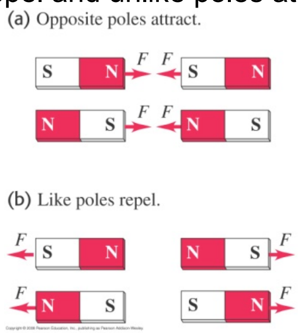
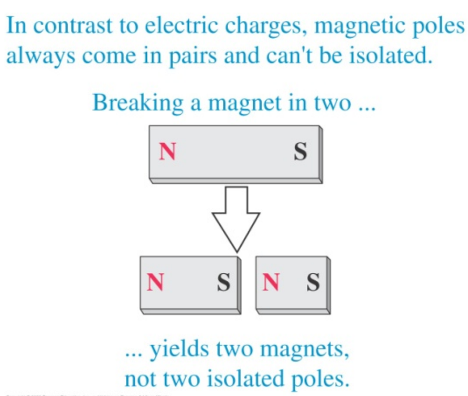
MAGNETIC FIELDS

Properties of Magnetism Based on Observation

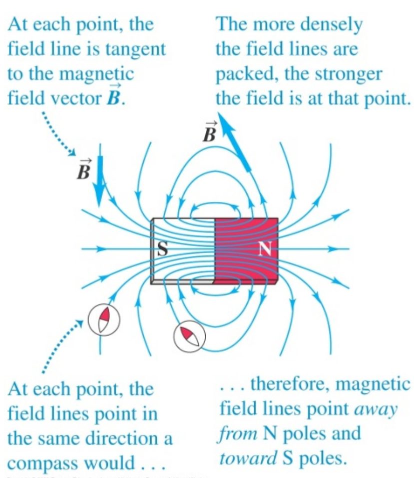
1. There are two magnetic poles – A *north* pole and a *south* pole.
2. Like poles repel and unlike poles attract.



3. There are no magnetic monopoles.



4. The direction of the external magnetic field (**B**-field) is from North to South.



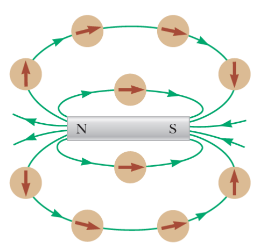
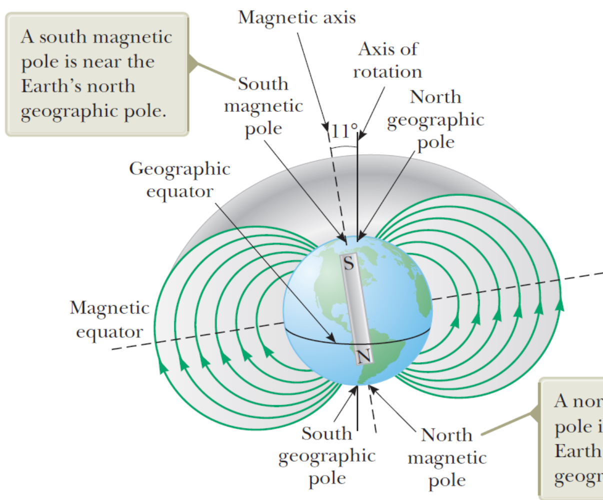
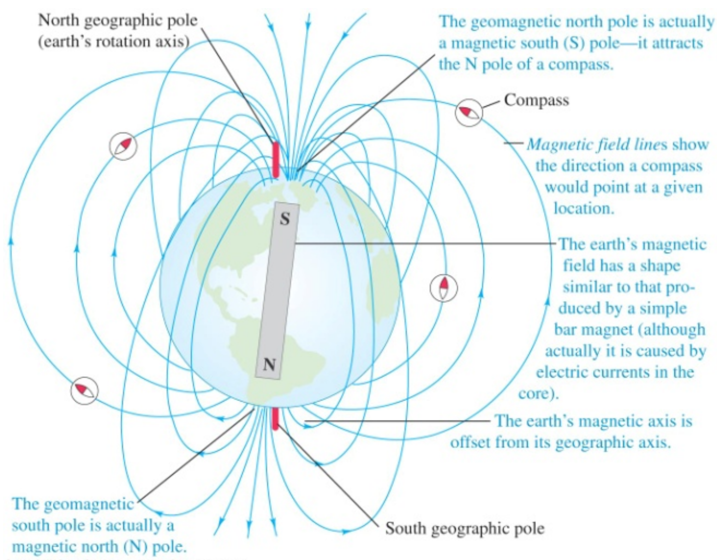


Figure 29.1 Compass needles can be used to trace the magnetic field lines in the region outside a bar magnet.

