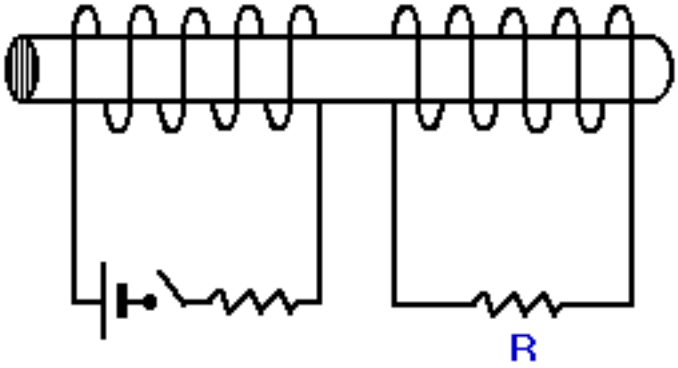
CPS lesson
Induction and AC Circuits
ANSWER KEY

1.

For a short time after the switch is closed, the current through resistor R is:



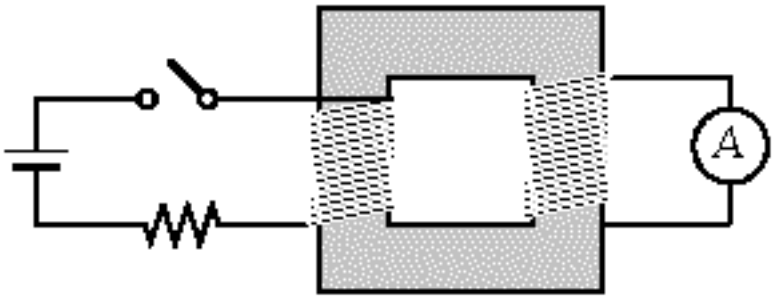
* A. to the left

B. to the right

C. zero

2.

After the switch is closed, the ammeter shows:



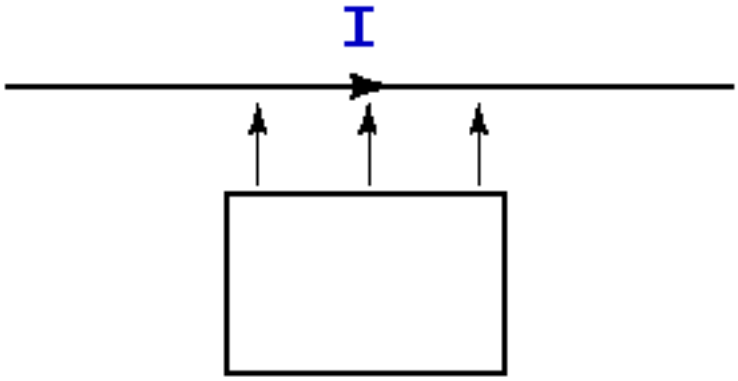
A. zero current always

B. a steady nonzero current

* C. a nonzero current which quickly fades away

3. A rectangular loop of wire is pushed toward a long straight current-carrying wire.

The induced current in the loop is:

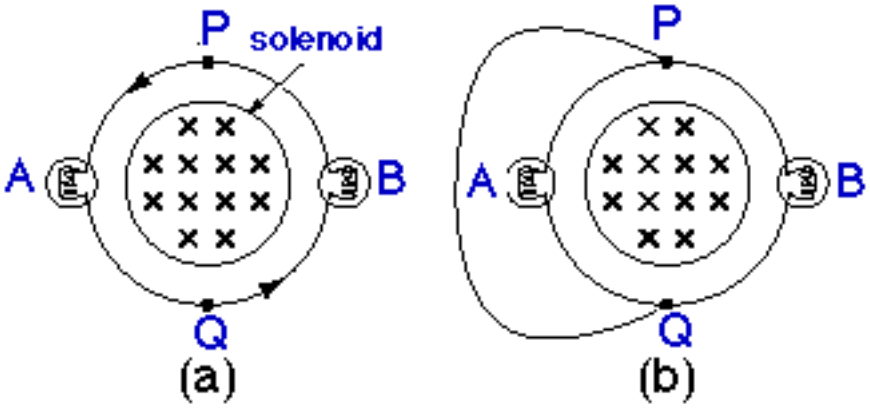


A. clockwise

* B. counter-clockwise

C. zero

4. A solenoid produces a magnetic field whose strength is increasing into the page. The induced emf in a loop around the wire lights up the bulbs in (a). What happens to the bulbs when points P and Q are shorted as in (b)?



