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SUMMARY OF TERMS (KNOWLEDGE)

Magnetic force (1) Between magnets, it is the attraction of unlike magnetic poles for each other and the repulsion between like magnetic poles. (2) Between a magnetic field and a moving charged particle, it is a deflecting force due to the motion of the particle: The deflecting force is perpendicular to the velocity of the particle and perpendicular to the magnetic field lines. This force is greatest when the charged particle moves perpendicular to the field lines and is smallest (zero) when it moves parallel to the field lines.

Magnetic field The region of magnetic influence around a magnetic pole or a moving charged particle.

Magnetic domains Clustered regions of aligned magnetic atoms. When these regions themselves are aligned with one another, the substance containing them is a magnet.

Electromagnet A magnet whose field is produced by an electric current. It is usually in the form of a wire coil with a piece of iron inside the coil.

Cosmic rays High-speed particles that travel throughout the universe.

READING CHECK QUESTIONS (COMPREHENSION)

24.1 Magnetism

1. By whom, and in what setting, was the relationship between electricity and magnetism discovered?
2. The force between electrically charged particles depends on the magnitude of each charge, their separation distance, and what else?
3. What is the source of magnetic force?

24.2 Magnetic Poles

4. Is the rule for the interaction between magnetic poles similar to the rule for the interaction between electrically charged particles?
5. In what way are magnetic poles very different from electric charges?

24.3 Magnetic Fields

6. How does magnetic field strength relate to the closeness of magnetic field lines about a bar magnet?
7. What produces a magnetic field?
8. What two kinds of rotational motion do electrons in an atom appear to have?

24.4 Magnetic Domains

9. What is a magnetic domain?
10. At the micro level, what is the difference between an unmagnetized iron nail and a magnetized iron nail?
11. Why is iron magnetic and wood is not?
12. Why will dropping an iron magnet on a concrete sidewalk make it a weaker magnet?

24.5 Electric Currents and Magnetic Fields

13. In Chapter 22, we learned that the direction of the electric field about a point charge is radial to the charge. What is the direction of the magnetic field surrounding a current-carrying wire?
14. What happens to the direction of the magnetic field about an electric current when the direction of the current is reversed?
15. Why is the magnetic field strength greater inside a current-carrying loop of wire than about a straight section of wire?

24.6 Electromagnets

16. Why does a piece of iron in a current-carrying loop increase the magnetic field strength?
17. Why are the magnetic fields of superconducting magnets often stronger than those of conventional magnets?

24.7 Magnetic Forces

18. True or false: A charged particle must move in a stationary magnetic field in order that a force due to the field act on it.
19. In what direction relative to a magnetic field does a charged particle move in order to experience maximum deflecting force? Minimum deflecting force?
20. What effect does Earth's magnetic field have on the intensity of cosmic rays striking Earth's surface?
21. What relative direction between a magnetic field and a current-carrying wire results in the greatest force?
22. How does a galvanometer detect electric current?
23. What is a galvanometer called when it has been calibrated to read current? When it has been calibrated to read voltage?
24. How often is current reversed in the loops of an electric motor?
25. Is it correct to say that an electric motor extends the physics that underlies a galvanometer?

24.8 Earth's Magnetic Field

26. Why are there probably no permanently aligned magnetic domains in Earth's core?
27. What are magnetic pole reversals?
28. What is the cause of the aurora borealis (northern lights)?

24.9 Biomagnetism

29. Name at least six creatures that are known to harbor tiny magnets within their bodies.
30. When do cosmic rays penetrate your body?