types of energy**.

**Instructions:** Use as an ELA-integrated reading to review the science standard.

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## The Sad Little Book

Once upon a time, there was a very sad little book. The little book lived in a middle school library, and he was sad because none of the children in the school had ever picked him up off the shelf. There was nothing he wanted more in the world than to be picked up and read by an eager student.

The little book watched every day as the bigger, more colorful books were read and loved by wide-eyed children – tons of them every day! The little book especially envied the most popular books in the whole library, the *Harry Potter* books. How great it would be if someone loved him just as much as they loved their *Harry Potter* books! He had been sitting on his shelf for so long, and he was just itching to be picked up!

One afternoon, as the children left school to go home, the librarian went around straightening up her books. As she bent down to return one of the *Harry Potter* books to its place, her shoulder bumped into a shelf – the very shelf that the little book lived on! Suddenly, the little book felt an amazing sensation as he toppled from the shelf and onto the floor. It was as if he had been strapped down to a chair for years and was now running for the very first time. It was like nothing he had ever experienced before! The little book had been storing his potential energy for far too long up on his shelf.

When the little book hit the floor, he felt relaxed. He had finally managed to release some of the potential energy that he had been waiting to use for so long! He hit the ground with a loud "*BANG!*", creating pressure waves that escaped into the air and floor as kinetic energy and sound. The librarian was so distracted by all the *Harry Potter* books she needed to put away that she didn't notice the little book that had fallen onto the floor.

The next morning, students streamed into the library, excited for a new day and a chance to catch up on all their favorite stories.

The little book became scared. What if somebody stepped on him? Just then, a little girl in pigtails walked by and stopped. She looked down at the little book on the floor with curiosity.

"Hey, Lizzy!" she whispered, careful not to catch the attention of the librarian. "Come look at this book! I've never seen it before."

"What is it, Meghan?" said a girl with curly hair and glasses who was flipping through a copy of *Charlie and the Chocolate Factory* at a table nearby.

"I can't tell – It's dark back here, and this book is pretty dusty. I'll bring it over there so we can look at it under your lamp."

The little book couldn't believe what was happening. He was about to be picked up and read by one of the children! The pig-tailed girl had eaten a good breakfast earlier in the morning, and her body had turned that food into chemical energy. She used some if it now to reach down and pick up the little book. The little book felt an increase in both kinetic and potential energy as he moved through the room and was held up against gravity by Meghan's hands. As Meghan dropped the little book down on the table, he again released a little bit of his energy as pressure waves into the air and table.

As Meghan and Lizzy fiddled with the lamp, they couldn't get it to turn on! They looked down and realized that the lamp hadn't been plugged in. Energy can't be created out of nothing! By plugging in the lamp, they transformed electrical energy into electromagnetic and thermal energy. The plug acted as a great metal conductor to take electrical energy from the wall and convert it into light and heat inside the light bulb!

With the light turned on, Meghan and Lizzy were finally able to wipe the dust from the little book's cover and to read what it said.

"*Energy: Where It Comes From and Where It Goes*," Meghan read. "No wonder this book was dusty. It sounds so boring!"

The little book heard his title and thought to himself, "No wonder I knew so much about energy! Energy is what I'm all about!" The little book didn't even care that he wasn't an exciting fiction book like the *Harry Potter* books. He was proud to feel so smart and educational!

"Actually, energy is pretty interesting," Lizzy said to Meghan. "I learned about it in my science class last year. Energy is a part of so many things we do in life! Did you know that there has always been the same amount of energy out there? It's sort of like the water cycle. There is always the same amount of water on Earth, but it's constantly in different forms like vapor, clouds, condensation, and ice. Energy is the same way – it's never created or destroyed, it's only transformed into different types of energy like heat, movement, light, sound, and electricity!"

"Then how come I have so much energy in the middle of the day, but I feel so exhausted at night?" Meghan asked.

"I asked that same question to my teacher," Lizzy replied. "She said that the sleepy sensation actually has nothing to do with energy. People need sleep at night in order to keep their brains alert, but sleep doesn't actually create energy. What *does* give us energy is the chemical energy from food. We need food because we constantly release energy into our surroundings all day. When we talk, we create sound. When we move, we create heat. When we pick up our backpacks in the morning, we're transferring our own chemical energy into the backpack as mechanical energy in order for it to move. Energy is constantly coming and going throughout our bodies!"

"Wow, that *is* really interesting!" Meghan exclaimed. "Too bad this book hasn't gotten much attention. Maybe we should show it to your science teacher?"

"Good idea!" said Lizzy.

The little book was thrilled. All in one day, he had been picked up, read, and shared! It was everything he had always dreamed about! After the girls brought him to the science teacher, he felt as if he was just as popular as the *Harry Potter* books. The little book used his knowledge about energy to teach all the new science classes that came through, and he soon became the science teacher's favorite book. From then on, the little book got to experience different kinds of energy every day! He never had to sit on a shelf and get bored with potential energy ever again.

# The End

# Some of My Thoughts...

## Why I think this is a great exercise...

What a perfect, easy way to integrate science and ELA instruction! These stories can be used for shared reading, a read-aloud, or for independent reading. No matter what, they will be a great addition to the Energy unit in science class.

## The Step-by-Step in the classroom...

The best way to utilize this story is to follow-up with an experiment. Use a book to recreate different scenarios from the story (i.e. sitting on the shelf, falling to the floor, using your arm to move it, etc), which will illustrate different kinds of energy and their transformations.

Bring out this story again later to focus on the ELA aspects. It is written from the perspective of the object, which can be a great opportunity for personification lessons in ELA. You could also do a mini-lesson on 1st person and 3rd person narration with the stories. Students can each get their own copy for a shared reading and it can be a good time to review what was learned in science class.

## Helpful Hint:

I always recommend having students illustrate stories after reading – it taps into the artistic intelligence and the left side of the brain where the processing of information takes place. Students can also create their own "energy" stories as a creative writing assignment!

**Original Poem & Song Parody**

# Electrical Circuits

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The switch's connected to the – **wire**
The wire's connected to the – **light bulb**
The light bulb's connected to the – **wire**
The wire's connected to the – **dry cell**
This is a complete – **circuit**
It is a complete – **circuit**

*For an electrical circuit to work, the electricity must be able to flow freely through it. This requires the use of **electrical conductors**. Here's a quick song to help your students remember this key vocabulary word...*

## Song Parody - Electrical Conductors

***(Sung to the tune of Oh My Darlin' Clementine…)***

Keys and spoons,
Copper, too,
Paper clips and pots & pans.
All of these are called conductors.
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# Section 2

## "Information Overload"

## Review Sheets

*The next few pages feature detailed review sheets for your students to study key topics.* ***Messy Mel*** *will serve as the narrator and walk students through a wide variety of terms and concepts (with his special brand of humor).*

***Feel free to make copies of these "Information Overload" sheets to distribute to your students.***

### Narrated by Messy Mel


Ok, here's the deal. My name is Mel, but my close friends call me "Messy Mel." I think it's their way of showing respect.

