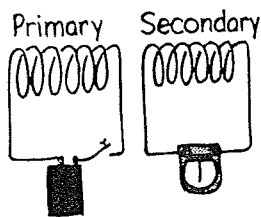
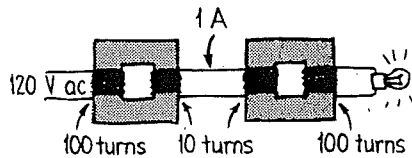


1. A common pickup for an electric guitar consists of a coil of wire around a small permanent magnet. The magnetic field of the magnet induces magnetic poles in the nearby guitar string. When the string is plucked, the rhythmic oscillations of the string produce the same rhythmic changes in the magnetic field through the coil, which in turn induce the same rhythmic voltages in the coil, which when amplified and sent to a speaker produce music! Why will this type pickup not work with nylon strings?
2. Why does an iron core increase the magnetic induction of a coil of wire?
3. Why are the armature and field windings of an electric motor usually wound on an iron core?
4. Why is a generator armature harder to rotate when it is connected to a circuit and supplying electric current?
5. Will a cyclist coast farther if the lamp connected to his generator is turned off? Explain.
6. If your metal car moves over a wide, closed loop of wire embedded in a road surface, will the magnetic field of the Earth within the loop be altered? Will this produce a current pulse? Can you think of a practical application for this at a traffic intersection?
7. At the security area of an airport, you walk through a weak ac magnetic field inside a coil of wire. What is the result of a small piece of metal on your person that slightly alters the magnetic field in the coil?
8. A piece of plastic tape coated with iron oxide is magnetized more in some parts than in others. When the tape is moved past a small coil of wire, what happens in the coil? What is a practical application of this?
10. A certain simple Earthquake detector consists of a little box firmly anchored to the Earth. Suspended inside the box is a massive magnet that is surrounded by stationary coils of wire fastened to the box. Explain how this device works, using two important principles of physics—one studied in Chapter 2, and the other in this chapter.
11. What is the primary difference between an electric motor and an electric generator?
15. If you place a metal ring in a region where a magnetic field is rapidly alternating, the ring may become hot to your touch. Why?
16. A magician places an aluminum ring on a table, underneath which is hidden an electromagnet. When the magician says "abracadabra" (and pushes a switch that starts current flowing through the coil under the table), the ring jumps into the air. Explain his "trick."
17. How could a light bulb near, yet not touching, an electromagnet be lit? Is ac or dc required? Defend your answer.
19. Two separate but similar coils of wire are mounted close to each other, as shown below. The first coil is connected to a battery and has a direct current flowing through it. The second coil is connected to a galvanometer. How does the galvanometer respond when the switch in the first circuit is closed? After being closed when the current is steady? When the switch is opened?

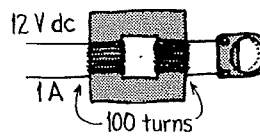


20. Why will more voltage be induced with the apparatus shown above if an iron core is inserted in the coils?

21. Why does a transformer require alternating voltage?
22. How does the current in the secondary of a transformer compare with the current in the primary when the secondary voltage is twice the primary voltage?
23. In what sense can a transformer be thought of as an electrical lever? What does it multiply? What does it *not* multiply?
24. Why can a hum usually be heard when a transformer is operating?
25. Why is it important that the core of a transformer pass through both coils?
26. In the circuit shown, how many volts are impressed across and how many amps flow through the light bulb?



27. In the circuit shown, how many volts are impressed across and how many amps flow through the meter?



28. How would you answer the previous question if the input were 12-V ac?
29. Can an efficient transformer step up energy? Defend your answer.
30. Your friend says that, according to Ohm's law, high voltage produces high current. Then your friend asks, so how can power be transmitted at high voltage and *low* current in a power line? What is your illuminating response?
31. If a bar magnet is thrown into a coil of high-resistance wire, it will slow down. Why?
32. When a bar magnet is dropped through a vertical length of copper pipe, it falls noticeably more slowly than when dropped through a vertical length of plastic pipe. If the pipe is long enough, the magnet will reach a terminal falling speed. Why?
33. The metal wing of an airplane acts like a "wire" flying through the Earth's magnetic field. A voltage is induced between the wing tips and a current flows along the wing, but only for a short time. Why does the current stop even though the airplane keeps flying through the Earth's field?
34. What is wrong with this scheme? To generate electricity without fuel, arrange a motor to run a generator that will produce electricity that is stepped up with transformers so that the generator can run the motor and simultaneously furnish electricity for other uses.
35. With no magnets around, why will current flow in a large coil of wire waved around in the air?
36. We know the source of a sound wave is a vibrating object. What is the source of an electromagnetic wave?
37. What does an incident radio wave do to the electrons in a receiving antenna?
38. How do you suppose the frequency of an electromagnetic wave compares with the frequency of the electrons it sets into oscillation in a receiving antenna?
39. A friend says that changing electric and magnetic fields generate one another, and this gives rise to visible light when the frequency of change matches the frequencies of light. Do you agree? Explain.

40. Would electromagnetic waves exist if changing magnetic fields could produce electric fields, but changing electric fields could not in turn produce magnetic fields? Explain.