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Electromagnetic induction worksheet

In order to continue using our site, we ask you to confirm your identity as a person. Thank you very much for your cooperation. The coil will tend to compress as the current travels through its loops. Challenge question: what happens to the wire coil if alternating current passes through it instead of direct current? Will the coil compress, expand, or do something completely different? Comments: Such questions require the student to visualise a bent version of the phenomenon defined in terms of straight wires (Ampére's experiment). Some students, of course, will have a much harder time visualizing this than others. For those who struggle with this form of problem solving, spend some time discussing problem-solving (visualization) techniques to help those who find it difficult to do. Is there a specific drawing, sketch, or analogy that other students have found useful in their analysis of the problem? The challenge of the alternating current question is to trick the question of sorts. The unthinking answer is that with alternating current, there will be a force that alternates direction: repelling one half-cycle, then appealing for the next half-cycle. You may find students divided on this assessment, some think there will be alternating power, while others think the force will stay in the same direction all the time. There is one sure way to prove who is right here: set up an experiment with AC power and see for yourself (straight, parallel wires will work just fine for that)! In the simple resistance circuit, the current can be calculated by splitting the applied voltage by resistance: Although the analysis of this circuit probably seems trivial to you, I would encourage you to look at what is happening here from a new perspective. An important principle observed many times in the study of physics is equilibrium, where quantities naturally seek a state of equilibrium. The equilibrium sought by this simple circuit is the equality of voltage: the voltage in the resistance must settle at the same value as the voltage output at the source: If the resistance is perceived as a source of voltage seeking balance with the source of voltage, then the current must converge at any value necessary to produce the necessary voltage balancing through resistance, according to ohm's law ($V = IR$). In other words, the resistance current reaches regardless of the size it has in order to generate a voltage drop equal to the voltage of the source. This may seem like a strange way of analyzing such a simple circuit, with resistance trying to generate a voltage drop equal to the source, and the current magically provided that regardless of the value you must achieve that voltage balance, but it is useful in understanding other types of circuit elements. For example, here we have a DC source connected to a large coil of wire through the switch. Suppose the wire coil has negligible resistance (0 Ω): Like the resistor circuit, the coil will try to balance the voltage with the voltage source after closing the switch. However, we know that the voltage induced by the coil is not directly proportional to the current, as is the case with resistance - instead, the decrease in coil voltage is proportional to the speed of magnetic flux change over time, as described by the Faraday Act of Electromagnetic Induction: Where, vcoil = instant induced voltage, in volts N = Number of revolutions in the wire coil \(\frac{dφ}{dt}\) = Instantaneous rate of magnetic flux change, in webers per second, Assuming that the linear relationship between the coil current and the magnetic flux (i.e. φ doubles when doubled), describe the current of this simple circuit over time after the switch is closed. Reveal the answer When the switch closes, the current will constantly increase at a linear pace over time: Challenge question: real wire coils contain electrical resistance (unless they are made of supreme wire, of course), and we know how voltage balance occurs in resistive circuits: the current converges to the value required for resistance to drop the same amount of voltage as the source. So describe what the current does in the circumference with a real wire vessel, not a supravodiving wire vessel. Note: Students who do not yet understand the concept of induction may be inclined to suggest that the current in this circuit will be infinite, following ohm law ($I=E/R$). One of the aims of this issue is to detect such misunderstandings so that they can be corrected. This circuit is an excellent example of the integration of the calculus principle, where the use of stable voltage through the inductor leads to an ever-increasing current. Whether you should touch on this topic or not depends on the mathematical ability of your students. In this worksheet, we will practice a description of the electrical current duced in the wire, which is located in a changing magnetic field. Q3: Diagram (a) shows a straight piece of copper wire moving along a rectangular path in a single magnetic field. The diagram (b) shows the potential difference between a piece of wire versus time, as it does. Position A in diagram (a) corresponds to the part indicated by P in diagram (b). Which part of diagram (b) corresponds to position C in diagram (a)? Which position in diagram (a) corresponds to Part S in diagram (b)? APosition B BPosition C CPositionA DPosition D Q4: The diagram shows a permanent magnet that moves through a loop of copper wire. This movement induces electrical current in the wire. Which of the following correctly describes how it is possible to increase the current in the wire? APo current in the wire can be increased by increasing wire loop. BS current in the wire can be increased by increasing the thickness of the wire. CConnection in the wire can be increased by moving the magnet through the loop faster. DPo current in the wire can be increased by moving the wire at the same speed and in the same direction as the magnet. EPo current in the wire can be increased by reversing the direction of movement of the magnet while keeping the wire in the same position. Which of the following correctly describes how it is possible to turn the current in the wire? AConnection in the wire can be reversed by rotating the loop on its axis when the magnet passes through it. BS current in the wire can be reversed by moving the magnet around the outside of the wire loop. The CS current in the wire can be reversed by reversing the direction of movement of the magnet while keeping the wire in the same position. DPo current in the wire can be reversed by moving the wire at the same speed and in the same direction as the magnet. EConnection in the wire can be reversed by faster movement of the magnet through a loop. What would be the effect of keeping the magnet still and moving the wire loop toward it so that the magnet passes through it? And the current in the wire would be zero. BHom the same current would be provoked in the wire. CS current in the wire would be turned. What would be the effect of turning the magnet around so that the south pole of the magnet passes through the loop first? And the current in the wire would be zero. BHom the same current would be provoked in the wire. C The current would be reversed. Question 5: Diagram (a) shows a straight piece of copper wire moving along a circular path in a single magnetic field. The diagram (b) shows the potential difference between a piece of wire versus time, as it does. If point A in diagram (a) corresponds to point P in diagram (b), what point in diagram (a) corresponds to the R point in diagram (b)? APosition BPosition CPosition C DPosition D Q6: Parts (a), (b), (c) and (d) of the diagram show a straight piece of copper wire moving through the magnetic field. The magnetic field is uniform and in each part the wire moves at the same speed, but in a different direction through the magnetic field. Which of (a), (b), (c) and (d) shows the movement of the wire which would lead to the induction of an electrical potential difference in the wire? A (b) and (d) B (a) and (c) C (b) and (c) D (a) and (b) E (a) and (d) Q7: Parts (a), (b), (c) and (d) shall show on the diagram a straight piece of copper wire moving through a magnetic field. The magnetic field is uniform and in each part the wire moves at the same speed, but in a different direction through the magnetic field. Which of (a), (b), (c) and (d) shows the movement of the wire which would lead to the greatest potential difference in it? Question 8: Parts (a), (b), (c) and (d) the diagram shows a straight piece of copper wire moving through the magnetic field. The magnetic field is uniform and in each part the wire moves in a different direction through the magnetic field. Which of (a), (b), (c) and d) show the movement of the wire that would lead to the induction of an electrical potential difference in it? A (c) and (d) B (a) and (d) C (a) and (b) D (a) and (c) E (b) and (d) Q9: The diagram shows a bar magnet which is moving away from the solenoid. It induces an electric current in the solenoid, which creates its own magnetic field in turn. Which end of solenoid is the North Pole induced magnetic field? Q11: The diagram shows a bar magnet moving in the direction and then through the copper solenoid. This movement makes a potential difference at both ends of the solenoid. Which of the following correctly describe the ways in which the potential difference at the ends of the solenoid could be increased? The potential difference would increase if the magnet was moved through the coil faster. The potential difference would increase if the number of revolutions of the coil was reduced. The potential difference would increase if the magnet was moved through the coil more slowly. The potential difference would increase if the number of revolutions of the coil increased. Aa a d Ba and b Ca and c Db and d Ec and d d