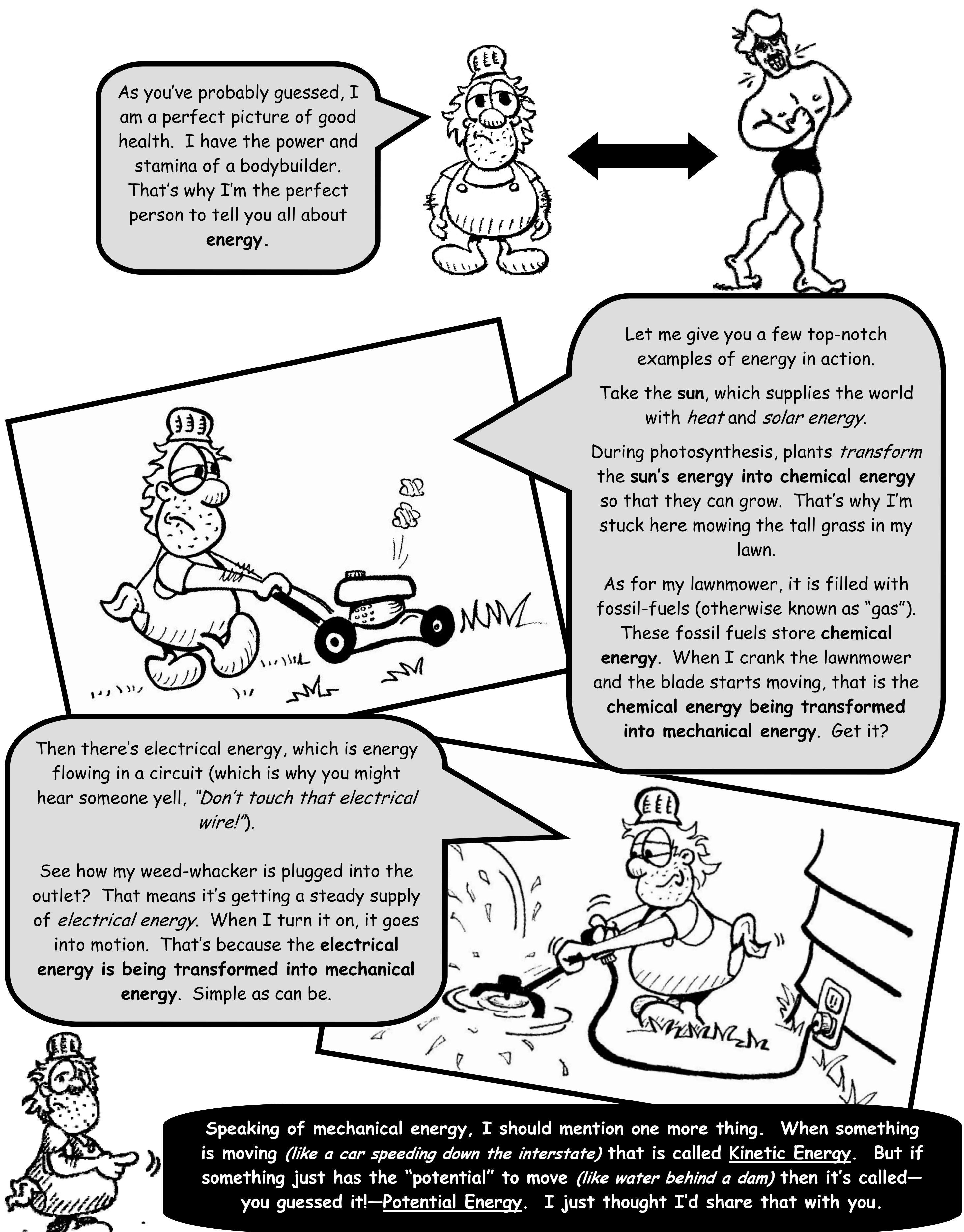
I'm a construction worker by day and a scientist by night (well, an "honorary" scientist, anyway).

I know that science is full of fancy terms, concepts, and theories. And that's just the basics.

Well, I'm about as basic as you can get. Let me break down some of that scientific jargon in way that's easy to understand and remember.

Like I said, I'm no rocket scientist *(for what it's worth, my dear Mother used to tell me I had rocks in my head)*, but I might be just what you need!

# ENERGY TYPES / TRANSFORMATIONS



# HEAT TRANSFER

For the past few weeks, I've been watching a lot of TV, taking long naps, and occasionally walking to the door to greet the pizza delivery man. I figured I needed a break from all of that stress, so I decided to go camping.

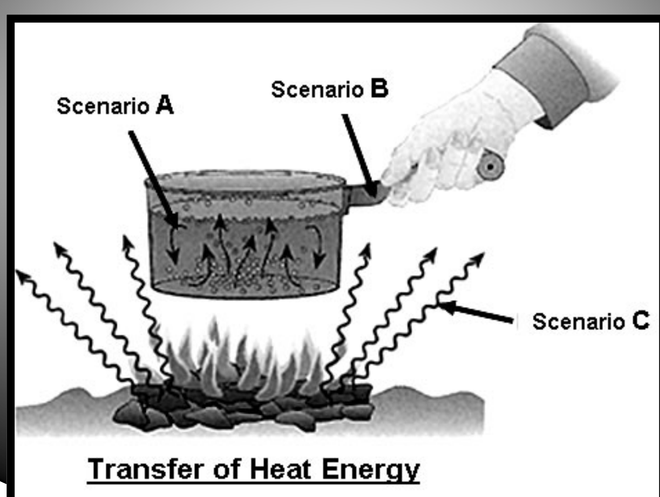
I can assure you that I did **NOT** want to learn about **heat transfer**. But that's exactly what happened. Oh well, I might as well share that knowledge with you.

**(B)** Heat can be transferred when **hot particles move through one object to reach another**. In this case, the heat is traveling freely through the metal handle of the pot.

That's **conduction.**

**(A)** Heat can be transferred by **direct contact**. See how the hot particles coming from the fire heat the pot, which in turn heats the liquid.

