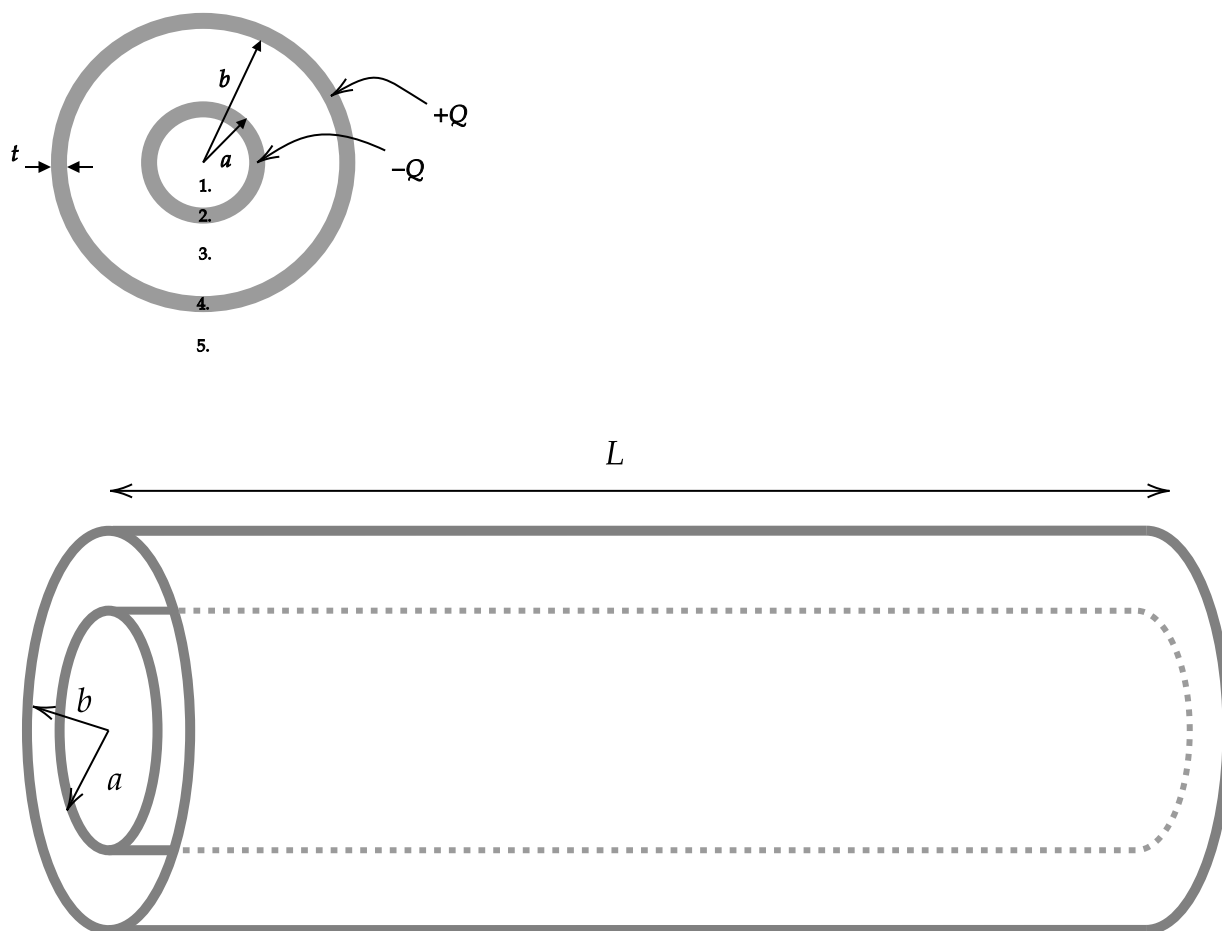


# Capacitance Part II

## 1 Cylindrical

Charge placed on two long cylindrical conducting shells, the cross-section of which is shown. Both shells have a thickness of  $t$ . The inner shell has an outer radius of  $a$  and a net charge of  $-Q$ . The outer shell has an inner radius of  $b$  and a net charge of  $+Q$ . Assume that  $Q$  is positive and the cylinders have length  $L$ .



1. How will the charges distribute on each surface (assume no charge appears on the ends of the cylinders)? That is, what is the total charge on
- the inner surface of the inner cylinder,
  - the outer surface of the inner cylinder,
  - the inner surface of the outer cylinder, and
  - the outer surface of the outer cylinder.

**Answer:**

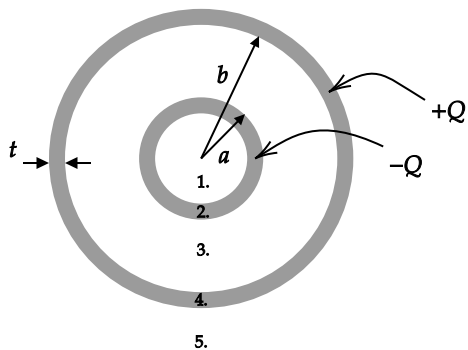


Figure from previous page is repeated above.

2. What is the electric field in each of the five regions? (Hint: Use Gauss's law.)

**Answer:**

3. What is the electric potential difference,  $V(b) - V(a)$ , between the outer and inner cylinder? (Make sure the sign of your result matches your expectation based on the techniques covered in the last activity.)

**Answer:**

4. Find the capacitance in terms of  $\epsilon_o$ ,  $L$ ,  $a$ , and  $b$ .

**Answer:**

5. How much work would the electric field do on a charge  $q_o$  moved from  $r = a$  to  $r = b$ ? What would be the change in  $q_o$ 's electric potential energy?

**Answer:**