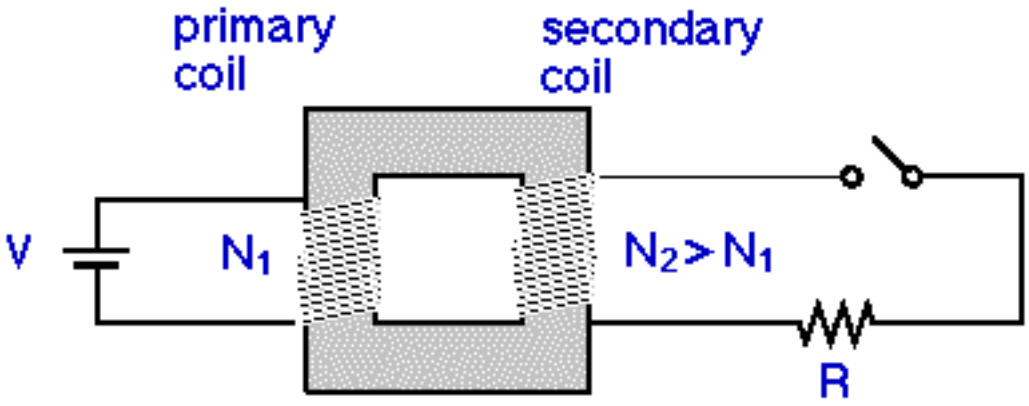
* A. A goes out, B brightens

B. B goes out, A brightens

C. A goes out, B dims

D. B goes out, A dims

5.
After the switch is closed, the voltage across the resistor R is:



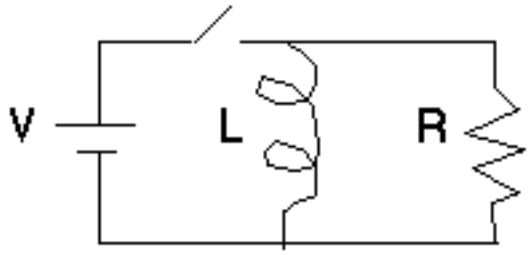
A. VN2/N1

B. VN1/N2

C. V

* D. zero

6. The switch is closed for a long time, so that current I is steadily flowing through the inductor. If the switch is opened, the voltage across the resistor is now:



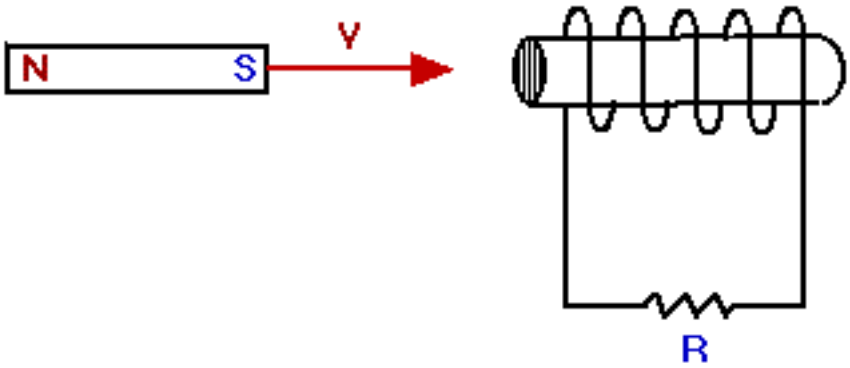
A. always zero

B. constantly V

* C. initially IR but fades away to zero

7.

As the magnet is moved toward the coil, the current through resistor R is:



* A. to the left

B. to the right

C. zero

8.

