FROM "PHYSICS, A CONTEMPORARY PERSPECTIVE" R. KNIGHT
ADDISON WESLEY, 1997 VII

= KEY =

Chapter 31

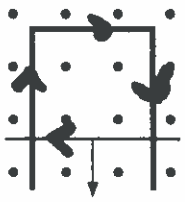
Electromagnetic Induction

31.1 Faraday and Henry

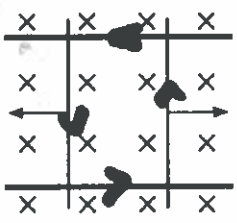
31.2 Motional emf

1. The figures below show one or more metal wires sliding on fixed metal rails in a magnetic field.

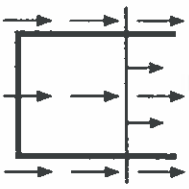
For each, determine if the induced current flows clockwise, flows counterclockwise, or is zero.

a) 

CW

b) 

CCW

c) 

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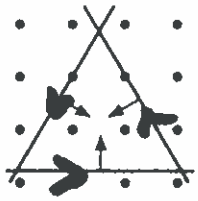
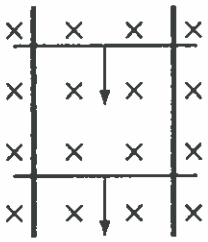
d) 

CCW

e) 

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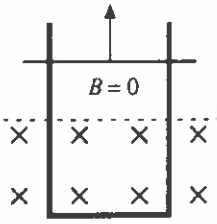
f) 

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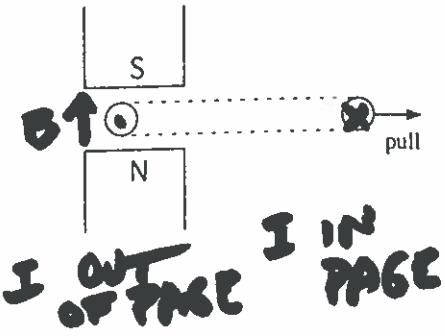
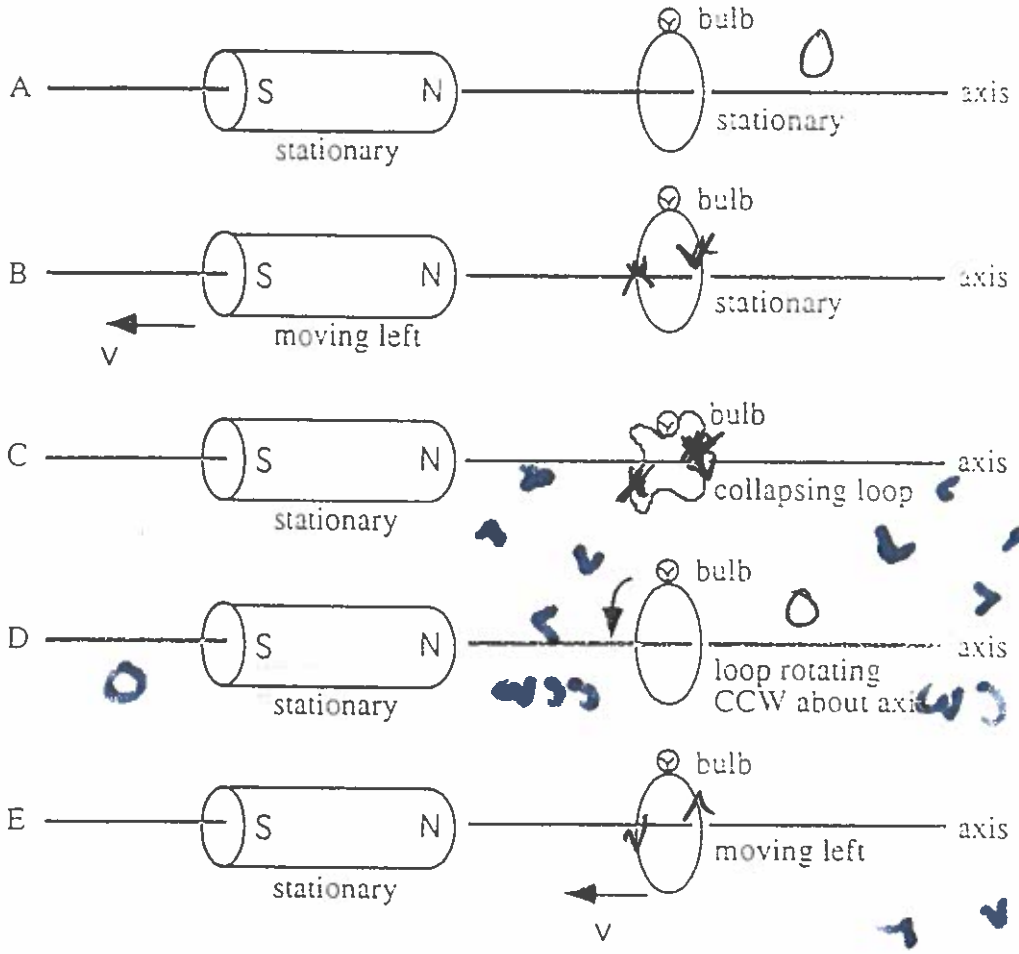
2. A loop of copper wire is being pulled from between two magnetic poles.

a) Show *on the figure* the current flow induced in the loop. Explain your reasoning.



