DOWNLOAD PDF SCIENCE ACTION LABS ELECTRICITY MAGNETISM

Chapter 1 : How to convert Magnetism to Electricity -- Electromagnetic Induction

Shed some light on electricity and magnetism with these Science Action Labs. Students will make and test magnets, investigate magnetic strength, build an electroscope, generate electricity, and more. They will feel the pull of science as they get hands-on experience with these complex subjects.

History of electromagnetic theory Originally, electricity and magnetism were considered to be two separate forces. There are four main effects resulting from these interactions, all of which have been clearly demonstrated by experiments: Electric charges attract or repel one another with a force inversely proportional to the square of the distance between them: Magnetic poles or states of polarization at individual points attract or repel one another in a manner similar to positive and negative charges and always exist as pairs: An electric current inside a wire creates a corresponding circumferential magnetic field outside the wire. Its direction clockwise or counter-clockwise depends on the direction of the current in the wire. A current is induced in a loop of wire when it is moved toward or away from a magnetic field, or a magnet is moved towards or away from it; the direction of current depends on that of the movement. As he was setting up his materials, he noticed a compass needle deflected away from magnetic north when the electric current from the battery he was using was switched on and off. This deflection convinced him that magnetic fields radiate from all sides of a wire carrying an electric current, just as light and heat do, and that it confirmed a direct relationship between electricity and magnetism. However, three months later he began more intensive investigations. Soon thereafter he published his findings, proving that an electric current produces a magnetic field as it flows through a wire. The CGS unit of magnetic induction oersted is named in honor of his contributions to the field of electromagnetism. James Clerk Maxwell His findings resulted in intensive research throughout the scientific community in electrodynamics. This unification, which was observed by Michael Faraday , extended by James Clerk Maxwell , and partially reformulated by Oliver Heaviside and Heinrich Hertz , is one of the key accomplishments of 19th century mathematical physics. It has had far-reaching consequences, one of which was the understanding of the nature of light. Unlike what was proposed by the electromagnetic theory of that time, light and other electromagnetic waves are at present seen as taking the form of quantized , self-propagating oscillatory electromagnetic field disturbances called photons. Different frequencies of oscillation give rise to the different forms of electromagnetic radiation , from radio waves at the lowest frequencies, to visible light at intermediate frequencies, to gamma rays at the highest frequencies. In , Gian Domenico Romagnosi , an Italian legal scholar, deflected a magnetic needle using a Voltaic pile. The factual setup of the experiment is not completely clear, so if current flew across the needle or not. An account of the discovery was published in in an Italian newspaper, but it was largely overlooked by the contemporary scientific community, because Romagnosi seemingly did not belong to this community. The owner emptying the box on a counter where some nails lay, the persons who took up the knives, that lay on the nails, observed that the knives took up the nails. On this the whole number was tried, and found to do the same, and that, to such a degree as to take up large nails, packing needles, and other iron things of considerable weight Whittaker suggested in that this particular event was responsible for lightning to be "credited with the power of magnetizing steel; and it was doubtless this which led Franklin in to attempt to magnetize a sewing-needle by means of the discharge of Leyden jars. The electromagnetic force is one of the four known fundamental forces. The other fundamental forces are: In particle physics though, the electroweak interaction is the unified description of two of the four known fundamental interactions of nature: All other forces e. Roughly speaking, all the forces involved in interactions between atoms can be explained by the electromagnetic force acting between the electrically charged atomic nuclei and electrons of the atoms. Electromagnetic forces also explain how these particles carry momentum by their movement. This includes the forces we experience in "pushing" or "pulling" ordinary material objects, which result from the intermolecular forces that act between the individual molecules in our bodies and those in the objects. The electromagnetic force is also involved in all forms of chemical phenomena. As a collection of electrons becomes more confined, their minimum momentum necessarily increases due to the Pauli exclusion principle. The behaviour of matter at the molecular scale including its density is determined by the balance between the electromagnetic force and the force generated by the exchange of momentum carried by the electrons themselves. Classical electrodynamics In , William Gilbert proposed, in his De Magnete , that electricity and magnetism, while both capable of causing attraction and repulsion of objects, were distinct effects. Mariners had noticed that lightning strikes had the ability to disturb a compass needle. One of the first to discover and publish a link between man-made electric current and magnetism was Romagnosi , who in noticed that connecting a wire across a voltaic pile deflected a nearby compass needle. A theory of electromagnetism, known as classical electromagnetism , was developed by various physicists during the period between and when it culminated in the publication of a treatise by James Clerk Maxwell , which unified the preceding developments into a single theory and discovered the electromagnetic nature of light. This violates Galilean invariance , a long-standing cornerstone of classical mechanics. One way to reconcile the two theories electromagnetism and classical mechanics is to assume the existence of a luminiferous aether through which the light propagates. However, subsequent experimental efforts failed to detect the presence of the aether. For more information, see History of special relativity. In addition, relativity theory implies that in moving frames of reference, a magnetic field transforms to a field with a nonzero electric component and conversely, a moving electric field transforms to a nonzero magnetic component, thus firmly showing that the phenomena are two sides of the same coin. Hence the term "electromagnetism". For more information, see Classical electromagnetism and special relativity and Covariant formulation of classical electromagnetism. Extension to nonlinear phenomena[edit] Magnetic reconnection in the solar plasma gives rise to solar flares , a complex magnetohydrodynamical phenomenon. The Maxwell equations are linear, in that a change in the sources the charges and currents results in a proportional change of the fields. Nonlinear dynamics can occur when electromagnetic fields couple to matter that follows nonlinear dynamical laws. This is studied, for example, in the subject of magnetohydrodynamics , which combines Maxwell theory with the Navierâ€"Stokes equations. Quantities and units[edit].

