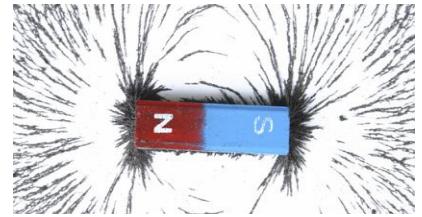


# MAGNETISM & INDUCTION

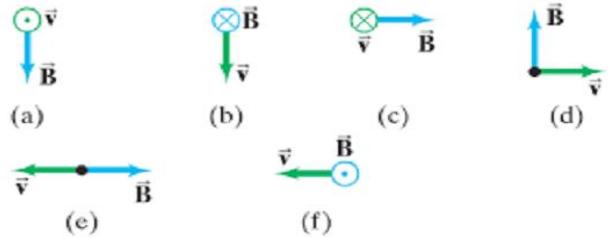


1. What creates a magnetic field?
2. What is a lodestone?
3. Describe the difference between paramagnetism and ferromagnetism.
4. Iron is magnetic, why isn't wood? Explain in terms of electrons.
5. Why can iron's electrons align?
6. What causes the earth's magnetic field? What is magnetic declination?
7. What is a compass? What is a potential pitfall when using it to determine which way is north?
8. How does the earth's magnetic field protect us? What does this have to do with the Lorentz force?
9. In the giant CERN particle accelerator in Switzerland, protons are accelerated to speeds of  $2.0 \times 10^8$  m/s through a magnetic field of 3.5 T and then collided with a fixed target. What is the magnitude of the magnetic force experienced by the protons as they are accelerated around the giant ring?  
*Ans:  $1.1 \times 10^{-10}$  N*

10. In Fred's old color TV, electrons are shot toward the screen through a  $1.0 \times 10^{-3}$  T magnetic field set up in the picture tube. If each electron experiences a magnetic force of  $2.9 \times 10^{-15}$  N, at what speed is it propelled through the picture tube? What percentage of the speed of light is this?  
*Ans:  $1.8 \times 10^7$  m/s, 6%*

11. A proton shot out of the sun at a speed of  $6.0 \times 10^6$  m/s during a "sunspot maximum" travels through the strong magnetic field of the sun. What is the maximum magnetic force experienced by the proton at a point where the sun's magnetic field is 0.090 T?  
*Ans:  $8.6 \times 10^{-14}$  N*

12. Find the direction of the force on a negative charge for each diagram shown, where  $v$  is the velocity of the charge and  $B$  is the direction of the magnetic field. Note: the 'X' inside the circle indicates the vector points inward and the '.' inside the circle means it points outward, toward you.



*Ans: a) left b) left c) up d) inward e) no force f) downward*

13. An electron experiences the greatest force as it travels  $2.9 \times 10^6$  m/s in a magnetic field when it is moving northward. The force is upward and of magnitude  $7.2 \times 10^{-13}$  N. What are the magnitude and direction of the magnetic field?

*Ans: 1.6 T, east*

14. A 0.90-m-long straight wire on board the Voyager spacecraft carries a current of 0.10 A perpendicular to Jupiter's strong magnetic field of  $5.0 \times 10^{-4}$  T. What is the magnitude of the magnetic force experienced by the wire?  
*Ans:  $4.5 \times 10^{-5}$  N*

15. While vacuuming the living room rug, Buster pulls the 4.0-m vacuum cleaner cord so that it is lying perpendicular to Earth's magnetic field of  $5.3 \times 10^{-5}$  T. If the cord is carrying a current of 6.0 A, how large a magnetic force is created on the cord by Earth's magnetic field? If Buster then pulls the cord so that it lies parallel to Earth's magnetic field, how large is the magnetic force now experienced by the cord?

*Ans:  $1.3 \times 10^{-3}$  N, zero*

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- 16.** At the equator, where Earth's  $3.0 \text{ E - 5 T}$  magnetic field is parallel to the surface of Earth, Donna is spinning her wedding ring (which has a diameter of 2.0 cm) on top of the table. Find the change in flux through the ring if Donna slides it across the table, rolls it across the table, spins it on its edge.

*Ans: Zero, zero,  $9.4 \text{ E - 9 Wb}$*

- 17.** A 10.2 cm diameter wire coil is initially oriented so that its plane is perpendicular to a magnetic field of  $0.63 \text{ T}$  pointing up. During the course of  $0.15 \text{ s}$ , the field is changed to one of  $0.25 \text{ T}$  pointing down. What is the average induced voltage in the coil?

*Ans:  $4.8 \text{ E - 2 V}$*

- 18.** A transformer has 320 turns in the primary coil and 120 in the secondary coil. What kind of transformer is this? By what factor does it change the voltage? Step up or step down? By what factor does it change the current?

*Ans: Step down, 0.375, 2.67*

- 19.** A transformer has 330 primary turns and 1340 secondary turns. The input voltage is  $120 \text{ V}$  and the output current is  $15.0 \text{ Am}$ . What are the output voltage and input current?

*Ans: 487 volts, 61 amps*

- 20.** While Hiroshi sits in his living room, the newspaper carrier rings his doorbell. If a voltage of  $120 \text{ V}$  passes through the 200-turn primary coil of the transformer, how many turns are needed in the secondary coil to reduce the voltage to the  $6.0 \text{ V}$  needed to run the doorbell?

*Ans: 10 turns*

- 21.** A bug zapper in the Snyders' back yard runs off a  $120\text{-V}$  household line through a transformer whose primary coil contains 50. turns while the secondary coil contains 2000. turns. What is the output voltage of the transformer? Is this a step up or step down transformer?

*Ans: 4800 V, step up*