Two current-carrying coils are near one another. We can increase the mutual inductance of the pair by:

A. moving the coils closer to each other

B. increasing the currents in the coils

C. increasing the number of turns in the coils

* D. doing two of the above

E. doing all three of the above

9.
In transmitting electricity from a power plant to a home, what are transformers used for?

A. to step up the output voltage at the power plant

B. to step down the input voltage to the house

* C. both of the above

D. neither of the above

10.
The magnetic energy stored in an inductor is proportional to:

A. the square of the current in the inductor

B. the square of the magnetic field through the inductor

* C. both of the above

D. neither of the above

11.
Which statement is true?

* A. Induced electric field lines form closed loops.

B. Induced electric field is conservative.

C. Both of the above are true.

D. Neither of the above are true.

12.
Where is emf induced in a transformer?

A. output voltage of the secondary

B. back emf at the primary

C. eddy currents in the iron core

D. in two of the above

* E. in all three of the above

13.
Which of the following have self-inductance?

A. solenoid

B. toroid

C. wire loop

D. straight wire

* E. all of the above

14. A conducting disc swings on a pendulum through the gap of a c-shaped magnet.

Which type of disc damps out the motion most rapidly?

* A. a solid disc

B. a disc which has slots cut into it

15.
Self-inductance of a coil depends upon:

A. magnetic flux through and current in the coil

* B. number of turns and cross-sectional area of the coil

C. both A and B

D. neither A nor B

16.
A resistor is connected across an ac emf e. The resulting current:

A. leads the emf

B. lags the emf

* C. is in phase with the emf

D. The answer depends upon the frequency of the emf.

17.

A capacitor is connected across an ac power supply. As the frequency is increased, the peak current in this circuit:

* A. increases

B. decreases

C. remains the same

18.
In a dc circuit, which element has the greatest resistance to charge flow?

* A. capacitor

B. inductor

C. resistor

D. The answer depends on the values of C, L, and R.

19. A capacitor having initial charge Q is connected across an inductor. The energy of the inductor is a maximum when the charge on the capacitor is:

A. Q

B. Q/2

* C. zero

D. The energy of the inductor is time-independent.

20. An initially charged capacitor is connected in series with an inductor having a small resistance. As a function of time, the charge on the capacitor:

A. oscillates sinusoidally with constant amplitude

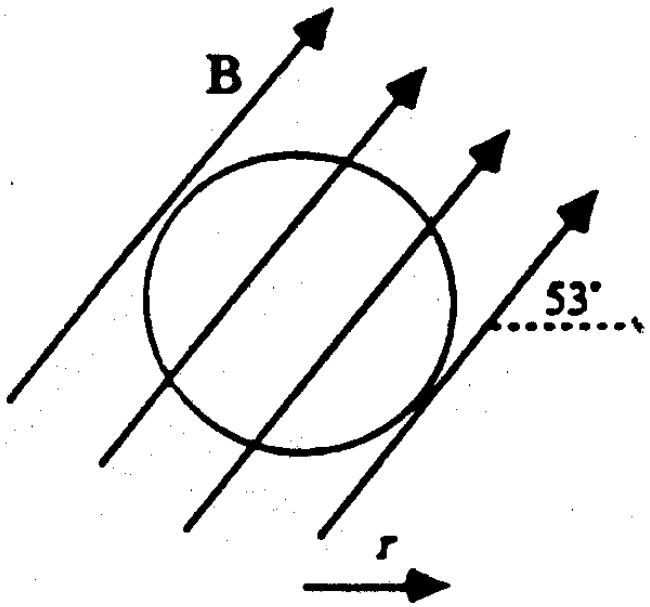
* B. oscillates sinusoidally with decreasing amplitude

C. monotonically decreases to zero

D. remains constant because there is no driving emf

21. The magnetic flux through the loop is:

(a)



The loop and the magnetic field are both in the plane of the paper.

