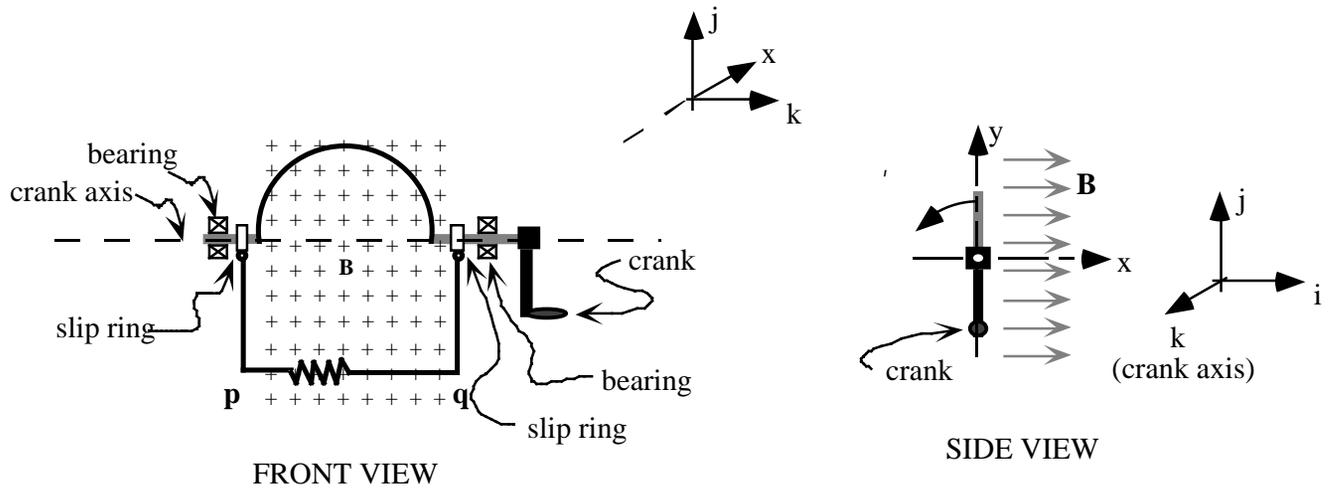**Simple AC Generator:**

An electrical ac generator circuit consists of a conducting wire bent into a semi-circular shape (radius "r_o") and a resistor R as shown in the figure. A constant magnetic field "**B**" (perpendicular to and inward the paper along +x direction) is applied in the region. The conducting wire, bent like a semi-circular shape, is rotated by a hand crank with a constant angular velocity " " in the counterclockwise direction, as viewed from the crank end, and the angle " " is measured from the vertical position a$_s$ shown. The area "A_o" of the segment of the circuit below the crank axis of rotation (i.e. the z-axis) is a constant. See figures below.

bearing
crank axis
slip ring
B
crank
slip ring
bearing
p   **q**

FRONT VIEW

B
crank
(crank axis)

SIDE VIEW

Assume that at t = 0, the angle " " is zero and the circuit appears as shown in the figure on the left.

a. Assuming that the angle   = zero at t = 0, what is **magnetic flux** ( ) linked to the circuit at t = 0? Express your answer in terms of the parameters "r_o", "**B**" and "A_o".

b. Assuming that the angle   = zero at t = 0, what is **magnetic flux** ( ) linked to the circuit at t = / ? Express your answer in terms of the parameters "r_o", "**B**" and "A_o".

c. What is the **"emf"** ([(t)] as a function of time) induced across the terminals (at the slip ring) of the conducting wire?

d. Between t=0 and t= / , the area bounded by the circuit decreases. What is the **direction of the induced current** in the resistor during this time interval? Give reasons to substantiate your answer. What is the **magnitude** of this induced current?