Chapter 2 : Electricity & Electronics Project Ideas

Explorations in Electricity & Magnetism. These easy-to-use, hands-on explorations are just what you need to get your science curriculum, and your students, into action!

Energy used or produced per second. Charged particles are at the basis of all electricity. Static electricity is a phenomenon caused by electric charges at rest. In this section, you will study what happens when charged particles start moving collectively. In this section, we will discuss electrons as carriers of charge, but other types of particles can also carry charge. See the Technical Note: Direction of Electric Current for more details. Certain materials have some loosely held electrons, which can escape from one atom and move around easily between other atoms. We call these electrons free electrons. Materials with a lot of free electrons are called conductors. They conduct electricity well. Most metals are good conductors. When a lot of free electrons are all moving in the same direction, we call it an electric current. The amount of electric current refers to the number of electrons to be precise, their charges passing through an area per unit of time, and is measured in amperes usually called amps for short, abbreviated with a capital A. One ampere equals roughly 6. Because the electron has such a small charge, the coulomb abbreviated with a capital C is often used as unit of charge for 6. Because electrons carry a negative charge and a coulomb refers to a positive charge, some definitions are needed. These are explained in the Technical Note: Direction of Electric Current. Just like water needs a pressure difference to start flowing, electrons require an electric potential difference to make them move. The potential difference provides the energy to create movement. Electric potential difference is also called voltage and it is measured in volts abbreviated V. In the case of water, pressure can be created by a water pump or difference in height, like a water tower. In electronics, batteries and electric generators are the common sources of voltage. The presence of two different charges also creates a voltage; it gives the electric charges the energy to flow. Conductors allow current to flow through them easily, and charges do not lose much energy as they flow through these materials. Similar to how water gets slowed down when it encounters a smaller section in a pipe, electric current can encounter materials that are harder to get through. The higher the value of the resistance, the more the material hinders or resists the current, and the more energy is lost as current flows through it. The total electric energy provided by a source is the amount of charge times the voltage. A source providing a larger voltage or more charges more electrons will both result in delivering more electric energy, which, in turn, allows it to power "heavier" electric devices or appliances. Energy Consumed explains this in more detail. Direction of Electric Current Electrons, being small and light, move easily and create the bulk of electric current we encounter, like current received from wall sockets or produced by most batteries. For this reason, we will continue to discuss electricity as the flow of electrons. Sometimes, electric current is created by the flow of other charged particles, like ions atoms that have a net electric charge due to a lack or surplus of electrons. To accommodate all variations, electric current is more accurately defined as the amount of electric charge passing per unit of time, regardless of what particles carry the electric charge. So far, we have only described the amount of current. The direction is given by the sign positive or negative of the current. Conventionally, positive electric current is opposite the direction of electron flow. This is called the conventional current. This means that if you draw an arrow in the direction electrons are moving through a wire, the conventional current points in the opposite direction. If the current is represented by a positive variable referred to as the conventional current, represented by a red arrow in the figure , the arrow representing the direction of current will point opposite to the movement of the electrons represented with a blue arrow. Batteries are often used as a source of electric current. The negative terminal has a surplus of electrons, giving it a net negative charge. These electrons flow from the negative terminal to the positive terminal when there is a conductive path connecting them. The direction of conventional current is opposite thisâ€”from the positive terminal to the negative terminal, as shown in Figure 3. When conductive material connects the two terminals of a battery, electrons will flow from the negative to the positive terminal. The conventional current will point from the positive to the negative terminal. Energy Consumed Most of our appliances specify how much electric energy they require per second they are in use. This is called a power expressed in watts abbreviated W. Power represents the amount of electric energy or voltage times charge consumed by the appliances