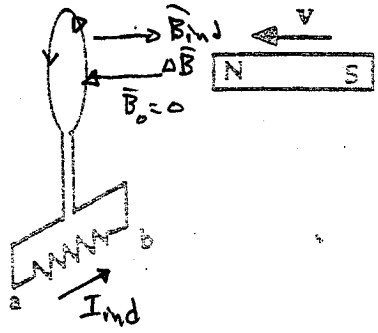
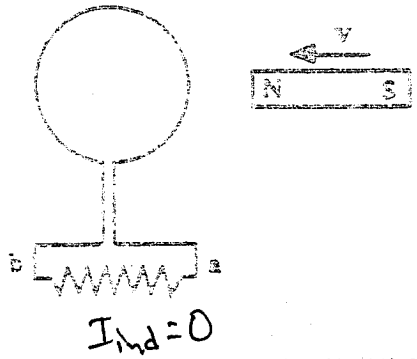
Polarity of Induced Voltage—1

For each situation described below, indicate whether a voltage is induced across the resistor. If so, indicate the side of the resistor at the higher voltage and the direction of the induced current.

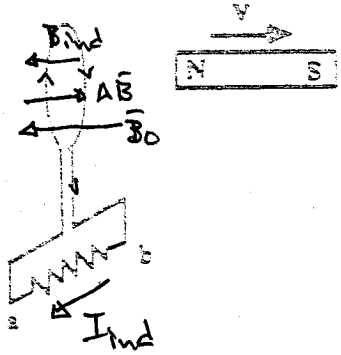
A magnet in the plane of the paper moves toward the fixed loop that is perpendicular to the paper.



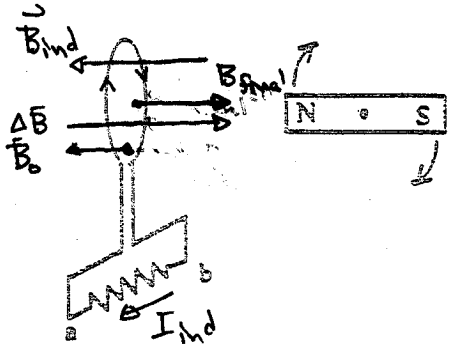
A magnet in the plane of the paper moves toward a fixed loop that is also in the plane of the paper.



A magnet in the plane of the paper moves away from a fixed loop that is perpendicular to the plane of the paper.



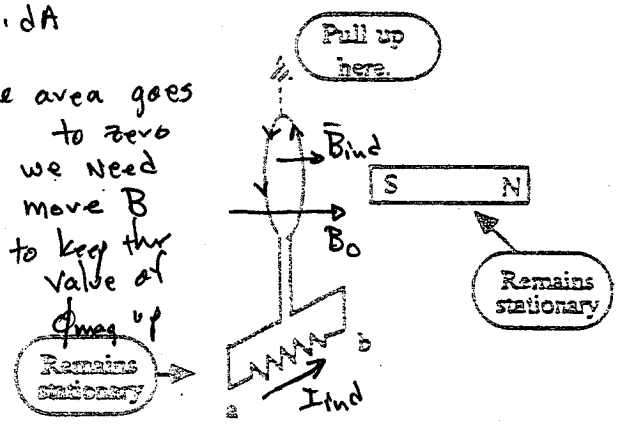
(d) A magnet in the plane of the paper is rotated about its center so that the North pole and South pole exchange positions relative to a fixed loop that is perpendicular to the plane of the paper.



(e) A magnet in the plane of the paper is held fixed as a loop perpendicular to the plane and originally open is stretched vertically so its opposite sides come together.

$\phi_m = \int \vec{B} \cdot d\vec{A}$

the area goes to zero so we need more B to keep the value of ϕ_{mag} up

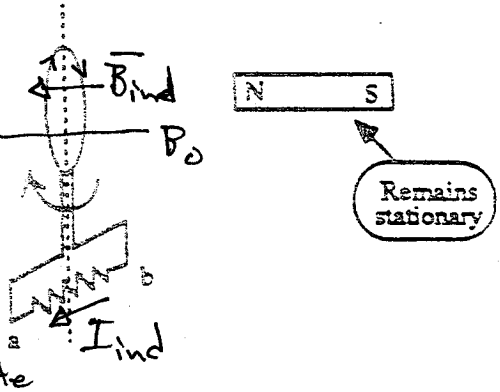


(f) A magnet in the plane of the paper is held fixed as a loop originally perpendicular to the plane of the paper, is rotated clockwise into the plane of the paper.

