CH25

2. || A scalloped hammerhead shark swims at a steady speed of 1.5 m/s with its 85-cm-wide head perpendicular to the earth's 50 μT magnetic field. What is the magnitude of the emf induced between the two sides of the shark's head?

6. || In the rainy season, the Amazon flows fast and runs deep. In one location, the river is 23 m deep and moves at a speed of 4.0 m/s toward the east. The earth's 50 μT magnetic field is parallel to the ground and directed northward. If the bottom of the river is at 0 V, what is the potential (magnitude and sign) at the surface?

12. || At a typical location in the United States, the earth's magnetic field has a magnitude of 5.0×10^{-5} T and is at a 65° angle from the horizontal. What is the flux through the 22 cm × 28 cm front cover of your textbook if it is flat on your desk?

20. || The loop in Figure P25.20 has an induced current as shown. The loop has a resistance of 0.10 Ω. Is the magnetic field strength increasing or decreasing? What is the rate of change of the field, $\Delta B/\Delta t$?

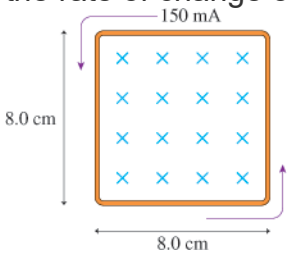

Figure Q25.20

24. || The magnetic field at the earth's surface can vary in response to solar activity. During one intense solar storm, the vertical component of the magnetic field changed by 2.8 μ T per minute, causing voltage spikes in large loops of the power grid that knocked out power in parts of Canada. What emf is induced in a square 100 km on a side by this rate of change of field?

60. |||| People immersed in strong unchanging magnetic fields occasionally report sensing a metallic taste. Some investigators suspect that motion in the constant field could produce a changing flux and a resulting emf that could stimulate nerves in the tongue. We can make a simple model to see if this is reasonable by imagining a somewhat extreme case. Suppose a patient having an MRI is immersed in a 3.0 T field along the axis of his body. He then quickly tips his head to the side, toward his right shoulder, tipping his head by 30° in the rather short time of 0.15 s. Estimate the area of the tongue; then calculate the emf that could be induced in a loop around the outside of the tongue by this motion of the head. How does this emf compare to the approximately 15 mV necessary to trigger an action potential? Does it seem reasonable to suppose that an induced emf is responsible for the noted effect?