per second it is running. If you write these relationships out in equation form: And then rearrange the equations a bit try this out if you know how to do algebra you can see that electric power is equal to voltage times current: And that energy is equal to power times time: Your electric bill expresses your use of electric energy in kilowatt-hours. However, note that the electricity supplied to your house by power lines is alternating current, meaning the voltage and current change with time instead of remaining constant. This is explained in the next section. Related Science Projects Click here for a list of science projects related to electric current. Summary of Key Concepts Current can only flow in a closed circuit of conductive material. In direct current DC , electrons all move in the same direction. In alternating current AC , electrons move back and forth with a specific frequency measured in hertz Hz. Never plug a homemade circuit directly into a wall outlet; the alternating current from the wall outlet can harm you badly. AC In the Current Electricity section, you learned about electric charge, current, voltage and other related topics. But, just because you have a voltage does not mean electric current will flow. Electrons also need a complete loop of conductive material to flow, called a closed circuit. When you turn the switch "on", the switch creates a path that conducts electricity and electrons start to moveâ€”meaning electric current flowsâ€—and the light turns on. As soon as you turn the switch "off", the path is broken and electrons can no longer flow. The switch is like a drawbridge; switching it on is letting down the bridge so the electrons can cross just like cars crossing a bridge and provide energy to the light bulb. Illustration of how electric current can move through a closed loop of conductive material left figure but stops flowing whenever the loop is broken right figure. This figure shows how a light bulb lights up when it is connected to a closed circuit. Note the yellow arrows show the direction of the conventional current. So remember, in order for electric current to flow, there must be a closed loop of conductive material. There are two different ways in which electrons can move through a loop of conductive material and create an electric current: In the case of a direct current abbreviated DC , the electrons always travel around the loop in the same direction so the conventional current also has a constant direction. Figure 5, below, shows a direct current, or electrons all moving in one direction in a conductive wire. All battery-powered devices, like cell phones and flashlights, run on direct current. Note that a constant voltage will create a direct current. In the case of direct current DC , the free electrons always collectively move in the same direction. This figure is not to scale. Read the technical note , below, to get a more accurate description. In the case of an alternating current AC , electrons travel back and forth. Figure 6, below, shows an animation of alternating current. One moment they all move collectively in one direction, and the next moment they all move collectively in the opposite direction, creating an oscillating electrical current. One back-and-forth oscillation is called a cycle, and the number of cycles delivered per time unit is called the frequency. Frequency is measured in hertz Hz. Note that the voltage creating this current will alternate with the same frequency. In the case of alternating current AC , the free electrons collectively move back and forth. Remember, just like in Figure 5, this figure is not to scale. Read the technical note, below, to get a more accurate view. Power lines deliver alternating electric current to our homes. Depending on what country you are in, alternating current from power outlets is usually 50 or 60 cycles per second Hz. Most electric appliances we "plug into the wall" run on alternating current. Some appliances need an "adapter" or "converter" to convert alternating current to direct current, like a cell phone charger. Also, these electrons do not actually move in a straight line. In reality, electrons bounce all around between atoms in a conductor, as illustrated in Figure 7, below. The overall drift toward one direction creates the electric current. Remember that the direction of conventional current is opposite the direction of electron motion, as shown in the figure. Illustration of how electrons bounce around between atoms in a conductor where the overall drift in one direction creates the electric current. Note that this figure is also not to scaleâ€”electrons are much smaller than atoms, but they are so tiny that it is impossible to draw an accurate to-scale figure where you can see the electrons. To understand the difference between AC and DC, you can also make a graph of electric current versus time.

Chapter 3 : Electromagnetism - Wikipedia

He also taught science education at Pepperdine and Cal State Northridge. Ed helped develop the science curriculum at the local and state levels in California. He is a member of the National Science Teachers Association.