The direction of the magnetic field B at any point is the direction in which a compass needle points at that point.

5. Earth’s Magnetic Field



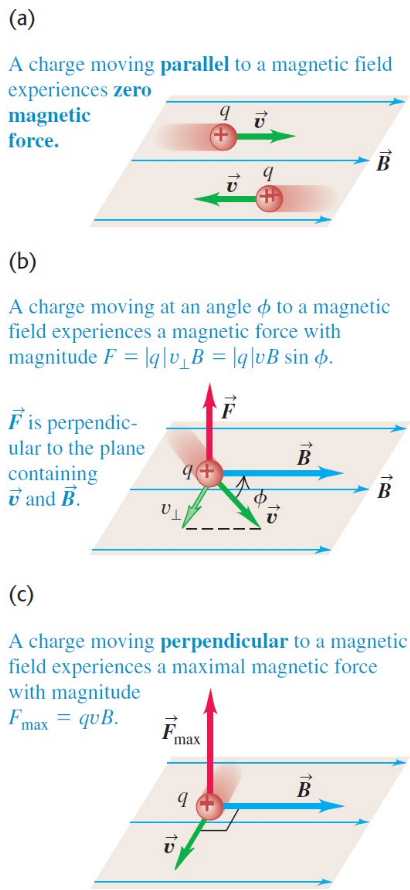


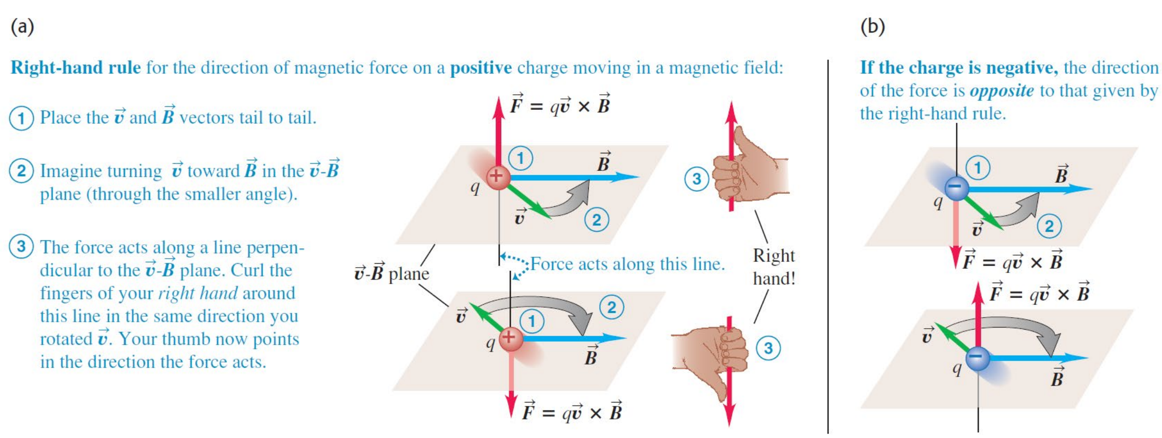
6. A magnetic field exerts a force on any moving charge moving in a magnetic field **B**.

$\boxed{\vec{F}_B = q\vec{v} \times \vec{B}}$ Magnetic Force on a Moving Charged Particle

$\boxed{F_B = qvB\sin\theta}$ Magnitude of Magnetic Force

$$\overrightarrow{F_B} = q \begin{bmatrix} \hat{\imath} & \hat{\jmath} & \hat{k} \\ v_x & v_x & v_x \\ B_x & B_y & B_z \end{bmatrix}$$





Units

$$[B] = \frac{F}{qv} = \frac{N}{C\frac{m}{s}} = \frac{N}{Am}$$

1 Tesla = 1T = 1 N/Am

1 Tesla is a relative large value of magnetic field. A smaller common unit is the Gauss (G):

1G = 10^{-4} T.

$B_{earth} \approx 0.5$ G

$B_{Lab} \approx 45$ T (largest steady B-field produced in the lab)