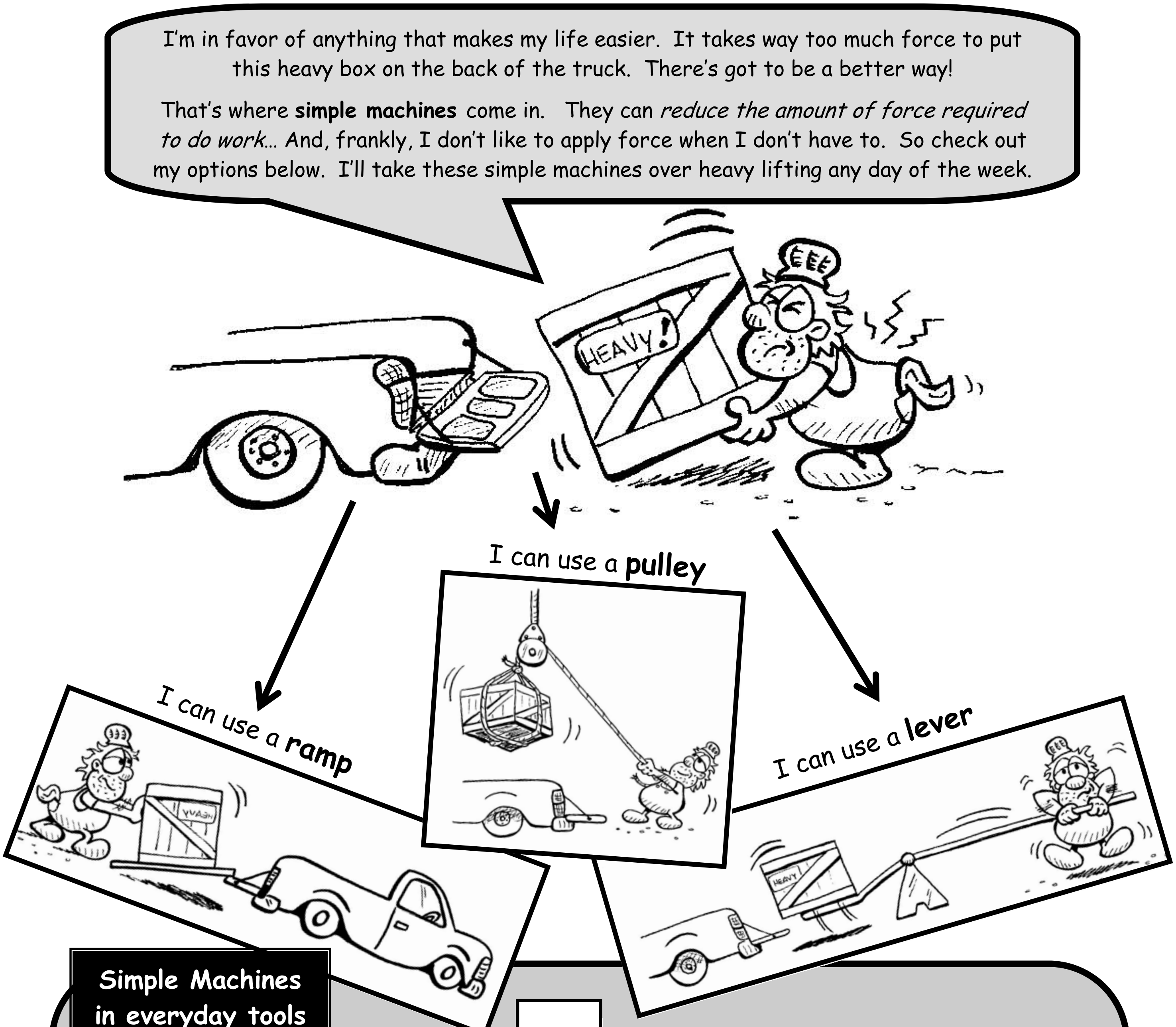
That's **convection.**



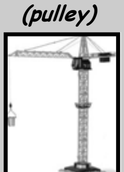

**(C)** Heat can be transferred by **indirect contact**. When sitting around a campfire, you don't actually touch the fire, but you still feel that it's giving off heat.

That's **radiation.**

# SIMPLE MACHINES




**Simple Machines in everyday tools**



Crane *(pulley)*

Screw *(inclined plane)*

Tweezers *(lever)*

Door knob *(wheel & axle)*

I can even combine simple machines to form nifty tools. Check out these scissors, which use levers and wedges *(i.e. inclined planes)*.

When you use more than one simple machine, it's called a **complex machine** or a **compound machine**.

# I Don't Like to Work!

I wanted to be very clear about that! Working does not fit in with the "Messy Mel" lifestyle.

Technically, **Work** means to ***apply force to an object over a distance***.

That means when I spend all of my energy to move this bar and it doesn't move, **I haven't done any work** *(refer to my fancy mathematical formula below)*. That doesn't make me happy.

**Force x Distance = Work**

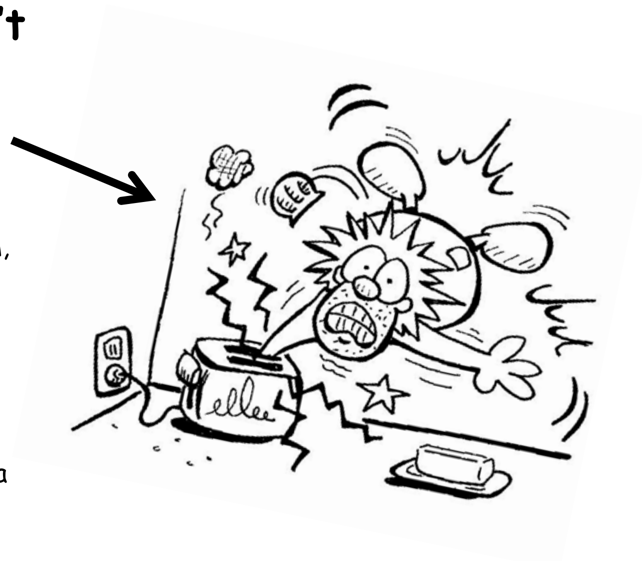
(every muscle in my body) (doesn't move a millimeter) (absolutely zero)

Now, if I get the bar moving a little bit, then I am doing **work**.

Look at that! I haven't moved the bar this much (or done this much **work**) in ten years!

## Electrical Energy and me just don't get along too well.

***(let's just say I've learned this from "experience")***



Still, electrical energy is very useful in our world. Especially in a **closed circuit**, which, in its simplest form, must have the following:

1) **A power source** (like a battery)
2) **A conductor** (usually a copper wire)
3) **A device to transform the electricity** (like my toaster)

The electricity in that circuit can be transformed into a number of other types of energy, including:



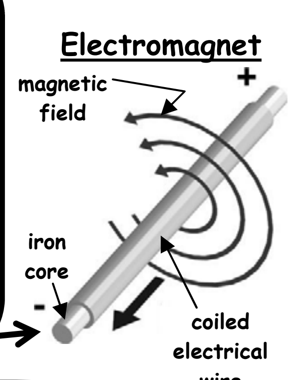


Now here's where it can get interesting (if you have an inquisitive mind like myself).

