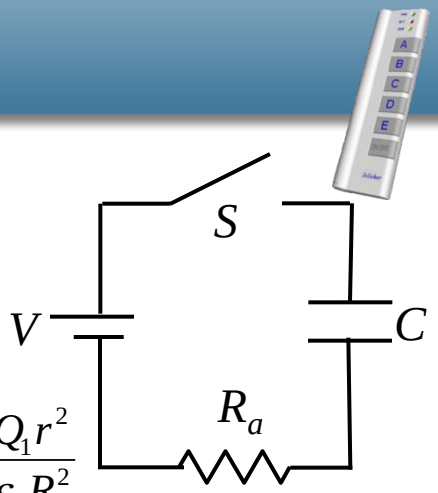
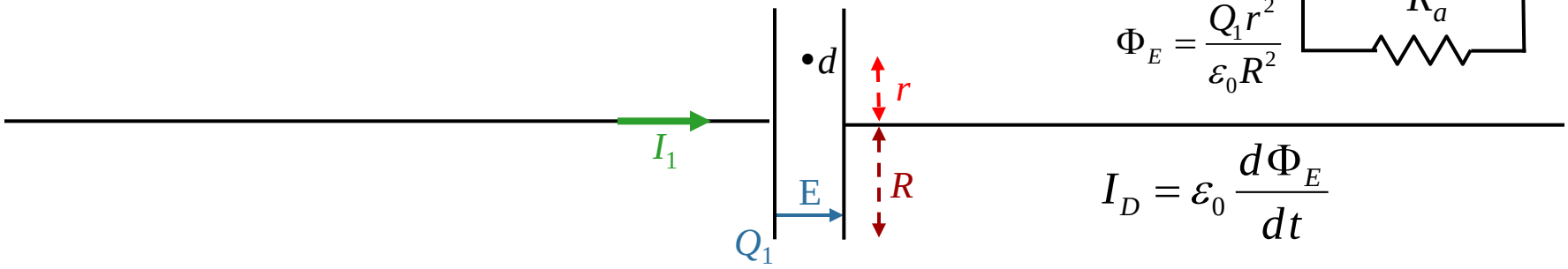
Calculation

Switch S has been open a long time when at $t = 0$, it is closed. Capacitor C has circular plates of radius R. At time $t = t_1$, a current I_1 flows in the circuit and the capacitor carries charge Q_1.



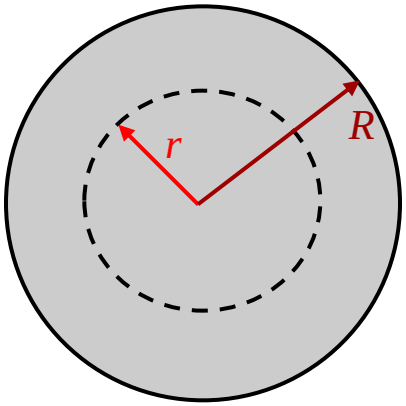
$$\Phi_E = \frac{Q_1 r^2}{\varepsilon_0 R^2}$$



$$I_D = \varepsilon_0 \frac{d\Phi_E}{dt}$$

What is the displacement current enclosed by circle of radius r ?

A) $I_D = I_1 \dfrac{R^2}{r^2}$ B) $I_D = I_1 \dfrac{r}{R}$ C) $I_D = I_1 \dfrac{r^2}{R^2}$ D) $I_D = I_1 \dfrac{R}{r}$



$$I_D = \varepsilon_0 \frac{d\Phi_E}{dt} = \frac{dQ_1}{dt}\frac{r^2}{R^2} = I_1 \frac{r^2}{R^2}$$

$$\rightarrow \quad I_D = I_1 \frac{r^2}{R^2}$$