The five separate figures below involve a cylindrical magnet and a tiny light bulb connected to the ends of a loop of copper wire. These figures are to be used in the following two questions, 13 and 14. The plane of the wire loop is perpendicular to the reference axis. The states of motion of the magnet and of the loop of wire are indicated in the diagram. Speed will be represented by v and CCW represents counter clockwise.



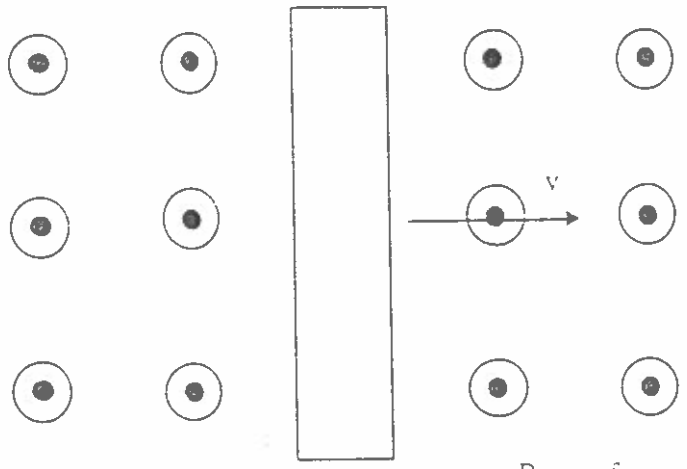
13) In which of the above figures will the light bulb be glowing?

(a) C (b) B, E (c) B, C, E (d) B, C, D, E (e) None will light

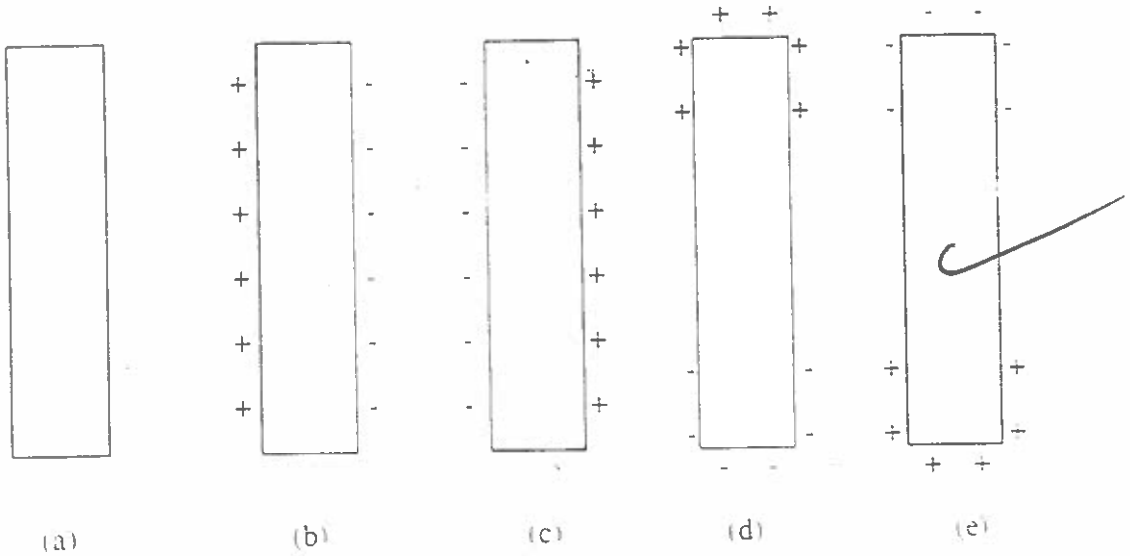
14) Place yourself at the north pole of the magnet looking toward the right and view the wire loop. In which figure will there be a current in the loop in the counterclockwise sense?

(a) None of these (b) C (c) B, C (d) D (e) E

31. A neutral metal bar is moving at constant velocity v to the right through a region where there is a uniform magnetic field pointing out of the page. The magnetic field is produced by some large coils which are not shown on the diagram.

