Dr. Sasha

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1) Consider an infinitely long conducting cylinder of radius a with its axis coinciding with the $z-$ axis. One half of the cylinder (cut the long way) ($y > 0$) is kept at a constant potential V_0, while the other half ($y < 0$) is kept at a constant potential $-V_0$ (see figure below). Find the potential for all points inside the cylinder and the field $\vec{E}$.
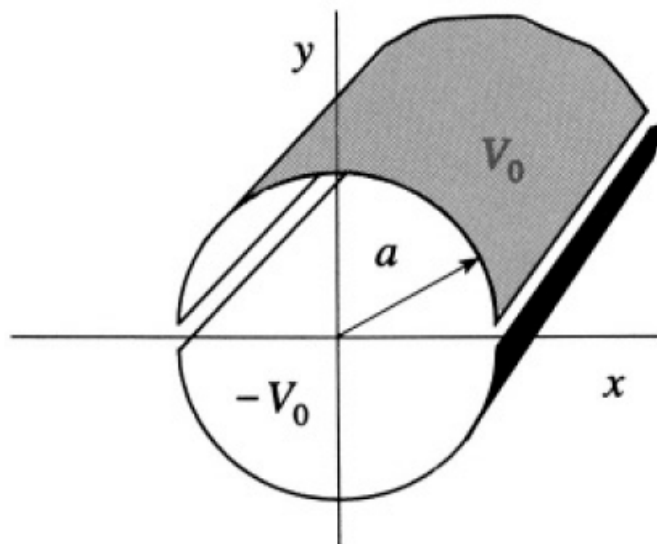
2) What is the difference between an incandescent lamp source and a gas discharge lamp?

3) As shown in figure below, a wheel consisting of a large number of thin conducing spokes is free to rotate about an axle.

B

Brush

L

V

+

Switch
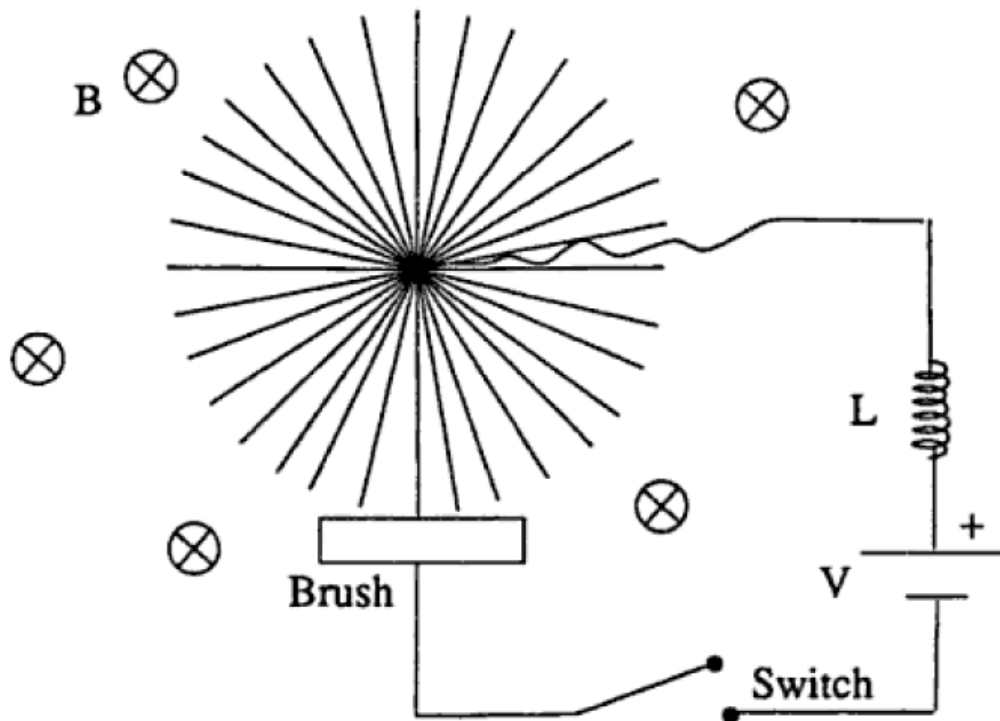
A brush always makes electrical contact with one spoke at a time at the bottom of the wheel. A battery with voltage V feeds current through an inductor, into the axle, through a spoke, to the brush. A permanent magnet provides a uniform magnetic field B into the plane of the paper. At time t=0 the switch is closed, allowing current to flow. The radius and moment of inertia of the wheel are R and J respectively. The total inductance of the current path is L, and the wheel is initially at rest. Neglecting friction and resistivity, calculate the battery current and the angular velocity of the wheel as functions of time.

4) When water freezes, it expands by about 9 %. What would be the pressure increase inside your automobile engine block if the water in it froze? (The bulk modulus of ice is $2 \cdot 10^9$ N/m^2.

water   water