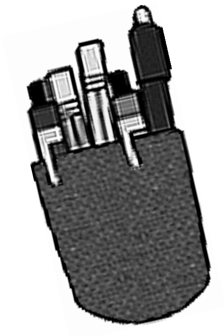
**Electricity and magnetism are related**. A magnet produces a magnetic field. This field can push and pull on a magnetic object (like an iron nail) without actually touching it.

Pretty cool, huh? Well wait until you hear this. If you take a copper wire and spin it around a magnet really fast, you can create an **electrical field**.

Or, look what I'm doing over here. I'm taking an electrical wire and wrapping it around an iron nail, which creates a strong magnet. That's an **electromagnet**. I know you're impressed, and I'm really going to blow you away with my fancy diagram.




Now, let's get crazy. If you have all of the ingredients—strong magnets, copper wire, iron cores—then you have the potential to create some real electrical power. All you have to do is rotate your coiled wire really fast around the magnets (or the other way around). That creates a **generator**, which could be used to power a small machine, or even your house.



# Section 3

## Pocket Activities

**These are quick activities that can be used for class-openers, ice-breakers, attention-grabbers, and so on.**

**We've also added a few jokes to have in your pocket when you're really trying to keep students from staring out the window!**

### Activity - Classroom Machines

Ask your students to look around the classroom and outside to make a list of the simple or complex machines that do **work** without relying on electricity, batteries, or any motors. Here are a few classic examples:

- **scissors**
- **bottle opener / can opener**
- **stapler / staple remover**
- **mechanical pencil sharpener**
- **zippers**
- **door hinges**
- **window blinds**
- **flag pole**

When the list is complete, discuss the work performed by each machine and how it makes it easier to do a specific task.

Next, discuss the *simple machines* that each item relies on. For example, bottle openers and zippers both rely on the **wedge or inclined plane** . Window blinds and a flag pole rely on a **pulley**.

Some items might be *complex machines* because they rely on more than one simple machine. For example, scissors take advantage of both the lever and wedges, while a can-opener uses a wheel and axle and a wedge.

## Activity - Classroom Energy

Ask your students to look around the room and make a list of any examples where energy is being put to good use. They should also note the type of energy. Here are a few possible examples:

- **Lights *(electrical energy or solar energy)***
- **Fans / Air Conditioners *(mechanical energy)***
- **Furnace / Heater *(heat energy)***
- **Overhead Projector *(electrical energy)***
- **Television *(electrical energy)***

Discuss what the final output of the energy is. For example, electrical energy is often used to make light, sound, or movement.

Also, discuss whether energy transformation has taken place. For example, a fan relies on mechanical energy to move the air. However, this mechanical energy has been transferred from electrical energy.

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## Activity - It's Electric

Ask your students to make a list of all of the **"electrical devices"** scattered throughout the room. This list should include lights, overhead projectors, clocks, phones, air-conditioner units, etc.

Combine the lists and create a "Master List" on the board or overhead. Go through the list and identify the **power source**, which may be an electrical outlet, hand-held battery, manufacturer's battery *(such as a watch battery or cell-phone battery)*, or it may be part of your school's electrical grid *(such as overhead lights)*. Discuss which power source is supplying the greatest amount of electrical energy, and why this would be the case *(most likely, the electrical device needs more voltage in order to operate)*.

Next, go through the list and identify all of the different functions that are acting on one complete circuit. Take an alarm clock, for example. In most cases, an alarm clock will run on one set of batteries, which serves as its power source. However, that power source operates two different functions--the clock and the radio alarm.

Aside from the power source and electrical device, what other features help complete the electrical circuits that your students listed?

**Answer:** Every electrical circuit must have a conductor, such as a copper wire, to carry the current through the circuit. Most also have a resistor, which controls the amount of current so that it is the right amount to operate the electrical device.

## Activity—An Energy Timeline

Ask your students to **create a timeline** showing the **History of Energy**. It should begin prior to the Industrial Revolution and mark all of the key advancements in what we use for fuel. Your students should note that wood was a main source of energy in the early days, when it was used to fuel a fire…

Some important stops on your students timeline should include:

- **3,500 BC** ***Simple Machines*** - Man begins to use simples machines such as wheels, ramps, levers, and pulleys to build landmarks like Stonehenge, the Great Pyramids, and the Great Wall of China
- **700 BC** ***Wind Power*** - One of the first natural energy sources, wind is first utilized in tasks such as sailing boats.
- **500 BC** ***Water & Wind Power*** - Windmills and water wheels use "advanced" technology to gather enormous amounts of energy. Energy from both wind and water helps do key tasks, such as grinding wheat and grain.
- **100 BC** ***Burning Coal*** - Burning coal releases heat, which is used for warmth, cooking, and metal work for weapons and construction.
- **1850** ***Coal-Powered Trains*** - Heat released from burning coal is used to boil water in the boiler, and the pressure from the steam moves the train.
- **1875** ***Coal & Oil Power Plants*** - Power plants use steam from boiled water the same way trains do, but in a much larger scale — this steam powers factories and cities.
- **1945** ***Nuclear Power*** - Nuclear power uses chemical reactions to heat water & produce steam, which spins generators to produce electricity. Though efficient, nuclear power can be dangerous
- **1970** ***Solar Power*** - Solar cells are incredibly efficient. Unfortunately, since they need the sun to work, energy cannot be produced at night or on cloudy days.
- **1990** ***Natural Gas*** - Natural gas is clean and efficient, but it is a nonrenewable resource, which means that the earth has a limited supply.

## Activity—Electrical Conductors

Here's a quick class-opener. Give your students a list of small everyday objects *(paperclips, pencils, zippers, erasers, clothing, etc.)*. Ask them to label a sheet with two columns, and label those columns **"Conductors"** and **"Insulators".** Your students should place each every day objects into the correct column.

Discuss what features make the objects good conductors *(i.e. they are metallic)*.

# A Little Humor

## Energy

TEACHER: It's a good thing that Thomas Edison invented the light bulb. Otherwise you would all have to watch television in the dark!

*(a bit silly, but it is good to use when you're reviewing a timeline of energy milestones)*

Q: Why was the pair of scissors able to grasp the concept of nuclear physics much better than the screw?

A: Because the screw was just a simple machine, while the scissors were much more complex.

*(yes, it's a bad pun, but your students will remember the definitions of simple and complex machines)*

## Fuel Sources

TEACHER: Let's review. Today in math class we learned that a kilometer is shorter than a mile. And in science class we talked about the limited supply of fossil fuels. Who can summarize what we learned?

STUDENT: That if we want to conserve gasoline, we should take our next trip in kilometers instead of miles.

*(when you tell this one, don't be surprised if some of your students actually think it's a good idea)*

MAN #1: Did you hear about the head of the power company who was trying to scam his customers?

