



Sketch of a galvanometer mechanism. The red wires carry the current to be measured; it passes through a coil wound around the (steel) cylinder holding the pointer. The green object is a restoring spring. N and S indicate the two poles of a magnet.

Following identification of the components, the examiner looked for some discussion of the force on wires or coils carrying current in a magnetic field. He then looked for some discussion of the curved shape of the faces of the magnet, which combined with the pivoting steel (!) cylinder holding the pointer, would lead to a uniform magnetic field surrounding the coil, independent of its angular position. In other words, the torque on the coil would be dependent only on the strength of the current passing through the coil. The restraining spring would balance this torque and lead to the current reading.

The student was then given a **second question**: If the operation of the meter depended on current passing through the coil, how did it measure resistance? Around this time, as a hint, the examiner would switch the multimeter to a resistance setting and demonstrate how the pointer would move toward its zero setting (on the right side of the dial) when the two probes were touched. The knurled knob labeled "Ohms" in the figure above enabled the pointer to be moved exactly to its zero setting. At this time the better students would carefully, and sometimes not so carefully, inspect the multimeter and declare with authority that there had to be a battery inside, since some source of energy was required to move the pointer, even though there was no obvious way of inserting such battery. The examiner would confirm this fact and then again ask how resistance was measured. The answer: the preparatory step, touching the probes together and adjusting the resistance measurement to zero, established a full-scale deflection for a known internal resistance. When the unknown resistance is placed in series in the circuit the deflection is less than full scale due to the reduced current flowing and the calibrated scale can indicate the resistance.