

12. A 52-turn coil with an area of $5.5 \times 10^{-3} \text{ m}^2$ is dropped from a position where $B = 0.00 \text{ T}$ to a new position where $B = 0.55 \text{ T}$. If the displacement occurs in 0.25 s and the area of the coil is perpendicular to the magnetic field lines, what is the resulting average emf induced in the coil?

GENERATORS, MOTORS, AND MUTUAL INDUCTANCE

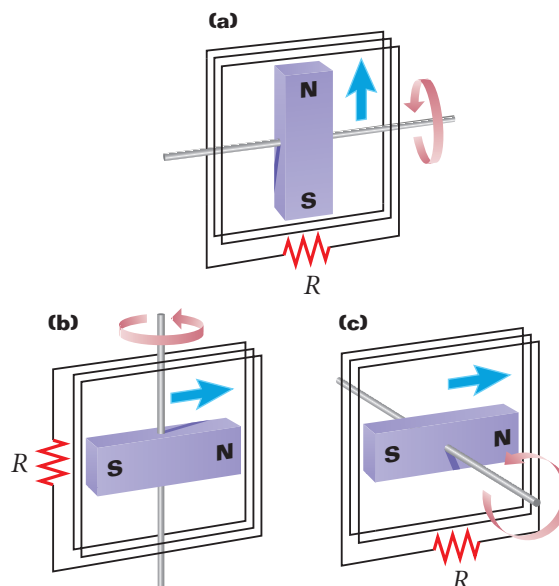
Review Questions

- List the essential components of an electric generator, and explain the role of each component in generating an alternating emf.
- A student turns the handle of a small generator attached to a lamp socket containing a 15 W bulb. The bulb barely glows. What should the student do to make the bulb glow more brightly?
- What is meant by the term *frequency* in reference to an alternating current?
- How can an ac generator be converted to a dc generator? Explain your answer.
- What is meant by back emf? How is it induced in an electric motor?
- Describe how mutual induction occurs.
- What is the difference between a step-up transformer and a step-down transformer?
- Does a step-up transformer increase power? Explain your answer.

Conceptual Questions

- When the plane of a rotating loop of wire is parallel to the magnetic field lines, the number of lines passing through the loop is zero. Why is the current at a maximum at this point in the loop's rotation?
- In many transformers, the wire around one winding is thicker, and therefore has lower resistance, than the wire around the other winding. If the thicker wire is wrapped around the secondary winding, is the device a step-up or a step-down transformer? Explain.

23. A bar magnet is attached perpendicular to a rotating shaft. The magnet is then placed in the center of a coil of wire. In which of the arrangements shown below could this device be used as an electric generator? Explain your choice.



- Would a transformer work with pulsating direct current? Explain your answer.
- The faster the coil of loops, or *armature*, of an ac generator rotates, the harder it is to turn the armature. Use Lenz's law to explain why this happens.

Practice Problems

For problems 26–29, see Sample Problem B.

- The rms applied emf across high-voltage transmission lines in Great Britain is 220 000 V. What is the maximum emf?
- The maximum applied emf across certain heavy-duty appliances is 340 V. If the total resistance of an appliance is 120Ω , calculate the following:
 - the rms applied emf
 - the rms current
- The maximum current that can pass through a light bulb filament is 0.909 A when its resistance is 182Ω .
 - What is the rms current conducted by the filament of the bulb?
 - What is the rms emf across the bulb's filament?
 - How much power does the light bulb use?