MAN #2: No, what happened to him?

MAN #3: They locked him up in a fuel cell.

*(hopefully this will get a chuckle, and it can also begin a conversation about different types of fuel)*

## Electricity

Q: What did the electrically charged copper wire say when it ran into another wire?

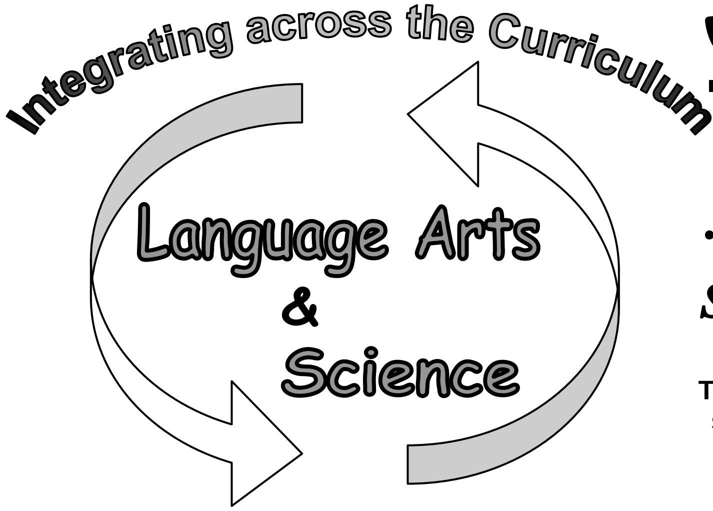
A: I can feel sparks between us.

*(it's silly and predictable, but this joke is not a bad way to talk about electrical conductors)*

Q: What did the light bulb say to the battery?

A: You light up my life!

*(this joke is a classic, and a great way to introduce the parts of an electrical circuit)*




# Section 4

## ...because there are only so many hours in the day.

**The next few pages include passages that focus on this scientific topic, but can also be used for practice with Reading Comprehension and other Language Arts skills. Please feel free to make copies.**

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### "A Great Quote..."

***"Mr. Prime Minister, what good is a baby?"***
**Michael Faraday (1830s)**

British physicist Michael Faraday had an odd way of explaining the potential of his new discovery to a skeptical visitor. According to oral tradition of the science world, the Prime Minister of England was visiting Faraday's laboratories in the 1830s, just as he was beginning to experiment with electricity. The Prime Minister was impressed by the sparks that were being produced, but couldn't help ask the question, *"What good is it?"* To this, Faraday answered, *"Mr. Prime Minister, what good is a baby?"*

Although electricity wouldn't have a significant impact on society during Faraday's lifetime, he understood that—like a newborn baby—it would grow into something great. Spurred on by this belief, he became one of the most influential experimental scientists in the field.

It was the next generation of scientists, such as the legendary Thomas Edison, that would help make electricity a common tool in society. In 1882, Edison helped develop the world's first sizable electric power station, located in New York City.


***"Not fit to hold a candle to..."***

By declaring that someone is *"not fit to hold a candle to,"* you are saying that they are not worthy to even be in the presence of another. It doesn't necessarily mean that the person doesn't know how to hold a candle, but that's exactly how the phrase originated.

Back in the days before electricity, it's easy to imagine that working at night was somewhat of a hassle—but that's not to say that it couldn't be done. If a craftsman had to work after hours, he would assign to his apprentice the job of holding a candle near him so he could see what he was doing. It's very similar to modern times where an apprentice holds a flashlight while his boss works in hard to see places. Obviously, the task of holding the candle didn't require nearly as much skill as doing the work itself.

From that set of roles, the idea of being *"not fit to hold a candle"* became a pretty common, and appropriate, insult. If an apprentice couldn't even perform that simple task, then there was really no use in having him around.

# Another Kind of War

***"We will never again permit any foreign nation to have Uncle Sam over a barrel of oil!"***

**Gerald Ford (1974)**

Vice-president Gerald Ford made a big promise in 1974. At a speech in West Palm Beach, Florida, he expressed his frustration of the fact that inflated international oil prices were causing an energy crisis in the United States. Ford wanted to step up the effort to make the nation self-sufficient when it came to energy. He proposed that alternate forms of energy be explored, especially nuclear, solar, and geothermal.

Gerald Ford probably didn't expect to be the one making the major decisions. He inherited the position of vice-president only after Spiro Agnew resigned in 1973. One year later, Nixon resigned—this made Ford the only man to hold the offices of vice-president and president and not be elected to either of them. And, to make a complicated situation even more complicated, he inherited the nation's highest office during what was perhaps the most difficult time since World War II. Inflation was rampant, unemployment was high, and the Organization of Petroleum Exporting Countries (OPEC) was refusing to export oil to the United States. The members of OPEC were angered by the fact that the United States supported the Israelis over several oil rich Arab nations.

Ford did his best to deal with the turmoil of the energy crisis, but left plenty for Jimmy Carter when he became president after Ford. When Carter addressed the nation in April 1977, he wanted to convey to the people just how serious the energy problem had become. Like his predecessor, he urged research in alternative methods of energy, hoping to end the United States' almost complete dependence on foreign nations for oil. Explaining the crisis, Carter declared: ***"This difficult effort will be the moral equivalent of war, except that we will be uniting our efforts to build and not to destroy."***

Eventually, Carter was able to make bold moves to help increase United States' energy independence. During his presidency in the late 1970s, he deregulated the oil and natural gas that was produced domestically. This had mixed results. While it stimulated the energy industry, it also increased the price of oil. The price increase only added to the country's already high inflation. But, knowing that any sort of wage controls would only result in further troubles, Carter decided that it was best to wait out the temporary rise in oil prices.

The prices did finally go down and the energy crisis wasn't such a crisis any longer. Unfortunately, the United States dependence on foreign nations for oil never did go away completely.

**In the search for alternative forms of oil, here are a few options that have been brought to the table:**

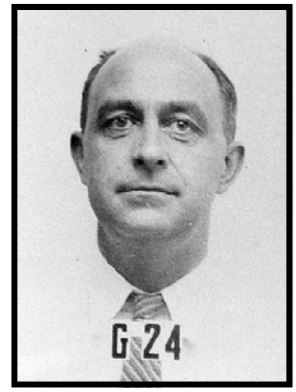
- **Wind power** *(gathered by a series of windmills, some as large as 300 feet high, spread over several acres of land)*
- **Solar power** *(seems to be the safest and most abundant, but hasn't advanced as quickly as hoped)*
- **Nuclear power** *(certainly the most powerful, but also the most dangerous)*
- **Geothermal power** *(difficult to extract and store for everyday use)*
- **Ocean Gas power** *(methane on the ocean floor—this seems to be abundant, but very difficult to extract)*
- **Water Power** *(extracted using hydro dams, which are usually massive and obtrusive construction projects)*
- **Biomass power** *(animal or plant products that can be burned for fuel—most likely possibilities seem to be pig waste or corn, but the verdict is still out on this one)*
- **Hydrogen power** *(the third most abundant element on earth, found in water, can be converted to energy—however, safety and technology are still drawbacks)*

# A New Kind of Energy

*Scientists unleash the potential of nuclear power*

The race for a grasp on nuclear power began in August 1942 with the creation of the top secret Manhattan Project. The enormous undertaking, which occupied several top scientists for years, was created after Albert Einstein wrote several letters to President Franklin D. Roosevelt telling him of the potential of nuclear fission. Einstein urged the President to devote more resources into studying it. At the time, the nation was heavily involved in a world war, so Roosevelt didn't hesitate to agree.

