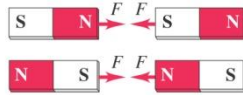


MAGNETISM

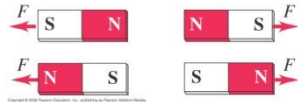
Properties of Magnetism Based on Observation

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

(a) Opposite poles attract.



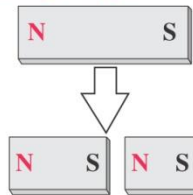
(b) Like poles repel.



3. There are no magnetic monopoles.

In contrast to electric charges, magnetic poles always come in pairs and can't be isolated.

Breaking a magnet in two ...



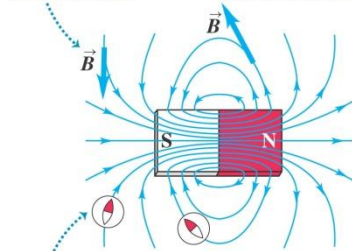
... yields two magnets,
not two isolated poles.

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

At each point, the field line is tangent to the magnetic field vector \vec{B} .

The more densely the field lines are packed, the stronger the field is at that point.



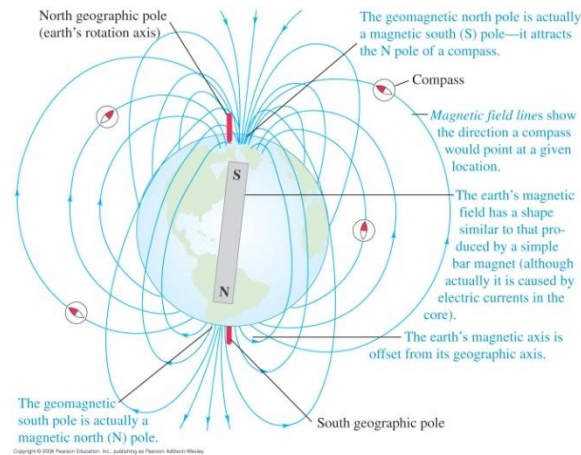
At each point, the field lines point in the same direction a compass would ...

... therefore, magnetic field lines point away from N poles and toward S poles.

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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**.

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

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

Units

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

$$1 \text{ Tesla} = 1T = 1 \text{ N/Am}$$

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

$$1G = 10^{-4} \text{ T.}$$

$$B_{\text{earth}} \approx 1.0 \text{ G}$$

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