MAGNETIC FORCES AND FIELDS STUDY GUIDE ANSWERS pdf

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Magnetic Fields Study Guide for Chapters It is likely that magnetic fields will appear on the exam. Make sure to study the right-hand rule.

Relativity Electromagnetic Forces and Fields The magnetic field of naturally occurring magnetite is too weak to be used in devices such as modern motors and generators; these magnetic fields must come from electric currents. Magnetic fields affect moving charges, and moving charges produce magnetic fields; therefore, the concepts of magnetism and electricity are closely intertwined. Magnetic fields and lines of force A bar magnet attracts iron objects to its ends, called poles. One end is the north pole, and the other is the south pole. If the bar is suspended so that it is free to move, the magnet will align itself so that its north pole points to the geographic north of the earth. If two bar magnets are brought close together, the like poles will repel each other, and the unlike poles attract each other. This magnetic attraction or repulsion can be explained as the effect of one magnet on the other, or it can be said that one magnet sets up a magnetic field in the region around it that affects the other magnet. The magnetic field at any point is a vector. The direction of the magnetic field B at a specified point is the direction that the north end of a compass needle points at that position. Magnetic field lines, analogous to electric field lines, describe the force on magnetic particles placed within the field. Iron filings will align to indicate the patterns of magnetic field lines. Force on a moving charge If a charge moves through a magnetic field at an angle, it will experience a force. Figure 1 Using the right-hand rule to find the direction of magnetic force on a moving charge. To find the direction of the force on the charge, with a flat hand point your thumb in the direction of the velocity of the positive charge and your fingers in the direction of the magnetic field. The direction of the force is out of the palm of your hand. If the moving charge is negative, point your thumb opposite to its direction of motion. Mathematically, this force is the cross product of the velocity vector and the magnetic field vector. If the velocity of the charged particle is perpendicular to the uniform magnetic field, the force will always be directed toward the center of a circle of radius r, as shown in Figure 2. The x symbolizes a magnetic field into the plane of the paperâ€"the tail of the arrow. A dot symbolizes a vector out of the plane of the paperâ€"the tip of the arrow. Figure 2 The force on a charge moving perpendicular to a magnetic field is toward the center of a circle. The magnetic force provides centripetal acceleration: This equation underlies the operation of a mass spectrometer, which can separate equally ionized atoms of slightly different masses. The singly ionized atoms are given equal velocities, and because their charges are the same and they travel through the same B, they will travel in slightly different paths and can then be separated. Force on a current-carrying conductor Charges confined to wires can also experience a force in a magnetic field. In this case, point your thumb in the direction of the currentâ€"the direction of motion of positive charges. The current will experience no force if it is parallel to the magnetic field. Torque on a current loop A loop of current in a magnetic field can experience a torque if it is free to turn. Figure a depicts a square loop of wire in a magnetic field directed to the right. The x in a circle depicts the current traveling into the page away from the viewer, and the dot in a circle depicts the current out of the page toward the viewer. If the loop is pivoted, these forces produce a torque, turning the loop. A needle is affixed to a current coilâ€"a set of loops. The torque gives a certain deflection of the needle, which is dependent upon the current, and the needle moves over a scale to allow a reading in amperes. Ammeters are manufactured to measure different ranges of current. A voltmeter is constructed from a galvanometer movement in series with a resistor. The voltmeter samples a small portion of the current, and the scale provides a reading of potential differenceâ€"voltsâ€"between two points in the circuit. Figure 4 Using the second right-hand rule to determine the direction of the magnetic field resulting from a current. Grasp the wire so that your thumb points in the direction of the current. Your fingers will curl around the wire in the direction of the magnetic field. Consider the circular path around the current shown in Figure. The equations for the magnitudes of these fields follow. Figure 5 illustrates the fields for these three different configurations. Figure 5 Magnetic field resulting from a a current loop, b a solenoid, and c a toroid. The field at the center of a single loop is given by where r is the radius of the loop. The field due to a toroid is given by where R is the radius to the center of the toroid.

