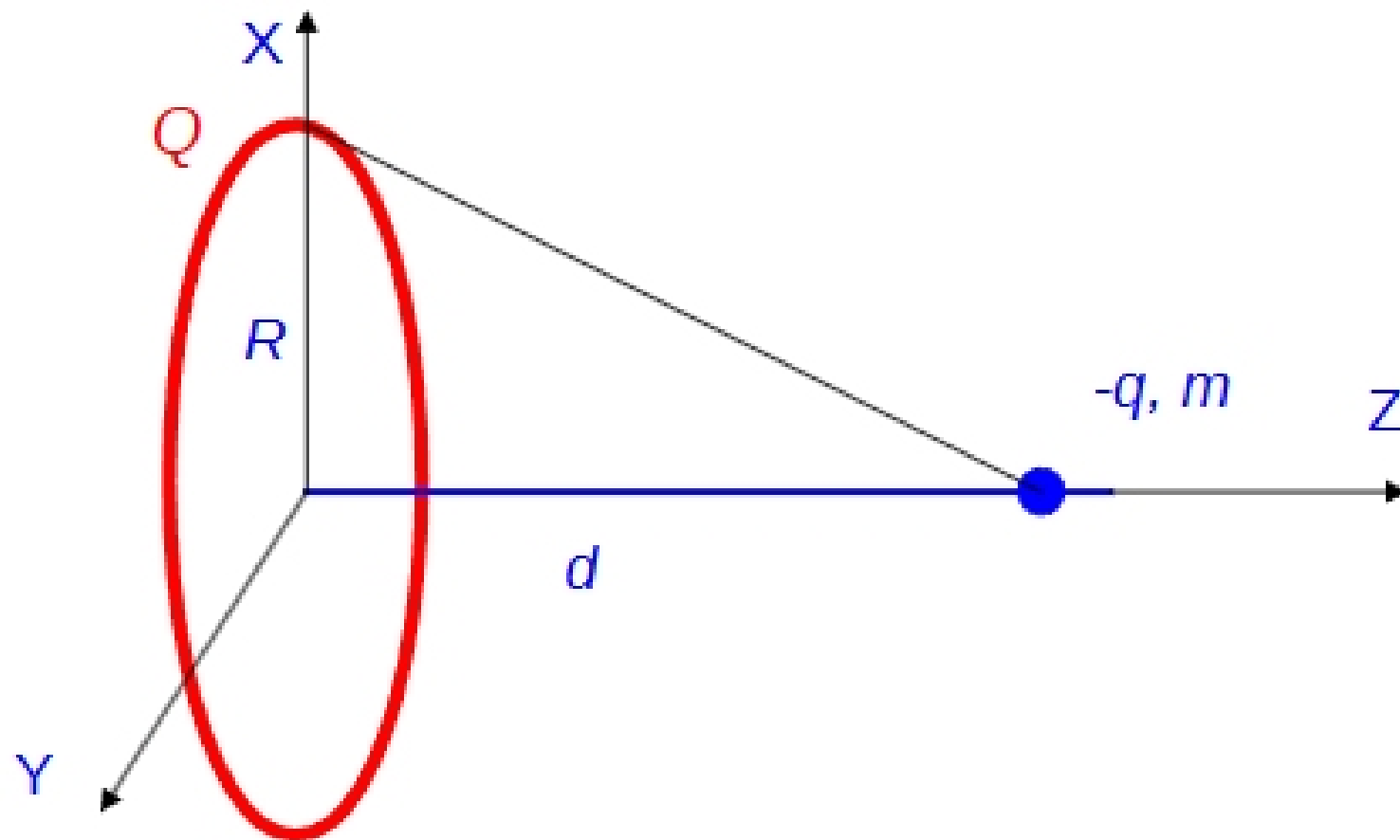


- Charges and current.
- Coulomb's Law.
- Electric field, flux, potential and Gauss's Law.
- Passive circuit components.
 - Resistance and resistor, Ohm's Law. Resistance as a function of temperature. Power dissipated through a resistor.
 - Capacitance and capacitor. Simple RC circuit, charge and discharge and the time constant, and energy and energy density (PE_E and u_E) stored in a capacitor.
 - Self-inductance and inductor. Simple RL circuit, "charge" and "discharge" and the time constant, and energy and energy density (PE_B and u_B) stored in an inductor.
- Power and battery model (emf + internal resistance).
- Circuit analysis, simple connections in series and in parallel and the Kirchhoff's rules.
- Current generates magnet field: Biot-Savart Law.
- Magnet field flux and Ampere's Law.
- Lorentz force law.
- Motion emf, Faraday's Law of induction and Lenz Law.
- Mutual and self induction.

1. A circle made of conductor with radius R carries charge Q . A particle of mass m carrying charge $-q$ is brought in along the center line from far away to a distance d away from the circle. What is the velocity and acceleration of this particle at this point?



2. A 3 meter tungsten wire with a diameter of $20\ \mu\text{m}$ is stretched in a multi-wire chamber and is connected to a positive high voltage power supply which provides a voltage V to the wire with respect to a far away grounded cage. The capacitance of this wire is $30\ \text{pF}$ ($1\ \text{pF} = 10^{-12}\ \text{F}$). To get an electric field strength at middle of the wire and $1\ \text{mm}$ away from the wire surface to be $10000\ \text{V/m}$, what is the supplied high voltage V ? One can treat the wire as infinitely long when calculating the electric field in the middle of the wire.