While much of the research for the Manhattan Project was conducted in Los Alamos, New Mexico, it was at the University of Chicago that Enrico Fermi and his team had their first major success. They were experimenting in a squash court that had been turned into a laboratory at the university's Stagg Field stadium. There, Fermi successfully demonstrated a chain reaction.




**Enrico Fermi's ID picture while working in Los Alamos on the Manhattan Project**

He telephoned Washington, DC, and left a strange message. Fermi declared: ***"The Italian navigator has just landed in the New World..."*** This was a secret code that confirmed the success of Fermi's experiment to government officials. It was necessary for the message to be encoded because top scientists in Germany and other axis countries were working towards the same goal—and, no doubt, they were keeping a close eye on the Americans.

This success in Chicago was just the first step. Now, the newfound technology had to be used to create a weapon of mass destruction. This gave a scientist named Robert Oppenheimer some mixed feelings. As he watched the first successful explosion of a nuclear bomb after years of serious experimentation, the American physicist didn't know exactly how to respond. Oppenheimer had been the organizer of the Manhattan Project in Los Alamos. In the summer of 1945, at the height of World War II, the team of scientists finally succeeded in their goal.

Oppenheimer had already made significant contributions to the project with his earlier work, and he understood the potential of what had been created. Upon the explosion, he exclaimed, ***"I am become death, the shatterer of worlds!"*** He was reciting a line from a collection of verses known as the *Bhagavad-Gita*, the most significant literary work in Hindu philosophy.

While the creation of an atomic bomb ultimately brought an end to World War II, it also introduced into the world the constant threat of nuclear war. Consequently, Oppenheimer dedicated his later life to studying the relationship between science and society, becoming an advisor to the government on atomic energy.


**Enrico Fermi was born in Rome, Italy. There is now a street named after him in Rome in honor of his accomplishments.**

**The street sign is shown here *("via" means "street" in Italian)***

A Key Moment in... History

# Oil found for the first time in the Middle East

## *The way it was...*

Oil has always been a valuable commodity—for those that were able to get their hands on it. Even in the 1850s, the only way to acquire the valuable product was to skim it off of the top of a pond, squeeze it out of fruits and vegetables, or hunt whales for fat. But if you could get it, oil could be refined and used in a number of ways. A few of the common uses were fuel, soaps, dyes, medicine, and machinery lubricants.

You can imagine the delight when, in 1859, Edwin Drake discovered a large oil supply in Pennsylvania only about seventy feet underground. He lucked out—usually it is necessary to drill *at least* twenty times that depth. His discovery sparked a new industry, which men such as John Rockefeller wasted no time in capitalizing upon. By 1880, Rockefeller's oil fields were supplying 95% of the United States' oil, and he was eventually accused of creating a monopoly.

Rockefeller wasn't the only one interested in the obvious profits to be made from oil. William Knox D'Arcy had already made a fortune by mining for gold in Australia. It made perfect sense that, if he had success mining for regular gold, then he would undoubtedly have success mining for "Black Gold." Being an Englishman, D'Arcy had no desire to try to compete with Rockefeller's hold on the oil market in the United States. Instead, he would have to find oil elsewhere. It had been rumored that there were untapped oil supplies in Persia *(modern day Iran)*, though nobody had succeeded in finding any yet. D'Arcy decided that he would give it a try and, in 1900, financed an exploration effort in the Middle East.

It started to become apparent why nobody had found oil in Persia. Covering an area of 500,000 square miles, the operation was extremely costly, and for years it yielded no results. There were moments of false alarms, but they never yielded a true oil supply. The morale was undoubtedly getting low by the time the workers began drilling at an oil field in Masjed-e-Suleyman in 1908.

## *What Happened Next...*

***On May 26, 1908, workers strike oil at the Masjed-e-Suleyman field in Persia. It is the first oil found in the Middle East and it sparks a new industry.***

## *How it changed history...*

William Knox D'Arcy had done it again. His first fortune was from striking gold in Australia, and he would make another by striking oil in the Middle East. D'Arcy's fortune, however, was of small significance compared to the impact that his find would have.

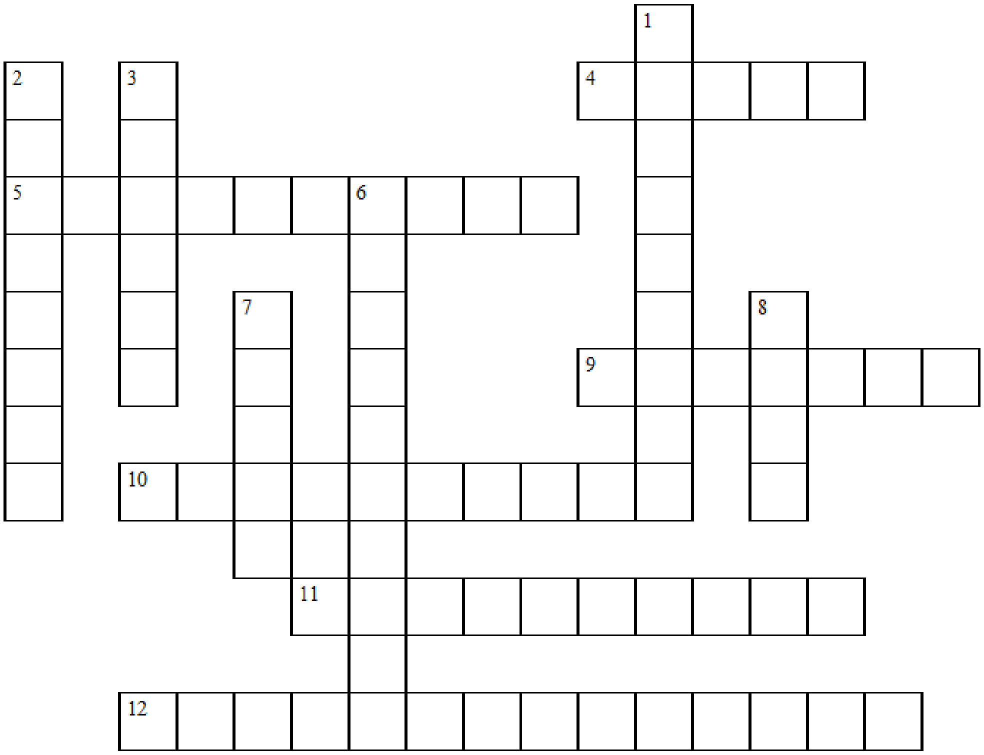
By 1911, the well at Masjed-e-Suleyman was producing a supply of 500 barrels of oil each day. Exploration in the Middle East continued and, in the 1930s, there were fields capable of producing millions of tons of oils. It was obvious that the potential in this area of the world far surpassed the large fields that existed in eastern Texas. Every major country wanted in on the action.