A. B pr2

* B. zero

C. B pr2 cos(53o)

pr2
B pr2
B pr2
B pr2 cos(53o)

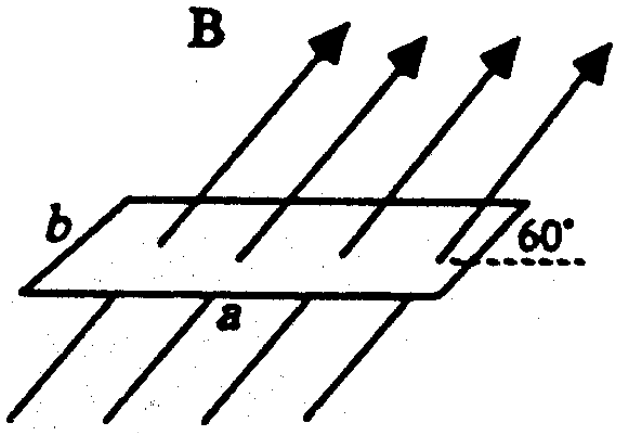
D. B pr2 cos(37o)

B pr2 sin(53o)

22. The magnetic flux through the loop is:

(b)

The rectangular loop is perpendicular to the page and the magnetic field is in the plane of the paper.



A. B ab

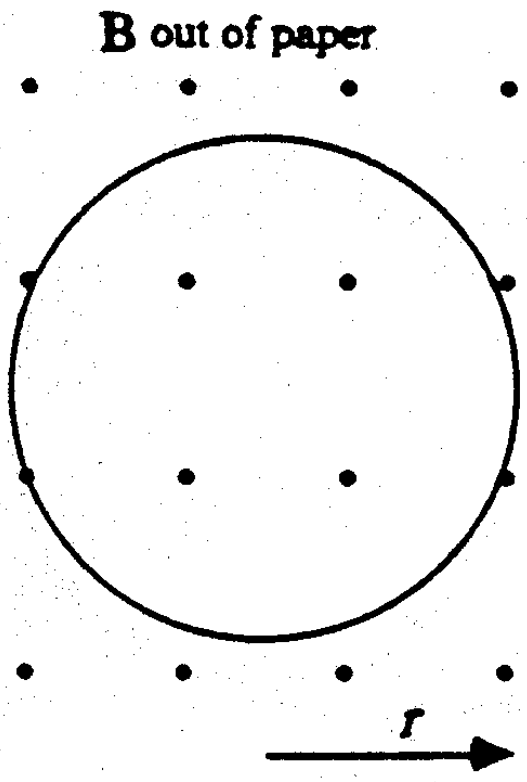
B. zero

C. B ab cos(60o)

* D. B ab cos(30o)

23. The magnetic flux through the loop is:

(c)



The loop is in the plane of the paper and the field is perpendicular to the paper.

* A. B pr2

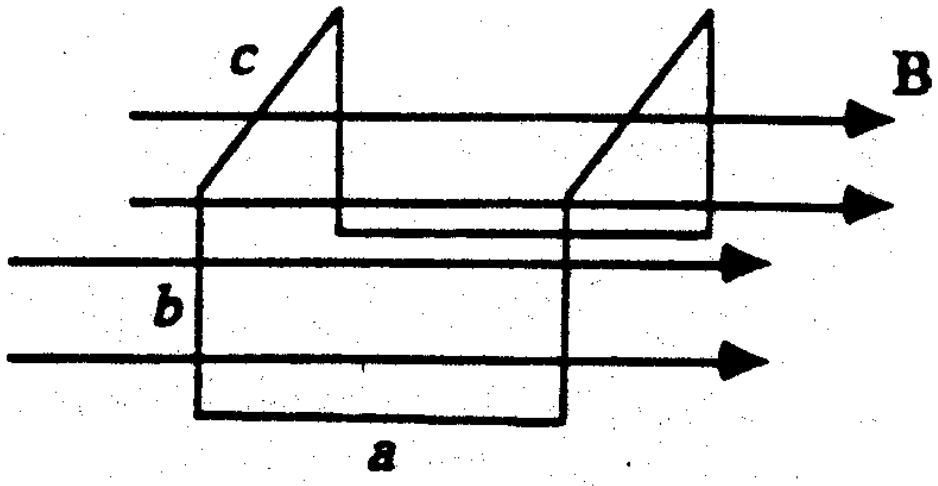
B. zero

C. B 2pr

D. none of the above

24. The magnetic flux through the loop is:

(d) The field is parallel to side a.



