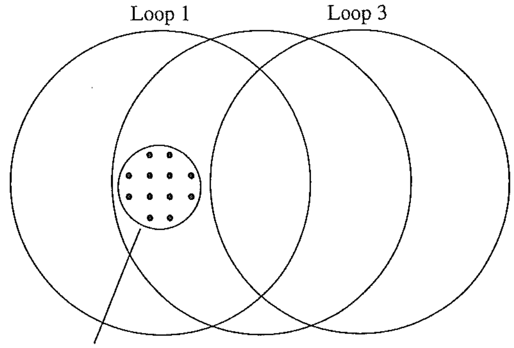
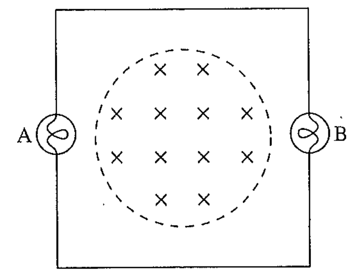
15. A solenoid is perpendicular to the page, and its field strength is increasing. Three circular wire loops of equal radii are shown. Rank in order, from largest to smallest, the size of the induced emf in the three rings.



Order: $\mathcal{E}_1 = \mathcal{E}_2 \quad \mathcal{E}_3 = 0$.

Explanation:

16. A conducting loop around a magnetic field contains two lightbulbs, A and B. The wires connecting the bulbs are ideal, with no resistance. The magnetic field is increasing rapidly.



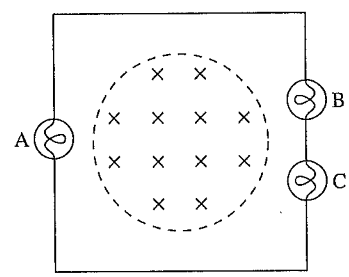
a. Do the bulbs glow? Why or why not?

yes. Induced E field & EMF.

b. If they glow, which bulb is brighter? Or are they equally bright? Explain.

Equal. I same.

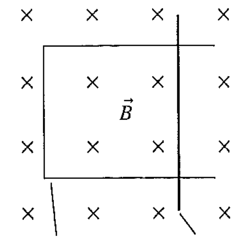
17. A conducting loop around a magnetic field contains three lightbulbs, A, B, and C. The wires connecting the bulbs are ideal, with no resistance. The magnetic field is increasing rapidly. Rank in order, from brightest to least bright, the brightness of the three bulbs.



Order: All same.

Explanation:

18. A metal wire is resting on a U-shaped conducting rail. The rail is fixed in position, but the wire is free to move.



a. If the magnetic field is increasing in strength, does the wire:

i. Remain in place?
ii. Move to the right?
iii. Move to the left?
iv. Move up on the page?
v. Move down on the page?
vi. Move out of the plane of the page, breaking contact with the rail?
vii. Rotate clockwise?
viii. Rotate counterclockwise?
ix. Some combination of these? If so, which?

Explain your choice.

i is ccw, up along wire. $I\vec{l} \times \vec{B}$ → left. (iii)

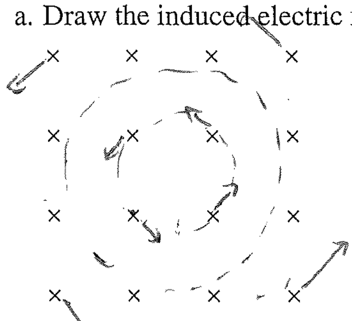
b. If the magnetic field is decreasing in strength, which of the above happens? Explain.

i is cw $I\vec{l} \times \vec{B}$ → right (ii)

34.6 Induced Fields

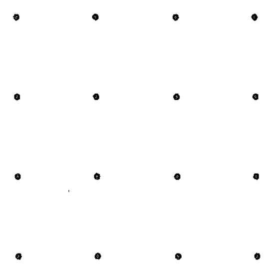
19. Consider these two situations:

a. Draw the induced electric field.



$\vec{B}$-field rapidly increasing

b. Draw the induced electric field.