$\phi = \int \vec{B} \cdot d\vec{A}$

the angle changes making ϕ smaller.

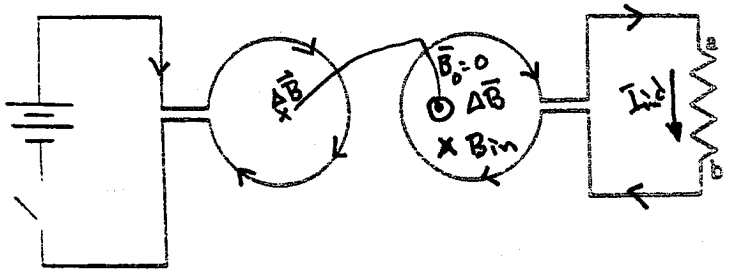
∴ Need more B to compensate



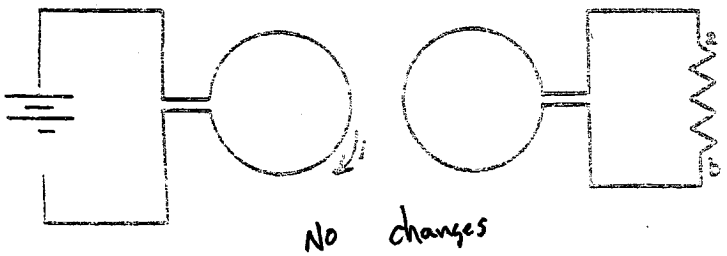
Polarity of Induced Voltage—2

For each situation described below, indicate whether a voltage is induced across the resistor. If so, indicate the side of the resistor at the higher voltage and the direction of the induced current.

) The switch on the left is closed. (This is similar to the ignition system on a car.)



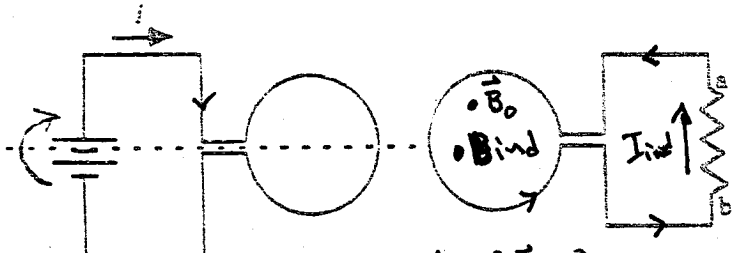
b) A steady clockwise current flows in the circuit on the left.



No changes

$I_{ind} = 0$

(c) The circuit on the left is rotated 90° about a horizontal axis.

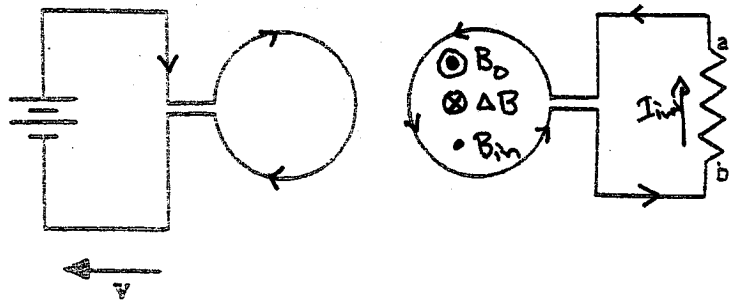


$\phi = \int \vec{B} \cdot d\vec{A}$

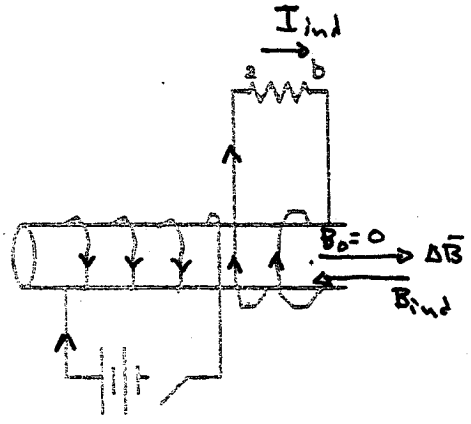
the rotation causes the flux through the 2nd loop to drop. ∴ we need more B to keep the value of ϕ as original

(d) The circuit on the left is moved away from the one on the right.