A. 2B ab

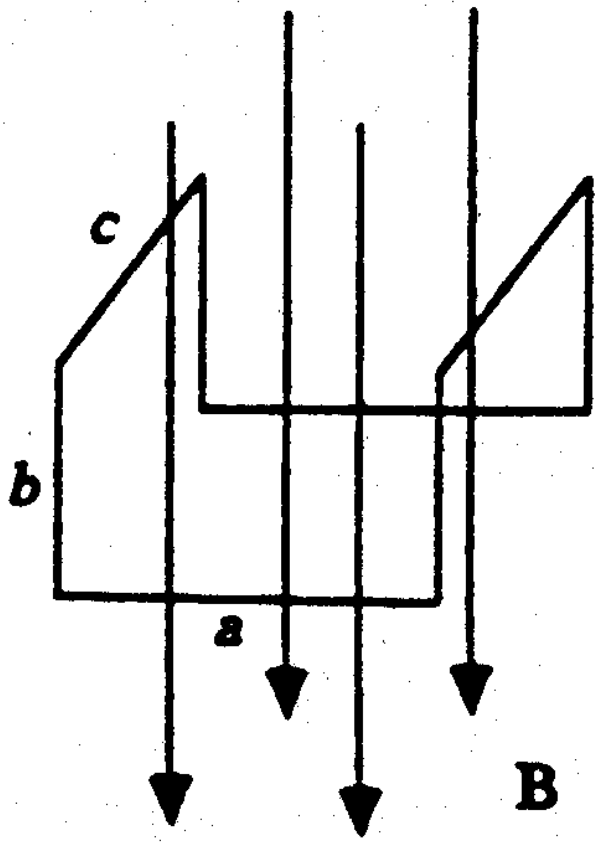
* B. zero

C. 2B bc

D. B ac

25. The magnetic flux through the loop is:

(c) **The field is parallel to side b.**



A. 2B ab

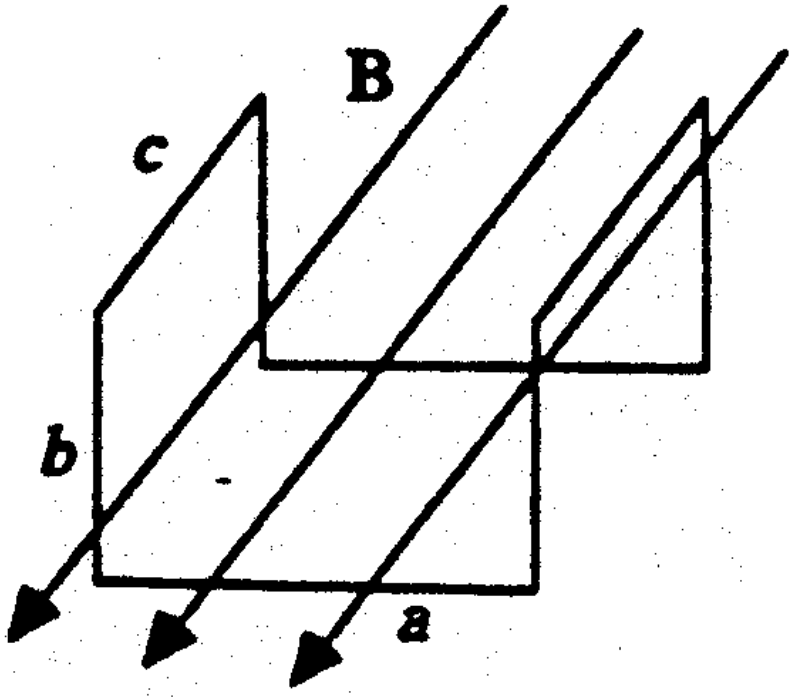
B. zero

C. 2B bc

* D. B ac

26. The magnetic flux through the loop is:

(f) **The field is parallel to side c.**



A. 2B ab

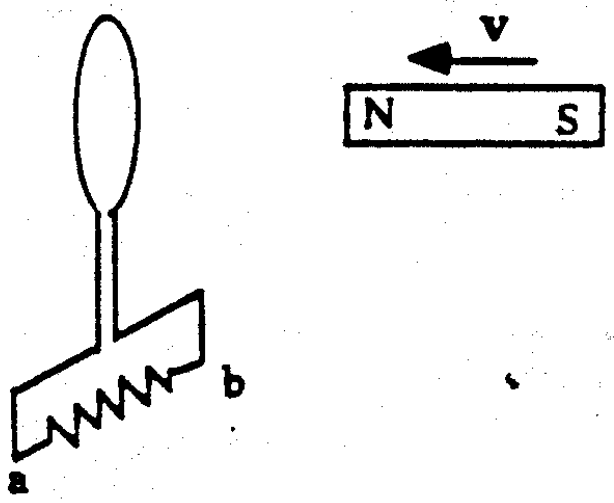
* B. zero

C. 2B bc

D. B ac

27. The induced current in the resistor is:

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



* A. from a to b

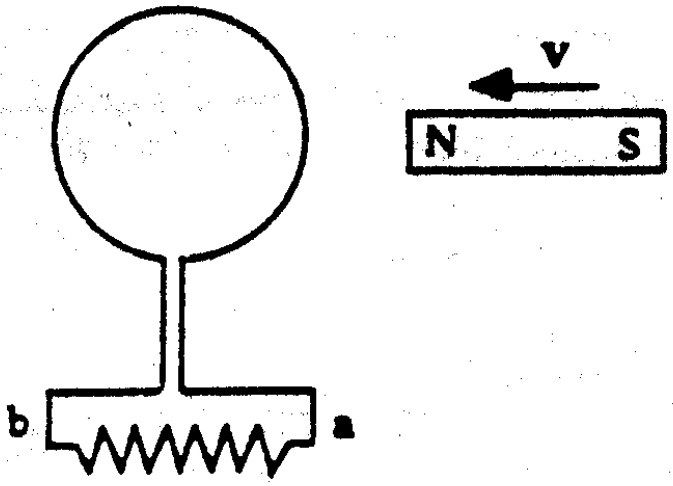