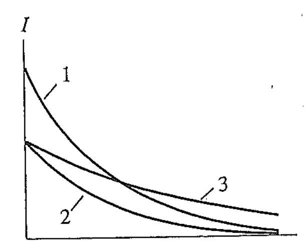


$\vec{B}$-field rapidly decreasing

Same

34.10 *LR* Circuits

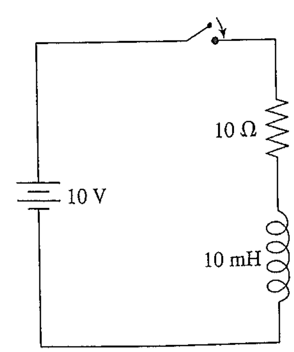
26. Three *LR* circuits are made with the same resistor but different inductors. The figure shows the inductor current as a function of time. Rank in order, from largest to smallest, the three inductances L_1, L_2, and L_3.



Order: $\tau = \frac{L}{R}$ $\tau_3 > \tau_2 = \tau_1$

Explanation: $L_3 > L_2 = L_1$

27. a. What is the battery current immediately after the switch closes? Explain.



0 $\frac{di}{dt}$ is finite, so $i = 0$.

b. What is the battery current after the switch has been closed a long time? Explain.

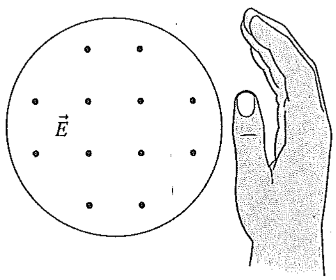
1 A $V_L = 0$.

35.2 The Field Laws Thus Far

35.3 The Displacement Current

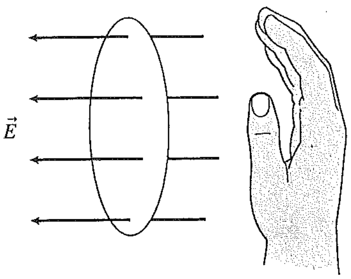
4. If you curl the fingers of your right hand as shown, is the electric flux positive or negative?

a.



Sign of Φ_e +

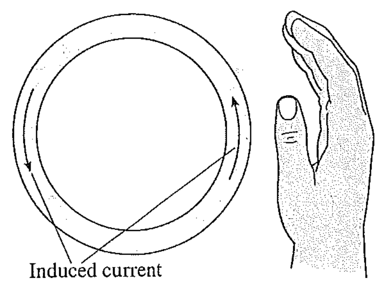
b.



Sign of Φ_e +

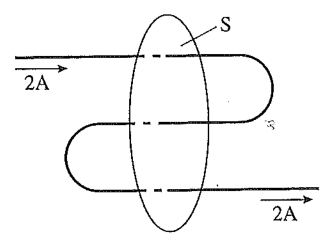
5. If you curl the fingers of your right hand as shown, is the emf positive or negative?

+

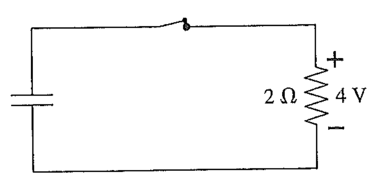


6. What is the current through surface S?

2A



7. The capacitor in this circuit was initially charged, then the switch was closed. At this instant of time, the potential difference across the resistor is $\Delta V_R = 4$ V.



a. At this instant of time, what is the current through the resistor?

$V = iR \quad i = \frac{4}{2} = 2A.$

b. At this instant of time, what is the current through the space between the capacitor plates?

0

c. At this instant of time, what is the displacement current through the space between the capacitor plates?

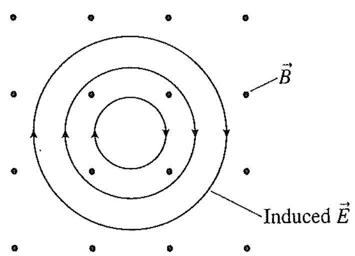
2A

d. Is the displacement current really a current? If so, what are the moving charges? If not, what is the displacement current?

