

14. A material that becomes strongly magnetized in the same direction as the magnetizing field is classified as
- diamagnetic.
  - ferromagnetic.
  - paramagnetic.
  - toroidal.
15. Which of the following materials are nonmagnetic?
- air.
  - wood.
  - glass.
  - all of the above.
16. The gauss (G) is a unit of
- flux density.
  - magnetic flux.
  - permeability.
  - none of the above.
17. One gauss (G) is equal to
- $\frac{1 \text{ Mx}}{\text{m}^2}$ .
  - $\frac{1 \text{ Wb}}{\text{cm}^2}$ .
  - $\frac{1 \text{ Mx}}{\text{cm}^2}$ .
  - $\frac{1 \text{ Wb}}{\text{m}}$ .
18.  $1 \mu\text{Wb}$  equals
- $1 \times 10^8 \text{ Mx}$ .
  - $10,000 \text{ Mx}$ .
  - $1 \times 10^{-8} \text{ Mx}$ .
  - $100 \text{ Mx}$ .
19. A toroid
- is an electromagnet.
  - has no magnetic poles.
  - uses iron for the core around which the coil is wound.
  - all of the above.
20. When a small voltage is generated across the width of a conductor carrying current in an external magnetic field, the effect is called
- the Doppler effect.
  - the Miller effect.
  - the Hall effect.
  - the Schultz effect.
21. The weber (Wb) is a unit of
- magnetic flux.
  - flux density.
  - permeability.
  - none of the above.
22. The flux density in the iron core of an electromagnet is  $0.25 \text{ T}$ . When the iron core is removed, the flux density drops to  $62.5 \times 10^{-6} \text{ T}$ . What is the relative permeability of the iron core?
- $\mu_r = 4$ .
  - $\mu_r = 250$ .
  - $\mu_r = 4000$ .
  - It cannot be determined.
23. What is the flux density,  $B$ , for a magnetic flux of  $500 \text{ Mx}$  through an area of  $10 \text{ cm}^2$ ?
- $50 \times 10^{-3} \text{ T}$ .
  - $50 \text{ G}$ .
  - $5000 \text{ G}$ .
  - both a and b.
24. The geographic North Pole of the earth has
- no magnetic polarity.
  - south magnetic polarity.
  - north magnetic polarity.
  - none of the above.
25. With an electromagnet,
- more current and more coil turns mean a stronger magnetic field.
  - less current and fewer coil turns mean a stronger magnetic field.
  - if there is no current in the coil, there is no magnetic field.
  - both a and c.

## Essay Questions

- Name two magnetic materials and three nonmagnetic materials.
- Explain the difference between a permanent magnet and an electromagnet.
- Draw a horseshoe magnet and its magnetic field. Label the magnetic poles, indicate the air gap, and show the direction of flux.
- Define *relative permeability*, *shielding*, *induction*, and *Hall voltage*.
- Give the symbols, cgs units, and SI units for magnetic flux and for flux density.
- How are the north and south poles of a bar magnet determined with a magnetic compass?
- Referring to Fig. 13-11, why can either end of the magnet pick up the nail?
- What is the difference between flux  $\phi$  and flux density  $B$ ?

## Problems

### SECTION 13-2 MAGNETIC FLUX ( $\phi$ )

- 13-1 Define (a) the maxwell (Mx) unit of magnetic flux,  $\phi$ ; (b) the weber (Wb) unit of magnetic flux,  $\phi$ .
- 13-2 Make the following conversions:
- $0.001 \text{ Wb}$  to  $\text{Mx}$ .
  - $0.05 \text{ Wb}$  to  $\text{Mx}$ .
  - $15 \times 10^{-4} \text{ Wb}$  to  $\text{Mx}$ .
  - $1 \times 10^{-8} \text{ Wb}$  to  $\text{Mx}$ .
- 13-3 Make the following conversions:
- $1000 \text{ Mx}$  to  $\text{Wb}$ .
  - $10,000 \text{ Mx}$  to  $\text{Wb}$ .
  - $1 \text{ Mx}$  to  $\text{Wb}$ .
  - $100 \text{ Mx}$  to  $\text{Wb}$ .
- 13-4 Make the following conversions:
- $0.0002 \text{ Wb}$  to  $\text{Mx}$ .
  - $5500 \text{ Mx}$  to  $\text{Wb}$ .