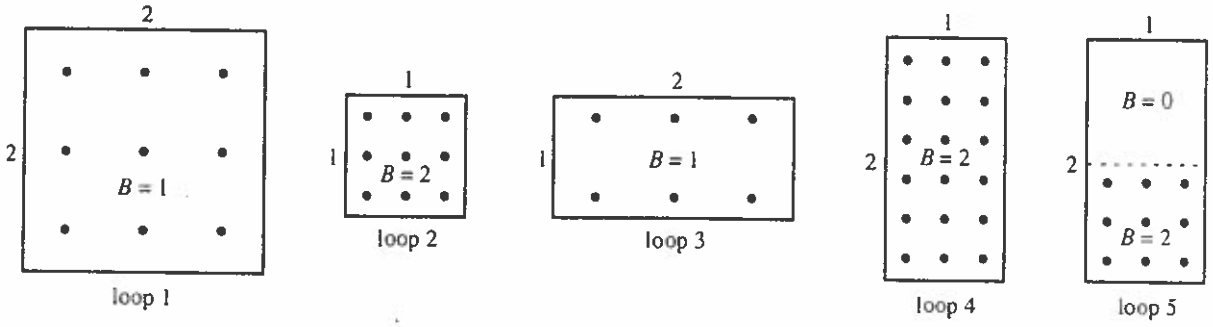


Which one of the following diagrams best describes the charge distribution on the surface of the metal bar?



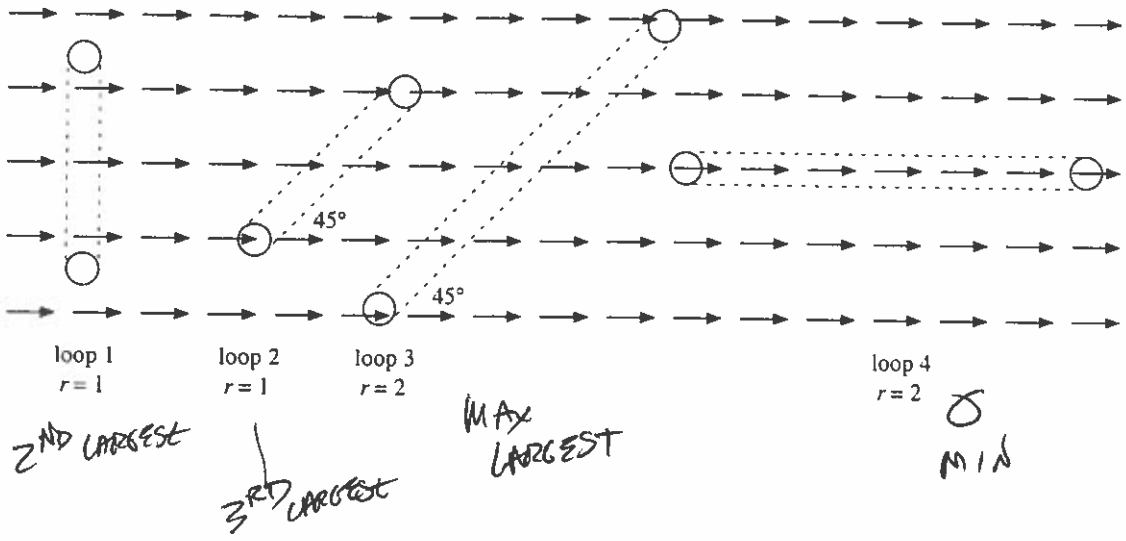
31.3 Magnetic Flux

8. The figure shows five different loops in a magnetic field. The numbers indicate the lengths of the sides and the strength of the field. Rank order the magnetic fluxes through the loops, from the smallest flux to the largest.



$\Phi = 4$, 2 , 2 , 4 , 2

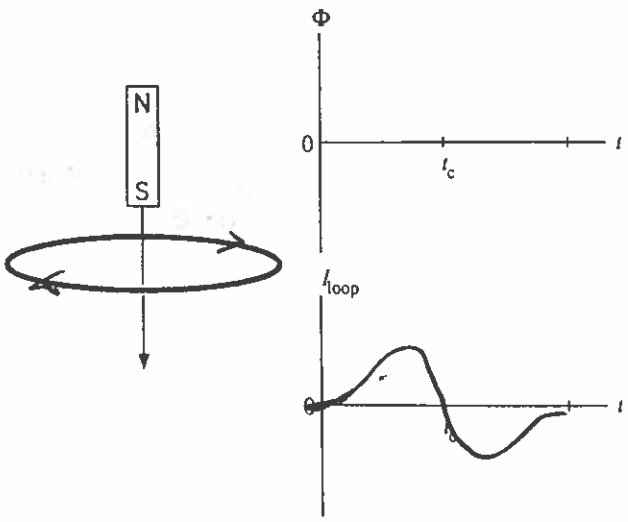
9. The figure shows four different circular loops that are perpendicular to the page. The radius of loops 3 and 4 is twice that of loops 1 and 2. The magnetic field is the same for each. Rank order the magnetic fluxes through the loops, from the smallest flux to the largest.