Relation between electricity and magnetism As early as the Swiss-born mathematician Leonhard Euler suggested that the same ether that propagates light is responsible for electrical phenomena. In comparison with both mechanics and optics , however, the science of electricity was slow to develop. Magnetism was the one science that made progress in the Middle Ages , following the introduction from China into the West of the magnetic compass , but electromagnetism played little part in the scientific revolution of the 17th century. It was, however, the only part of physics in which very significant progress was made during the 18th century. There was no apparent connection of electricity with magnetism, except that magnetic poles, like electric charges , attract and repel with an inverse-square law force. Following the discoveries in electrochemistry the chemical effects of electrical current by the Italian investigators Luigi Galvani , a physiologist, and Alessandro Volta , a physicist, interest turned to current electricity. The list of four fundamental empirical laws of electricity and magnetism was made complete with the discovery of electromagnetic induction by Faraday in In brief, a change in magnetic flux through a conducting circuit produces a current in the circuit. When the laws were put into mathematical form by Maxwell, the law of induction was generalized to include the production of electric force in space, independent of actual conducting circuits, but was otherwise unchanged. As a result, he found on combining the equations that he arrived at a wave equation , according to which transverse electric and magnetic disturbances were propagated with a velocity that could be calculated from electrical measurements. These measurements were available to Maxwell, having been made in by the German physicists Rudolph Hermann Arndt Kohlrausch and Wilhelm Eduard Weber , and his calculation gave him a result that was the same, within the limits of error, as the speed of light in vacuum. It was the coincidence of this value with the velocity of the waves predicted by his theory that convinced Maxwell of the electromagnetic nature of light. The electromagnetic wave and field concept Faraday introduced the concept of field and of field lines of force that exist outside material bodies. As he explained it, the region around and outside a magnet or an electric charge contains a field that describes at any location the force experienced by another small magnet or charge placed there. The lines of force around a magnet can be made visible by iron filings sprayed on a paper that is held over the magnet. The concept of field, specifying as it does a certain possible action or force at any location in space, was the key to understanding electromagnetic phenomena. It should be mentioned parenthetically that the field concept also plays in varied forms a pivotal role in modern theories of particles and forces. Besides introducing this important concept of electric and magnetic field lines of force, Faraday had the extraordinary insight that electrical and magnetic actions are not transmitted instantaneously but after a certain lag in time, which increases with distance from the source. Moreover, he realized the connection between magnetism and light after observing that a substance such as glass can rotate the plane of polarization of light in the presence of a magnetic field. This remarkable phenomenon is known as the Faraday effect. As noted above, Maxwell formulated a quantitative theory that linked the fundamental phenomena of electricity and magnetism and that predicted electromagnetic waves propagating with a speed, which, as well as one could determine at that time, was identical with the speed of light. For one, there was little direct proof of the new theory. Furthermore, Maxwell not only had adopted a complicated formalism but also explained its various aspects by unusual mechanical concepts. On the Continent, particularly in Germany, matters were further complicated by the success of Carl Friedrich Gauss and Wilhelm Eduard Weber in developing a potential field theory for the phenomena of electrostatics and magnetostatics and their continuing effort to extend this formalism to electrodynamics. It is difficult in hindsight to appreciate the reluctance to accept the Faradayâ€”Maxwell theory. In so doing, he clarified the equations, making the symmetry of electric and magnetic fields apparent. Four years later, Hertz made a second major contribution: In Marconi received the first patent for wireless telegraphy, and in he achieved transatlantic radio communication. A wave of this kind is produced, for example, when a line of charges is moved back and forth along the line. Moving charges represent an electric current. In this back-and-forth motion, the current flows in one direction and then in another. These time-varying electric and magnetic fields spread out from their source, the oscillating current, at the speed of light in free space. The oscillating current in this discussion is the oscillating current in a transmitting antenna , and the time-varying electric and magnetic fields that are perpendicular to one another propagate at the speed of light and constitute an electromagnetic wave. Its frequency is that of the oscillating charges in the antenna. Once generated, it is self-propagating because a time-varying electric field produces a time-varying magnetic field , and vice versa. Electromagnetic radiation travels through space by itself. The belief in the existence of an ether medium, however, was at the time of Maxwell as strong as at the time of Plato and Aristotle. It was impossible to visualize ether because contradictory properties had to be attributed to it in order to explain the phenomena known at any given time. This fraction is one part in million. Michelson set out to measure this effect and, as noted above, designed for this purpose the interferometer sketched in Figure 4. Two beams of light race against each other, like two swimmers, one struggling upstream and back, while the other, covering the same distance, just crosses the river and returns. The second swimmer will always win, if there is any current in the river. An improved version of the interferometer, in which each half beam traversed its path eight times before both were reunited for interference, was built in by Michelson in collaboration with Morley. A heavy sandstone slab holding the interferometer was floated on a pool of mercury to allow rotation without vibration. This negative result did not, however, shatter the belief in the existence of an ether because the ether could possibly be dragged along with Earth and thus be stationary around the Michelson-Morley apparatus. In spite of this, ether-drift experiments continued to be conducted until about the mids. The eclipses of Io occur later than expected when Jupiter is at its most remote position. This effect is understandable