4. Permanent Magnets and Electromagnets

Subject: Magnetism

Objective: To demonstrate the variety of magnets and of magnetic effects.

Logistics: This experiment is best conducted in groups of three or four.

Materials (per group):
- Lodestone
- Two bar magnets
- Compass
- Four-inch nail
- 25 feet of insulated wire
- Battery set of two flashlight batteries
- Switch
- Six paper clips

Procedure:

**Step 1:** Use Lodestone to attract objects. Try ferrous and non-ferrous materials. Show Lodestone influence on compass. The Earth is a magnet.

**Step 2:** Experiment with bar magnets. Illustrate principle that like poles repel and unlike poles attract. Show effect on compass.

**Step 3:** Wrap insulated wire around nail and connect to battery set through the switch. Demonstrate electromagnetism using paper clips and compass. No effect on non-ferrous materials such as pencils.

Vocabulary: Lodestone, permanent magnet, magnetic material, ferrous material, compass.

What they Learn: Magnetism exists in nature and can be produced as permanent or electromagnets.