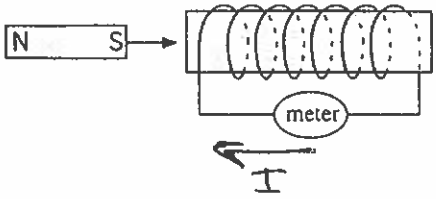
17. A bar magnet is dropped, south pole down, through the center of a loop of wire. The center of the magnet passes the plane of the loop at time t_c.

a) Sketch a graph of the magnetic flux through the loop as a function of time.

b) Sketch a graph of the current in the loop as a function of time. Let a clockwise current be a positive current and a counterclockwise current be a negative current.



18. a) As the magnet is inserted into the coil, does current flow toward the right or toward the left through the current meter? Or is it zero? Explain.



b) As the magnet is held at rest inside the coil, does current flow toward the right or toward the left through the current meter? Or is it zero? Explain.

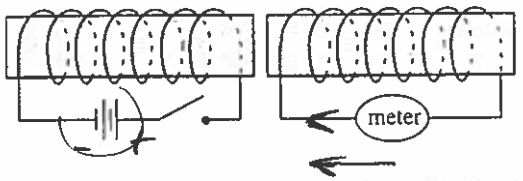
0

c) As the magnet is withdrawn from the coil, does current flow toward the right or toward the left through the current meter? Or is it zero? Explain.

TO RIGHT

d) If the magnet is inserted into the coil more rapidly than in part a), does the size of the current increase, decrease, or remain the same? Explain.

19. a) Just after the switch on the left coil is closed, does current flow toward the right or toward the left through the current meter of the right coil? Or is it zero? Explain.



I ALWAYS GET CONFUSED WHICH SIDE OF BATTERY SYMBOL IS +

I INDUCED

b) Long after the switch on the left coil is closed, does current flow toward the right or toward the left through the current meter of the right coil? Or is it zero? Explain.

0

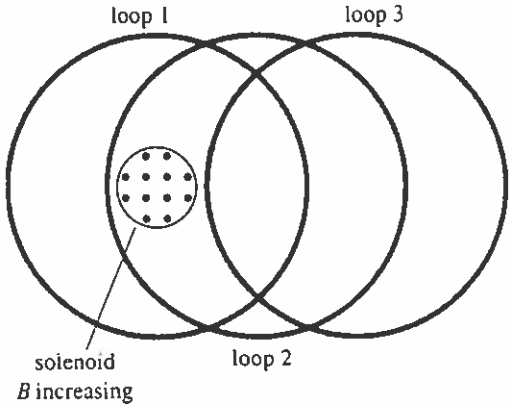
$\frac{d\Phi_M}{dt} = 0$ SINCE ~~ALTHOUGH~~ Φ_M = CONST

c) Just after the switch on the left coil is opened, does current flow toward the right or toward the left through the current meter of the right coil? Or is it zero? Explain.

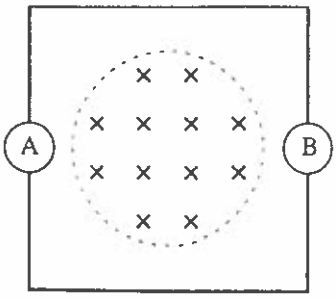
20. A solenoid is perpendicular to the page, and its field strength is increasing. Three circular wire loops of equal radii are shown. Rank order the size of the induced emf in the three rings, from the smallest to the largest. Explain your reasoning.

$V_1 = V_2$

V_3 LEAST ≈ 0



21. A conducting loop around a magnetic field contains two light bulbs, as shown. The wires connecting the bulbs are ideal, with no resistance. The magnetic field is increasing rapidly.

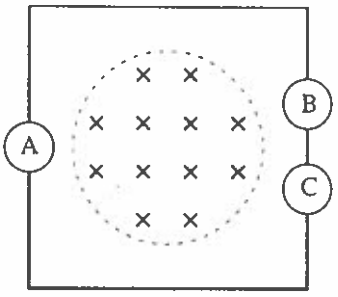


a) Do the bulbs glow? Why or why not?

YUP

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

22. A conducting loop around a magnetic field contains three light bulbs, as shown. The wires connecting the bulbs are ideal, with no resistance. The magnetic field is increasing rapidly. Rank order the brightness of the three bulbs, from least bright to brightest.



ALL SAME