if light requires a finite time to reach Earth from Jupiter. He computed the time for light to reach Earth from the Sun as 8 minutes 12 seconds. The first terrestrial measurements were made in by Fizeau and a year later by Foucault. Any measurement of velocity requires, however, a definition of the measure of length and of time. Current techniques allow a determination of the velocity of electromagnetic radiation to a substantially higher degree of precision than permitted by the unit of length that scientists had applied earlier. In the value of the speed of light was fixed at exactly ,, metres per second, and this value was adopted as a new standard. Furthermore, the second â€”the international unit of timeâ€”has been based on the frequency of electromagnetic radiation emitted by a cesium atom. Development of the quantum theory of radiation After a long struggle electromagnetic wave theory had triumphed. The Faraday - Maxwell - Hertz theory of electromagnetic radiation seemed to be able to explain all phenomena of light , electricity , and magnetism. The understanding of these phenomena enabled one to produce electromagnetic radiation of many different frequencies which had never been observed before and which opened a world of new opportunities. No one suspected that the conceptional foundations of physics were about to change again. Planck was led to this radically new insight by trying to explain the puzzling observation of the amount of electromagnetic radiation emitted by a hot body and, in particular, the dependence of the intensity of this incandescent radiation on temperature and on frequency. The quantitative aspects of the incandescent radiation constitute the radiation laws. The Austrian physicist Josef Stefan found in that the total radiation energy per unit time emitted by a heated surface per unit area increases as the fourth power of its absolute temperature T Kelvin scale. In another Austrian physicist, Ludwig Boltzmann , used the second law of thermodynamics to derive this temperature dependence for an ideal substance that emits and absorbs all frequencies. Such an object that absorbs light of all colours looks black, and so was called a blackbody. The wavelength or frequency distribution of blackbody radiation was studied in the s by Wilhelm Wien of Germany. It was his idea to use as a good approximation for the ideal blackbody an oven with a small hole. Any radiation that enters the small hole is scattered and reflected from the inner walls of the oven so often that nearly all incoming radiation is absorbed and the chance of some of it finding its way out of the hole again can be made exceedingly small. The radiation coming out of this hole is then very close to the equilibrium blackbody electromagnetic radiation corresponding to the oven temperature. The range of visible light is between the vertical dashed lines. The decrease of the radiation output at low frequency had already been explained by Lord Rayleigh in terms of the decrease, with lowering frequency, in the number of modes of electromagnetic radiation per frequency interval. Rayleigh, following the principle of equipartition of energy , assumed that all possible frequency modes could radiate with equal probability. A possible way out of this dilemma was to deny the high-frequency modes an equal chance to radiate. To explain quantized absorption and emission of radiation, it seemed sufficient to quantize only the energy levels of mechanical systems. Photoelectric effect Hertz discovered the photoelectric effect quite by accident while generating electromagnetic waves and observing their propagation. His transmitter and receiver were induction coils with spark gaps. He measured the electromagnetic field strength by the maximum length of the spark of his detector. In order to observe this more accurately, he occasionally enclosed the spark gap of the receiver in a dark case. In doing so, he observed that the spark was always smaller with the case than without it. He concluded, correctly, that the light from the transmitter spark affected the electrical arcing of the receiver. He used a quartz prism to disperse the light of the transmitter spark and found that the ultraviolet part of the light spectrum was responsible for enhancing the receiver spark. Hertz took this discovery seriously because the only other effect of light on electrical phenomena known at that time was the increase in electrical conductance of the element selenium with light exposure. Explanation of the photoelectric effect. This was accomplished in by J. Lenard discovered that for a given frequency of ultraviolet radiation the maximum kinetic energy of the emitted electrons depends on the metal used rather than on the intensity of the ultraviolet light. The light intensity increases the number but not the energy of emitted electrons. Moreover, he found that for each metal there is a minimum light frequency that is needed to induce the emission of electrons. Light of a frequency lower than this minimum frequency has no effect regardless of its intensity. This derivation and comparison made no references to substances and oscillators. At the end of this paper, Einstein concluded that if electromagnetic radiation is quantized, the absorption processes are thus quantized too, yielding an elegant explanation of the threshold energies and the intensity dependence of the photoelectric effect. Compton effect Convincing evidence of the particle nature of electromagnetic radiation was found in by the American physicist Arthur Holly Compton. While investigating the scattering of X-rays , he observed that such rays lose some of their energy in the scattering process and emerge with slightly decreased frequency. This so-called Compton effect can be explained, according to classical mechanics , as an elastic collision of two particles comparable to the collision of two billiard balls. The recoiling electron was observed and measured by Compton and Alfred W. Simon in a Wilson cloud chamber. It has the value 0. Resonance absorption and recoil During the mids the German physicist Gustav Robert Kirchhoff observed that atoms and molecules emit and absorb electromagnetic radiation at characteristic frequencies and that the emission and absorption frequencies are the same for a given substance. Such resonance absorption should, strictly speaking, not occur if one applies the photon picture due to the following argument. Since energy and momentum have to be conserved in the emission process, the atom recoils to the left as the photon is emitted to the right, just as a cannon recoils backward when a shot is fired. Because the recoiling atom carries off some kinetic recoil energy ER, the emitted photon energy is less than the energy difference of the atomic energy states by the amount ER. When a photon is absorbed by an atom, the momentum of the photon is likewise transmitted to the atom, thereby giving it a kinetic recoil energy ER.

