Iron paper clips are strongly attracted to

A. the north pole of a magnet.
B. the south pole of a magnet.
C. either the north or south pole of a magnet.
D. None of the above.
Iron paper clips are strongly attracted to

A. the north pole of a magnet.
B. the south pole of a magnet.
C. either the north or south pole of a magnet.
D. None of the above.

Explanation:
Magnetic domains in the clips are induced into alignment in much the same way that electric charges are induced when polarized.
Moving electric charged particles can interact with

A. an electric field.
B. a magnetic field.
C. Both of the above.
D. Neither of the above.
Moving electric charged particles can interact with

A. an electric field.
B. a magnetic field.
C. Both of the above.
D. Neither of the above.
When a magnetized compass is placed in a magnetic field, it aligns with the field because of

A. attracting forces between the compass and the field.
B. torques on the magnet.
C. magnetic domains in the compass needle.
D. All of the above.
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A. attracting forces between the compass and the field.
B. *torques on the magnet.*
C. magnetic domains in the compass needle.
D. All of the above.
Surrounding moving electric charges are

A. electric fields.
B. magnetic fields.
C. Both of the above.
D. Neither of the above.
Surrounding moving electric charges are

A. electric fields.
B. magnetic fields.
C. Both of the above.
D. Neither of the above.
A magnetic force cannot act on an electron when it

A. is at rest.
B. moves parallel to magnetic field lines.
C. Both of the above.
D. Neither of the above.
A magnetic force cannot act on an electron when it

A. is at rest.
B. moves parallel to magnetic field lines.
C. Both of the above.
D. Neither of the above.

**Explanation:**
A force is exerted on charged particles only when they move at an angle to magnetic field lines. The force is greatest when motion is at right angles to the magnetic field, and it is zero when motion is parallel to the field.
The reason a magnetic force can’t increase the kinetic energy of a moving electron is because

A. energy conservation would be violated.
B. electrons and magnets don’t interact.
C. electron spin cancels any energy buildup.
D. the magnetic force acts at right angles to the electron’s motion.
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A. energy conservation would be violated.
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The fact that a force is exerted on a current-carrying wire in a magnetic field underlies

A. motors.
B. electric meters.
C. Both of the above.
D. Neither of the above.
The fact that a force is exerted on a current-carrying wire in a magnetic field underlies

A. motors.
B. electric meters.
C. Both of the above.
D. Neither of the above.
A motor and a generator are

A. similar devices.
B. very different devices with different applications.
C. forms of transformers.
D. energy sources.
A motor and a generator are

A. similar devices.
B. very different devices with different applications.
C. forms of transformers.
D. energy sources.

**Explanation:**
The main difference in a motor and generator is energy input and output, which are opposite for each.
A voltage will be induced in a wire loop when the magnetic field within that loop

A. changes.
B. aligns with the electric field.
C. is at right angles to the electric field.
D. converts to magnetic energy.
A voltage will be induced in a wire loop when the magnetic field within that loop

A. changes.
B. aligns with the electric field.
C. is at right angles to the electric field.
D. converts to magnetic energy.
An electric field is induced in any region of space in which

A. a magnetic field changes with time.
B. a magnetic field’s orientation is at right angles to the electric field.
C. the accompanying electric field undergoes changes in time.
D. All of the above.
An electric field is induced in any region of space in which

A. a magnetic field changes with time.
B. a magnetic field’s orientation is at right angles to the electric field.
C. the accompanying electric field undergoes changes in time.
D. All of the above.

Comment:
Quite wonderfully, changing electric and magnetic fields produce light!
Push a magnet into 4 turns of wire, then 2 turns, both connected to a lamp. Which more greatly resists your push?

A. The 2-turn coil.
B. The 4-turn coil.
C. Both the same.
Push a magnet into 4 turns of wire, then 2 turns, both connected to a lamp. Which more greatly resists your push?

A. The 2-turn coil.
B. The 4-turn coil.
C. Both the same.
Magnet A has twice the magnetic field strength of magnet B, and, at a certain distance, it pulls on magnet B with a force of 50 N. With how much force, then, does magnet B pull on magnet A?

A. 50 N.
B. 25 N.
C. 100 N.
D. Not enough information in the problem (need at least distance).
Magnet A has twice the magnetic field strength of magnet B, and, at a certain distance, it pulls on magnet B with a force of 50 N. With how much force, then, does magnet B pull on magnet A?

A. 50 N. 
B. 25 N. 
C. 100 N. 
D. Not enough information in the problem (need at least distance).

*Explanation:*

Newton’s Third Law states that both magnets pull on each other with the same amount of force in opposite directions.
What happens to the coasting distance of a cyclist if the lamp connected to the generator is turned off (for example, disconnected from the wheel)?

A. Coasts farther.
B. Coasts less.
C. Coasts the same.
D. Not enough information for a reasoned answer.
What happens to the coasting distance of a cyclist if the lamp connected to the generator is turned off (for example, disconnected from the wheel)?

A. Coasts farther.
B. Coasts less.
C. Coasts the same.
D. Not enough information for a reasoned answer.

Comment:
When the generator is lighting the lamp, it takes energy from the bicycle wheel. That means a slowing of the wheel. But when the lamp is inactive, the KE of the bike is greater and the rolling distance greater.
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 change of current in the wire?

A. Yes and no.  
B. No and no.  
C. No and yes.  
D. Yes and yes.
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 change of current in the wire?

A. Yes and no.
B. No and no.
C. No and yes.
D. Yes and yes.

Comment:
Traffic lights detect vehicles this way.
If you have metal in your pockets at the airport will the closed loop of wire you walk through be altered? Will this produce a change of current in the wire?