No. Misnomer. $I_D \equiv \epsilon_0 \frac{d\Phi_E}{dt}$

8. Consider these two situations:

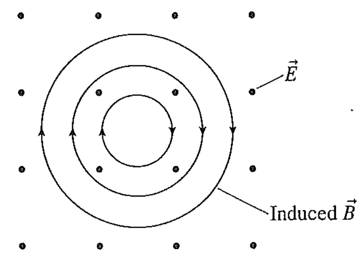
a.

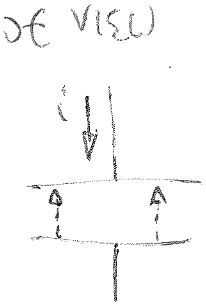


Is the magnetic field strength increasing, decreasing, or not changing? Explain.

Increasing.

b.



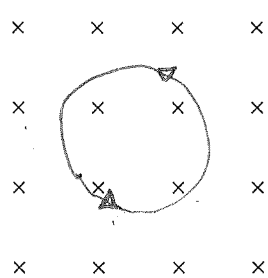


Is the electric field strength increasing, decreasing, or not changing? Explain.

Decreasing.
think side view of a capacitor

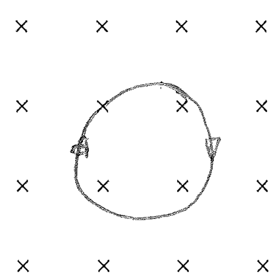
9. Consider these two situations:

a. Draw the induced electric field.



$\vec{B}$-field rapidly increasing

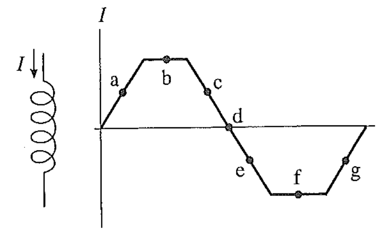
b. Draw the induced magnetic field.



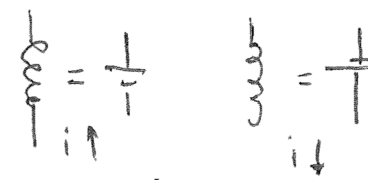
$\vec{E}$-field rapidly increasing

34.8 Inductors

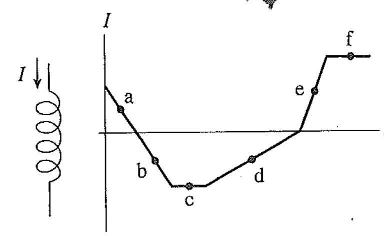
20. The figure shows the current through an inductor. A positive current is defined as a current going from top to bottom. At the time corresponding to each of the labeled points, does the potential across the inductor (going from top to bottom) increase, decrease, or stay the same?



a. decrease
b. 0
c. increase
d. increase
e. increase
f. 0
g. decrease



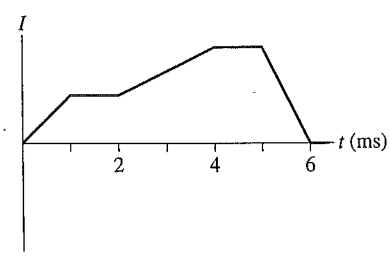
21. Rank in order, from most positive to most negative, the inductor's potential difference $(\Delta V_L)_a$, $(\Delta V_L)_b$, …, $(\Delta V_L)_f$, at the six labeled points. ΔV_L is the change in going from the top of the inductor to the bottom. Some may be equal. Note that 0 V > −2 V.

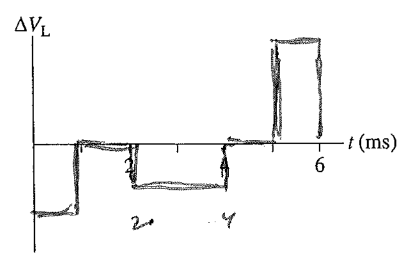


Order: a = b, c = f = 0, d, e

Explanation:

22. The figure shows the current through an inductor. Draw a graph showing the potential difference ΔV_L across the inductor. There are no numbers, but your graph should have the correct shape and proportions.





23. The figure shows the potential difference across an inductor. There is no current at $t = 0$. Draw a graph of the current through the inductor as a function of time. There are no numbers, but your graph should have the correct shape and proportions.