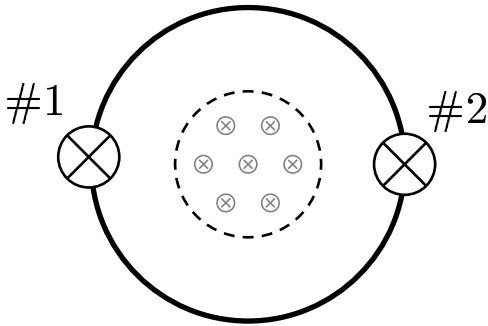


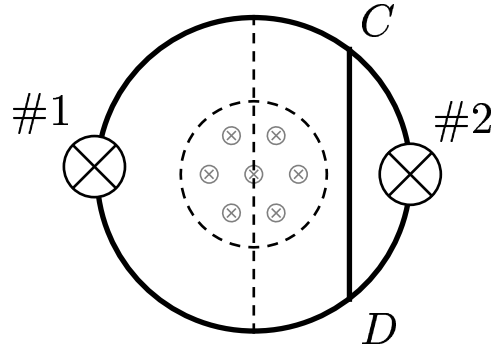
A solenoid is producing the same steadily increasing magnetic flux through two circular circuits shown below.

Case A: Two identical bulbs #1 and #2 are in series. Each has a resistance  $R$ . Their brightnesses (or their electric powers) are the same, i.e.  $P_1 = P_2$ .

Case B: There is a short  $CD$  which is to the right of the center line. We label the respective electric powers of the bulbs by  $P'_1$ , and  $P'_2$ .



Case A



Case B

Compare the power of bulb #1 for the two cases.

- A)  $P'_1 < P_1$
- B)  $P'_1 = P_1$
- C)  $P'_1 > P_1$

For case A, denote  $I$  to be the loop current, the loop equation is:

$$\mathcal{E} - 2IR = 0, \text{ or } I = \frac{\mathcal{E}}{2R}. \text{ For case B, label currents through the bulbs}$$

by  $I'_1$  and  $I'_2$ , and through the short by  $I'$ . The loop equations for  $C1DC$

and  $C2DC$  are :  $\mathcal{E}'_1 - I'_1 R = 0$  and  $\mathcal{E}'_2 - I'_2 R = 0$  respectively. The emf is

proportional to area of the enclosed flux. Thus  $I'_1 > I > I'_2$ , or  $P'_1 > P_1$ .

Answer **C**.

31.04-04 Two Light Bulbs and a Short Wire 2004-3-24