A. Yes and no.
B. No and no.
C. No and yes.
D. Yes and yes.
If you have metal in your pockets at the airport will the closed loop of wire you walk through be altered? Will this produce a change of current in the wire?

A. Yes and no.
B. No and no.
C. No and yes.
D. Yes and yes.
Your friend says that, if you crank the shaft of a dc motor manually, the motor becomes a dc generator. Do you agree or disagree?

A. Disagree; for one thing, the magnet for an ac motor is not the same as for a DC motor.
B. Agree; Your friend is right on!
C. Agree only if your friend will agree to some of your ideas.
D. Don’t commit yourself, for what if you’re mistaken?
Your friend says that, if you crank the shaft of a dc motor manually, the motor becomes a dc generator. Do you agree or disagree?

A. Disagree; for one thing, the magnet for an ac motor is not the same as for a DC motor.

B. **Agree; Your friend is right on!**

C. Agree only if your friend will agree to some of your ideas.

D. Don’t commit yourself, for what if you’re mistaken?
A magician places a light bulb connected only to a coil of wire on the table. Then she says “abracadabra” and the light bulb turns on. What’s your explanation?

A. The magician must have hidden a battery which switched on.
B. The magician is magical and can control the laws of physics.
C. She placed the center of the coil over an AC electromagnet beneath the table and then activated a switch.
D. None of these.
A magician places a light bulb connected only to a coil of wire on the table. Then she says “abracadabra” and the light bulb turns on. What’s your explanation?

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C. She placed the center of the coil over an AC electromagnet beneath the table and then activated a switch.
D. None of these.

*Comment:*
Electromagnetic induction doesn’t require physical contact between circuit elements!
Which of the following can transmit energy wirelessly?

A. Solar.
B. Electromagnetic Induction.
C. Wind.
D. All of the above.
Which of the following can transmit energy wirelessly?

A. Solar.
B. Electromagnetic Induction.
C. Wind.
D. All of the above.
A portable iPod requires 9 volts to operate correctly. A transformer nicely allows the device to be powered from a 120-volt outlet. If the primary has 120 turns, how many turns should the secondary have?

A. 1
B. 9
C. 10
D. 90
A portable iPod requires 9 volts to operate correctly. A transformer nicely allows the device to be powered from a 120-volt outlet. If the primary has 120 turns, how many turns should the secondary have?

A. 1  
B. 9  
C. 10  
D. 90
An electric car requires 12 V for its devices. When connected to a 120-V household circuit, a transformer is needed. If the primary coil of the transformer has 240 windings, how many turns should there be in the secondary coil?

A. 10  
B. 12  
C. 24  
D. 240
An electric car requires 12 V for its devices. When connected to a 120-V household circuit, a transformer is needed. If the primary coil of the transformer has 240 windings, how many turns should there be in the secondary coil?

A. 10
B. 12
C. 24
D. 240
A transformer for a laptop computer converts a 120-V input to a 12-V output. How many turns does the primary coil have compared to the number of turns the secondary coil has?

A. 1  
B. 2  
C. 5  
D. 10
A transformer for a laptop computer converts a 120-V input to a 12-V output. How many turns does the primary coil have compared to the number of turns the secondary coil has?

A. 1
B. 2
C. 5
D. 10
The type of voltage a transformer operates on is

A. DC.
B. AC.
C. either.
D. neither.
The type of voltage a transformer operates on is

A. DC.
B. AC.
C. either.
D. neither.
The magnetic field lines about a current-carrying wire form

A. circles.
B. radial lines.
C. eddy currents.
D. energy loops.
The magnetic field lines about a current-carrying wire form

A. circles.
B. radial lines.
C. eddy currents.
D. energy loops.
If you change the magnetic field in a closed loop of wire, you induce in the loop a

A. current.
B. voltage.
C. electric field.
D. All of the above.
E. None of the above.
If you change the magnetic field in a closed loop of wire, you induce in the loop a

A. current.
B. voltage.
C. electric field.
D. **All of the above.**
E. None of the above.
A magnetic force acting on a beam of electrons changes its

A. direction.
B. energy.
C. Both of these.
D. None of these.
A magnetic force acting on a beam of electrons changes its

A. direction.
B. energy.
C. Both of these.
D. None of these.
A 120-V hair dryer has a power input required of 1200 W. What is the current that goes through the wires?

A. 1 A.
B. 5 A.
C. 10 A.
D. 20 A.
A 120-V hair dryer has a power input required of 1200 W. What is the current that goes through the wires?

A. 1 A.
B. 5 A.
C. 10 A.
D. 20 A.

Explanation:
Power/voltage = 1200 W/120 V = 10 A.
The power output of an ideal transformer is

A. greater than the power input.
B. the same as the power input.
C. somewhat less than the power input.
D. appreciably less than the power input.
The power output an ideal transformer is

A. greater than the power input.
B. the same as the power input.
C. somewhat less than the power input.
D. appreciably less than the power input.
A step-up transformer in an electrical circuit can step up

A. voltage.
B. energy.
C. Both of these.
D. Neither of these.
A step-up transformer in an electrical circuit can step up

A. voltage.
B. energy.
C. Both of these.
D. Neither of these.

Comment:
Stepping up energy is a conservation energy no-no!
A magnetic field is induced in any region of space in which

A. a magnetic field’s orientation is at right angles to the electric field.
B. the accompanying electric field remains steady.
C. an electric field changes with time.
D. All of these.
A magnetic field is induced in any region of space in which

A. a magnetic field’s orientation is at right angles to the electric field.
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If the voltage produced by a generator alternates, it does so because

A. in effect it is an AC motor in reverse.
B. the current it produces alternates.
C. the changing magnetic field that produces it alternates.
D. of alterations in the mechanical energy input.
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