Unfortunately, the Middle East was already an area of high tension, and the discovery of oil put it on center stage. The internal problems in countries such as Iraq, Iran, Egypt, and Saudi Arabia were no longer just internal problems—they affected the entire world. To calm the playing field, the Organization of Petroleum Exporting Countries (OPEC) was established in 1960, but the political tensions of the Middle Eastern nations still remained a major concern.

For years, nations such as the United States have looked for ways to reduce dependence on the Middle East for oil *(by researching alternative fuels, for example)*. The search, however, still continues.

# Energy Types

**Directions: Solve the crossword puzzle using the clues and picture clues below.**



## Across

5 This type of energy flows in a circuit.
10 This type of energy can put things in motion.
11 Materials that transfer electrical current
12 When energies change from form to form, they go through an energy ________.

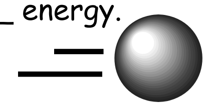
## Down

2 Plants use this type of energy to make food during photosynthesis.
3 Electricity is a form of ______.
6 Materials that do not transfer electrical current

## Across

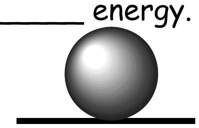
**4** This stereo uses electrical energy to produce ______.

**9** This moving ball has _______ energy.



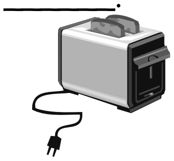
## Down

**1** This stationary ball has _______ energy.



**7** This lamp uses electrical energy produce _____.

**8** This toaster uses electrical energy to produce _______.

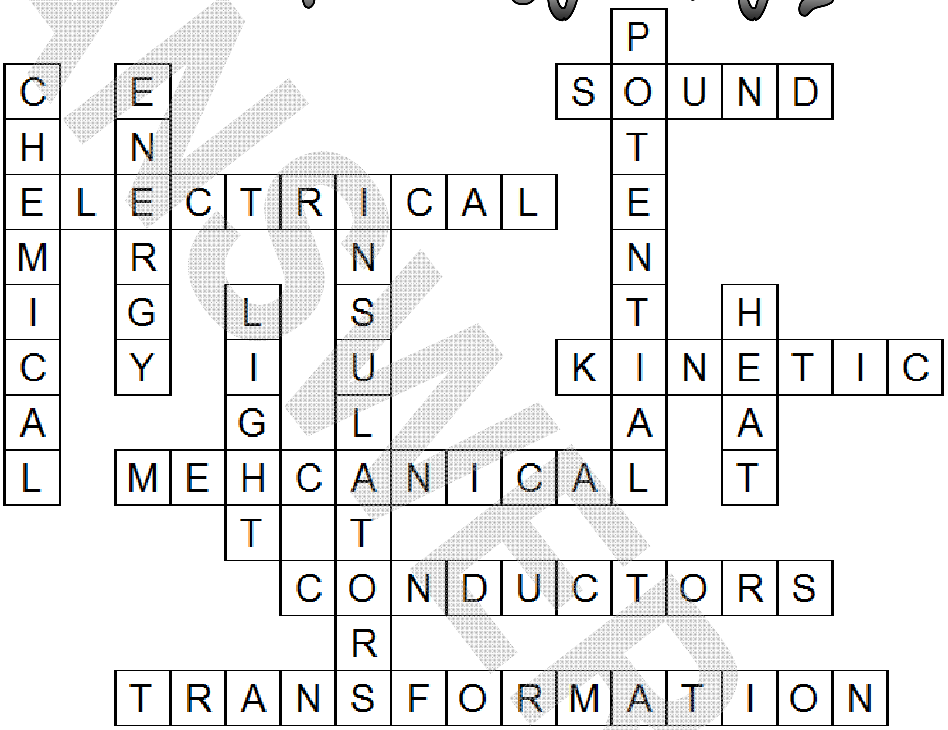


# Section 5


**Feel free to make copies of the puzzles to distribute to your students for review**



## Energy Types




**Across**

5 This type of energy flows in a circuit.
10 This type of energy can put things in motion.
11 Materials that transfer electrical current
12 When energies change from form to form, they go through an energy ________.

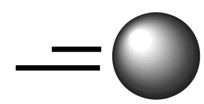
**Down**

2 Plants use this type of energy to make food during photosynthesis.
3 Electricity is a form of ______.
6 Materials that do not transfer electrical current

**Across**

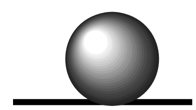
4 This stereo uses electrical energy to produce ______.

9 This moving ball has ________ energy.



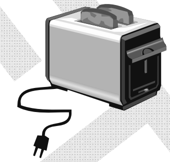
**Down**

1 This stationary ball has ________ energy.



7 This lamp uses electrical energy to produce ______.

8 This toaster uses electrical energy to produce _______.

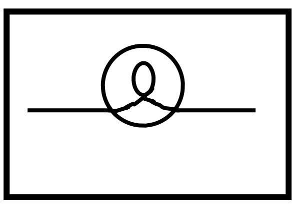
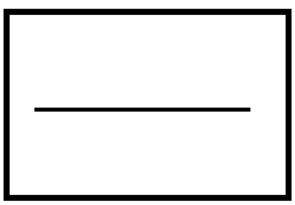
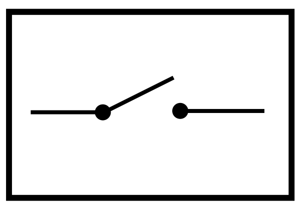
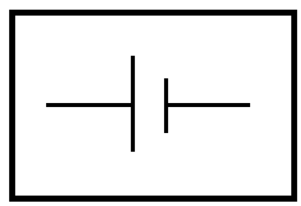


# Circuits & Electromagnets

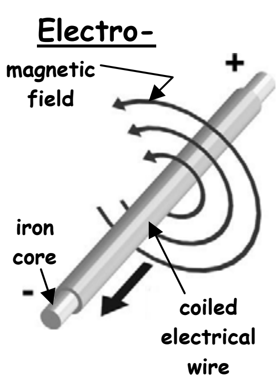
1. Unscramble the words.
2. Draw lines from the words to the matching definitions.
3. Draw lines from the definitions to the matching symbols.

| rewi | wtcihs | rabteyt | higlt ubbl |
|---|---|---|---|
| _ _ _ _ _ | _ _ _ _ _ _ _ _ | _ _ _ _ _ _ _ _ _ | _ _ _ _ _ _<br>_ _ _ _ _ |

| | | | |
|---|---|---|---|
| Completes the circuit | Pushes the electric current | Conducts the electric current | Changes electrical energy to light energy |

Directions: Finish the sentence by placing letters in the correct box in the column directly above each letter column.