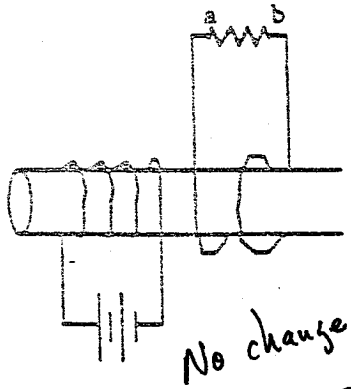
$\vec{B}$ threading the 2nd loop gets weaker



(e) The switch on the bottom circuit is closed.



(f) A steady current flows in the circuit on the left.

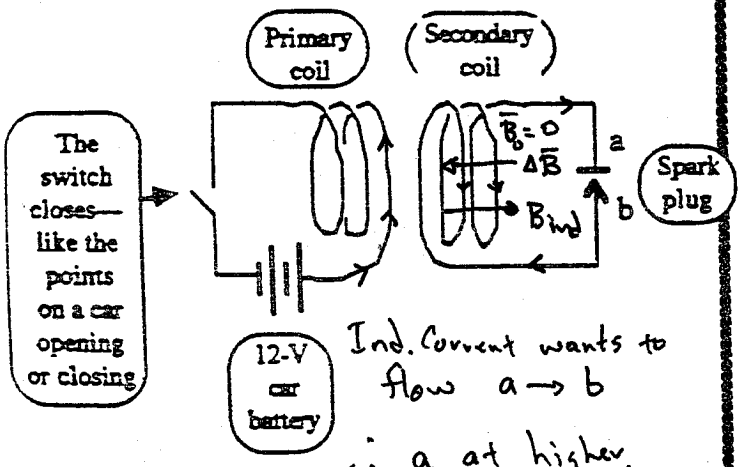


No changes

$I_{ind} = 0$

For each situation below, determine whether position a or position b is at a higher potential as a result of the change shown in the sketch.

(a) Automobile Ignition System

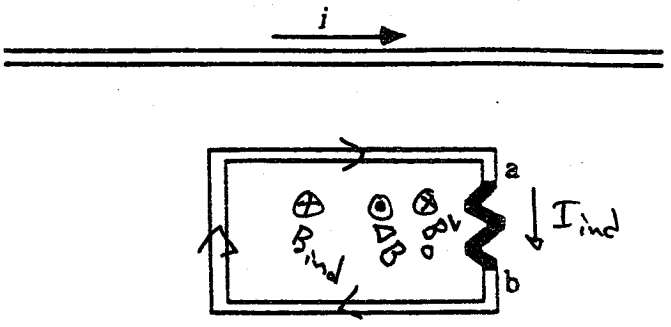


Ind. Current wants to flow a → b

∴ a at higher potential

(c) Alternating Current Inductor

The current in the long straight wire, initially toward the right, reverses direction.



I_{ind} flows a → b

∴ a at higher potential

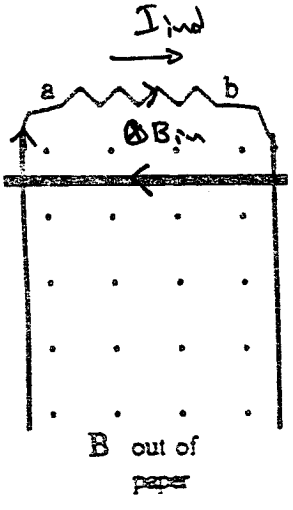
(b) Falling Bar Inductor

Determine the polarity of voltage across the resistor as the horizontal bar falls along the vertical side bars.

$\phi = \int \vec{B} \cdot d\vec{A}$

Area increase

∴ Need to make $\vec{B}$ smaller to get same value for ϕ

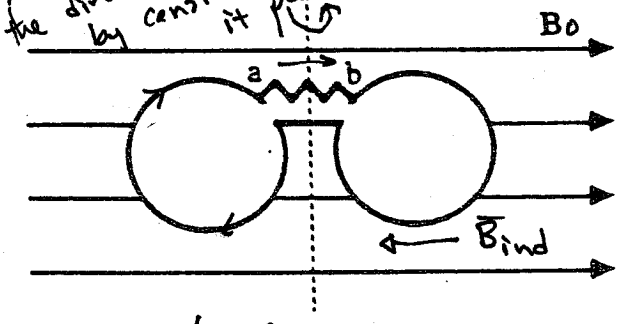


a higher pot'l than b

(d) "Eyeglasses" Inductor

The eyeglasses, initially in the plane of the magnetic field, are rotated 90° so that the rims now face in the direction of the magnetic field.

I figured out the direction by considering it partially rotated.



$\phi = \int \vec{B} \cdot d\vec{A}$ originally $\phi = 0$

Will need an induced B_{ind} that opposes the established B_0