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Superconductors, which allow current to flow with no resistance. However these have only been produced in relatively extreme laboratory conditions, such as at temperatures approaching absolute zero Conductors, which allow electric current to flow with little resistance. Semiconductors, which allow some electric current to flow but with significant resistance. Insulators, which do not allow electric current to flow. Any two like charges repel each other, and opposite charges attract each other. Electric fields[edit] A charge in an electrical field feels a force. The charge is not a vector, but force is a vector, and so is the electric field. If a charge is positive, then force and the electric field point in the same direction. If the charge is negative, then the electric field and force vectors point in opposite directions. A point charge in space causes an electric field. The field is stronger closer to the point and weaker farther away. Electricity is made of subatomic particles called Electrons and so are Electric Fields and Magnetic Fields. One must also note that electrical fields come under the category of spherical fields as the inverse square law may be applied to the electrical field. This means that the electrical force, exhibited by the electrical field emitted by the subatomic electron charge - , acting upon a body is inversely proportional to the distance between the center point of the electric field subatomic electron and the body on which the electric force is acting upon. An electric circuit is composed of conducting wires through which an electric current flows through , a key or switch which is utilized to open and close the circuit, components which transfer electrical energy to a form of energy required by the component and an electromotive source such as a voltaic cell. A voltaic cell is an electromotive source in which are present two plates, zinc and copper, placed in dilute sulphuric acid. Whence the circuit is closed the zinc reacts with the sulphuric acid to produce zinc sulphate. The electromotive force which discharges the electrical energy in the electric current is considered to be originated on the surface of the zinc plate in the voltaic cell. However, depending upon the cell, closing the circuit gives rise to polarization, accumulation of hydrogen bubbles on the surface of the copper plate which seriously interferes with the movement of electricity and reduces the magnitude of the electromotive force. Consisting of similar characteristics as that of the voltaic cell however a Mage difference is present. Instead of the use of copper plates, a carbon plate is used. For this reason, magneze dioxide may be placed on the carbon to react to form a compound which whence in contact with hydrogen bubbles will turn the hydrogen into water, hence increasing the size of the electromotive force produced by the cell. The resistance encountered in conducting wires: Inversely proportional to the diameter of the conducting wire. Directly proportional to the length of the conducting wire. Varies with different substances. Varies with temperature of the conducting wire. In order to maintain a constant flow of an electric current a constant expenditure of chemical or mechanical energy is required. An electric current is accompanied by an electric field and a magnetic field. A device employed into determining the presence of an electric current is known as a galvanoscope. The conducting wire hriugh which the electric current flows through is he led over and parallel to the galvanoscope the magnetoscope preset inside of the galvanoscope being deflected in the opposite direction to which the electric current flows in. So with the aid of a galvanoscope one may not only deduce the magnetic properties of an electric current, the exhibition of a magnetic field, but the direction in which the current flows through. An electromotive force may also be generators by a dynamo. A rotating magnet present inside of a helix. The magnetic properties of electric currents may be used to construct magnets. The magnetic field emitted by the electric current is increased if the solenoid is placed around a magnetic mass of iron or any other substance possessing magnetic properties, that is the magnetic field of the iron is added to that of the electic current producing a more powerful magnetic field. Conductors may be arranged in two variants. Series and parallel circuits.

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Although magnets were first discovered over 2, years ago, it wasn't until the 19th century that scientists learned that moving electrons are responsible for magnetic force fields.

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The force on a current-carrying wire in a magnetic field is proportional to the field strength, the current flow, and the length of the wire a galvanometer can be used as an ammeter by.

6: Unit Resources (Physics C) - Mr. Smith Science

â€¢ Magnetic force is the force a magnet exerts on another magnet, on iron or a similar metal, or on moving charges. Like magnetic poles repel one another, and opposite magnetic poles.

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Unformatted text preview: CHAPTER 21 Magnetic Forces and Magnetic Fields PREVIEW In this chapter you will study the properties of magnetic ï¬•elds. You will learn how a magnetic ï¬•eld exerts a force on moving charges and currents, how electric currents produce magnetic ï¬•elds, and about the properties of magnetic materials.

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The magnetic force exerted on a moving particle in a magnetic field is the cross product of the magnetic field and the velocity of the particle, multiplied by the charge of the particle. Because the magnetic force is perpendicular to the particle's velocity, this causes uniform circular motion.

9: Electromagnetic Forces and Fields

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