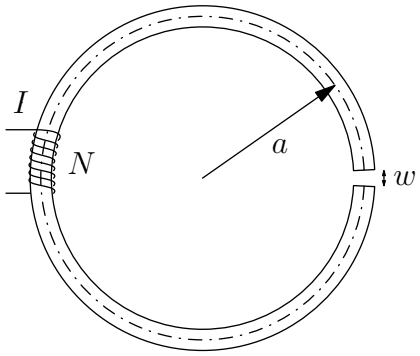
M02E.1—Iron Ring with a Gap

Problem

N turns of a wire are wrapped around an iron ring in which a small gap has been cut. The radius of the ring is a and the width of the gap is w, with $w \ll a$. A current I flows in the wire. The magnetic permeability of the iron is μ.



a) Find the $\boldsymbol{B}$ field in the gap.

b) Find the force per unit area on the faces of the gap. Does the gap have the tendency to widen or contract?