**You can increase the strength of an electromagnet by using a battery with a higher voltage, by increasing the diameter of the core, and...**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | ■ | ■ | A | | | | | |
| ■ | ■ | ■ | M | | | | ■ | ■ | ■ |
| C | | | | | ■ | ■ | O | | ■ |
| | | | | | | | | D | ■ |
| ■ | ■ | ■ | | | | | ■ | ■ | ■ |
| | | | | A | | | | | |
| | | | U | S | R | E | | | |
| C | O | | L | L | D | T | I | F | |
| B | Y | I | M | O | R | D | O | N | |
| I | N | S | W | I | A | E | E | D | G |

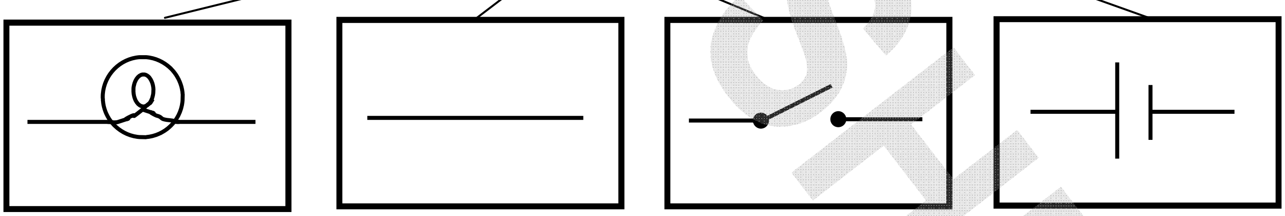
# Circuits & Electromagnets

Feel free to make copies of the puzzles to distribute to your students for review.



| rewi | wtcihs | rabteyt | higlt ubbl |
|---|---|---|---|
| w i r e | s w i t c h | b a t t e r y | l i g h t b u l b |

| Completes the circuit | Pushes the electric current | Conducts the electric current | Changes electrical energy to light energy |
|---|---|---|---|



You can increase the strength of an electromagnet by using a battery with a higher voltage, by increasing the diameter of the core, and...

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| B | Y | | | A | D | D | I | N | G |
| | | | M | O | R | E | | | |
| C | O | I | L | S | | | O | F | |
| I | N | S | U | L | A | T | E | D | |
| | | | W | I | R | E | | | |

A
U S R E
C O L L D T I F
B Y I M O R D O N
I N S W I A E E D G

# Section 6

## 3-D TEMPLATES

### Why 3-D Templates?

Our **3-D Templates** give students a hands-on way to interact with information. This kinesthetic technique engages the learner while the information is being presented, and also helps in the processing and cognitive organization of it. To put it another way:

*"Tell me and I'll forget; show me and I may remember; involve me and I'll understand."*

---

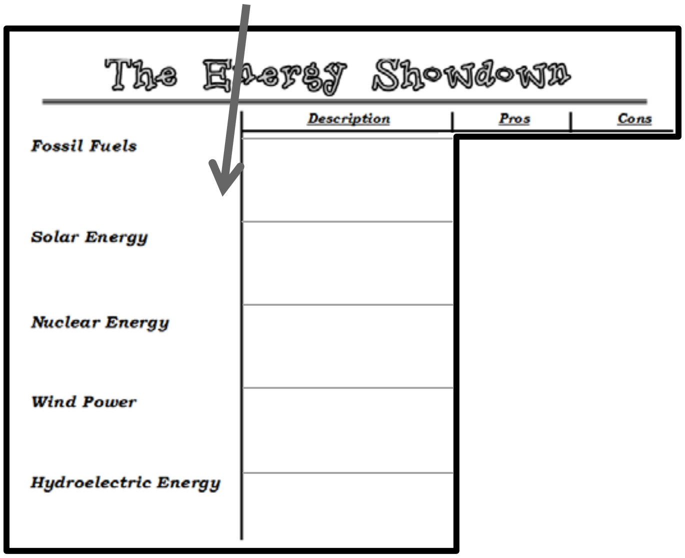
## Different Types of Energy

This template is a great way to review what fuels we use as sources of energy, as well as other alternative fuels. While this template lists the basics, you can make it more advanced by including other forms of energy (i.e. geothermal, biomass, etc.). Once completed, the 3-D Template will make a great review sheet!

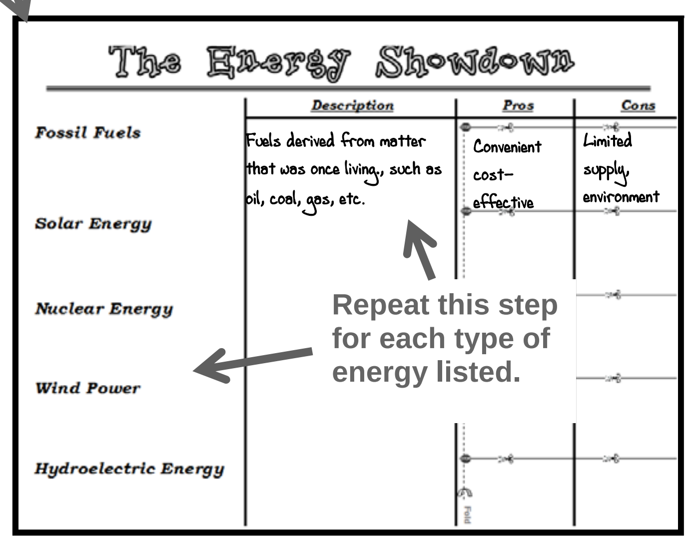
---

## Watch as it "Unfolds"

**Step 1:** Students cut and fold the template As shown, so that only the different types of energy are seen.




**Step 2:** Students fill out the template, giving a description of each type of energy, as well as its pros and cons.




---

**The template is provided on the next page.**
**Make copies to hand out to your students.**

# The Energy Showdown

| | Description | Pros | Cons |
|---|---|---|---|
| **Fossil Fuels** | | | |
| **Solar Energy** | | | |
| **Nuclear Energy** | | | |
| **Wind Power** | | | |
| **Hydroelectric Energy** | | | |

STOP
Fold

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