PHYSICS IN MOTION
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Unit 5J
Magnetism
Practice Problems TEACHER

Work each of the following problems. SHOW ALL WORK.

1. **Using the right-hand rule, in which direction will the magnetic force act on a positively charged particle that is moving to the left and experiencing a magnetic field straight ahead?**

The magnetic force will act straight down on the positively charged particle.

2. **Using the right-hand rule, in which direction will the magnetic force act on a negatively charged particle that is moving to the left and experiencing a magnetic field straight down?**

The magnetic force will act straight ahead on the negatively charged particle.

3. **Two charged particles with opposite signs but the same magnitude of charge enter a magnetic field that is perpendicular to their direction of motion. How will the motion of the two particles differ when they enter the magnetic field?**

Because the particles have opposite charges, they will be deflected in opposite directions when they encounter the magnetic field.

4. **An electron that is moving to the right experiences a magnetic field of 2.5 T directed upward. If the force on the electron is 2.4 x 10^{-12} N, what is the speed of the electron?**

$$B = 2.5\,T$$
$$F_B = 2.4 \times 10^{-12}\,N$$
$$q = 1.6 \times 10^{-19}\,C$$

$$F_B = qvB$$
$$(2.4 \times 10^{-12}\,N) = (1.6 \times 10^{-19}\,C)v(2.5\,T)$$
$$v = 6.0 \times 10^{6}\,m/s$$

5. **A proton that is moving north at 7.5 x 10^{7} m/s encounters a uniform magnetic field of 4.5 T directed east. What are the magnitude and direction of the force acting on the proton?**

$$B = 4.5\,T$$
$$v = 7.5 \times 10^{7}\,m/s$$
$$q = 1.6 \times 10^{-19}\,C$$

$$F_B = qvB$$
$$F_B = (1.6 \times 10^{-19}\,C)(7.5 \times 10^{7}\,m/s)(4.5\,T)$$
$$F_B = 5.4 \times 10^{-11}\,N$$

The direction of the force is straight down.

questions continued on next page

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Work each of the following problems. SHOW ALL WORK.

6. A particle moving at 3.6 x 10^6 m/s experiences a force of 1.2 x 10^{-10} N when it encounters a magnetic field of 3 T. What is the magnitude of the charge on the particle?

$$B = 3.0\,T$$
$$v = 3.6 \times 10^6\,m/s$$
$$F_B = 1.2 \times 10^{-10}\,N$$

$$F_B = qvB$$
$$(1.2 \times 10^{-10}\,N) = q\,(3.6 \times 10^6\,m/s)(3.0\,T)$$
$$q = 1.11 \times 10^{-17}\,C$$

7. A proton moving to the left at 4.2 x 10^8 m/s experiences a force of 1.4 x 10^{-10} N downward. What are the direction and magnitude of the magnetic field acting on the proton?

$$q = 1.6 \times 10^{-19}\,m/s$$
$$v = 4.2 \times 10^8\,m/s$$
$$F_B = 1.4 \times 10^{-10}\,N$$

$$F_B = qvB$$
$$(1.4 \times 10^{-10}\,N) = (1.6 \times 10^{-19}\,C)(4.2 \times 10^8\,m/s)B$$
$$B = 2.08\,T$$

The direction of the magnetic field is straight ahead.

8. An electron moves to the west at 1.2 x 10^6 m/s and experiences a magnetic force of 6.0 x 10^{-13} N upward. What are the magnitude and direction of the magnetic field acting on the electron?

$$q = 1.6 \times 10^{-19}\,C$$
$$v = 1.2 \times 10^6\,m/s$$
$$F_B = 6.0 \times 10^{-13}\,N$$

$$F_B = qvB$$
$$(6.0 \times 10^{-13}\,N) = (1.6 \times 10^{-19}\,C)(1.2 \times 10^6\,m/s)B$$
$$B = 3.13\,T$$

The direction of the magnetic field is to the north.