

24. From the way the wire is wound it is clear that  $P_2$  is the magnetic north pole while  $P_1$  is the south pole.

- (a) The deflection will be toward  $P_1$  (away from the magnetic north pole).
- (b) As the electromagnet is turned on, the magnetic flux  $\Phi_B$  through the aluminum changes abruptly, causing a strong induced current which produces a magnetic field opposite to that of the electromagnet. As a result, the aluminum sample will be pushed toward  $P_1$ , away from the magnetic north pole of the bar magnet. As  $\Phi_B$  reaches a constant value, however, the induced current disappears and the aluminum sample, being paramagnetic, will move slightly toward  $P_2$ , the magnetic north pole of the electromagnet.
- (c) A magnetic north pole will now be induced on the side of the sample closer to  $P_1$ , and a magnetic south pole will appear on the other side. If the magnitude of the field of the electromagnet is larger near  $P_1$ , then the sample will move toward  $P_1$ .