Chapter 4 : Edward Shevick | LibraryThing

In these labs, students make and test magnets, investigate magnetic strength, build an electroscope, generate electricity, and more. Many of the science action labs provide data tables and other additional information, and an answer key is provided.

Great Thinkers How to Make Electricity from Magnetism- Electromagnetic Induction Moving a coil across a magnetic field will produce a current see image below. This is called electromagnetic induction. The direction of the current depends on how the coil is moved. The current produced in called the induced current. Electromagentic current is key to how a transformers, generator elecgtric motors and solenoids works. Michael Faraday is generally credited with the discovery of induction in He formulated the elecromotive force EMF produced around a closed path is proportional to the rate of the change in magnetic flux by any surface bounded by that path -- simplify this. This means that an electric current will be induced in any circuit when the magnetic flux through a surface by the conductor changes. This applies whether the field itself changes in trength or the conductors is moved through it. The Generator An important application from electromagnetic induction is the generator. A generator is a device that converts mechanical energy into electrical energy see types of energy. A simple generator is composed of a loop of wire located between the poles of a magnet. The loop is attached to a rod or axle that can rotate. When the loop of wire is rotated or cuts through the magnetic field lines a current of electricity is induced. As the loop of wire continues to rotate there will be a point where the wire is parrallel to the lines of force of the magnetic field. At this point no current is produced. Further rotation moves the loop to a position where the lines of force are cut in the opposite direction. This will cause the direction of current to flow in the opposite direction. Since the direction of current changes with each rotation of the loop the current in called Alternating Current AC -- Need a few images on this page. What is a transformer? A transformer is a device that increases or decreases voltage of alternating current. The current in one coil induces a current in another coil. A transformer consists of two coils one coil is the primary coil the other is the secondary coil wrapped around a metal core. If the number of loops of wire is the same in both coils the induced voltage will be the same in the secondary coil. If the number of loops in the secondary coil are greater than the primary coil the voltage will be greater in the secondary coil. This is an example of a step up transformer. See how do transformers work.

Chapter 5 : Magnetism Science Fair Projects and Experiments

Shed some light on electricity and magnetism with these Science Action Labs. Students will make and test magnets, investigate magnetic strength, build an electroscope, generate electricity, and more.

Chapter 6 : Magnet Man - Cool Experiments with Magnets

A basic explanation of what electricity and magnetism are, including details about how static electricity, current electricity, permanent magnets, magnetic fields and electromagnets work. Please enter a search term in the text box.

Chapter 7 : Third grade Lesson Electricity and Magnetism Pretest

In this featured chapter - Electricity and Magnetism - students will be given the opportunity to show their understanding of the included concepts by completing the engaging and creative activities for the OUTPUT side of their Science Interactive Notebook.

Chapter 8 : BBC Bitesize - KS2 Science

A magnet falls more slowly through a metallic tube than it does through a nonmetallic tube.

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