B. from b to a

C. zero

D. it depends

28. The induced current in the resistor is:

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



A. from a to b

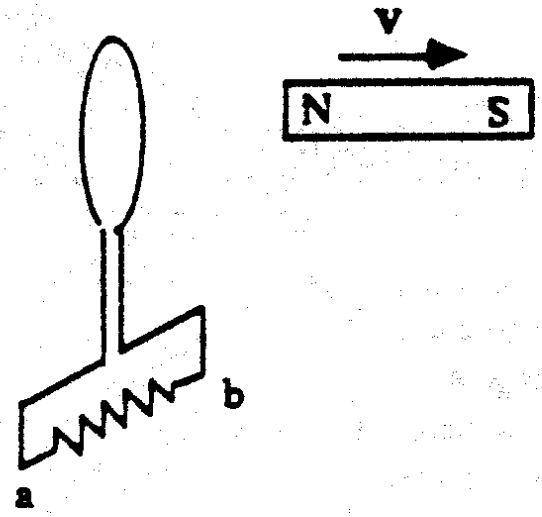
B. from b to a

* C. zero

D. it depends

29. The induced current in the resistor is:

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



A. from a to b

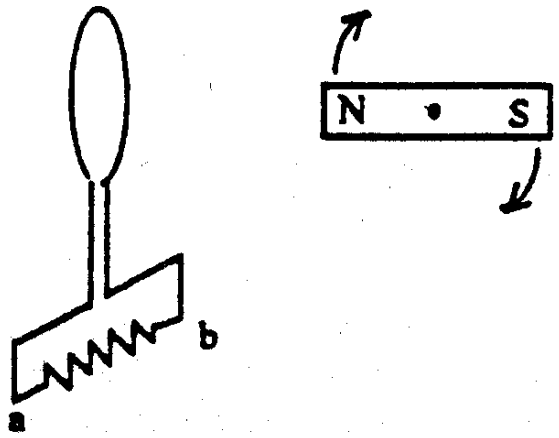
* B. from b to a

C. zero

D. it depends

30. The induced current in the resistor is:

(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.



A. from a to b

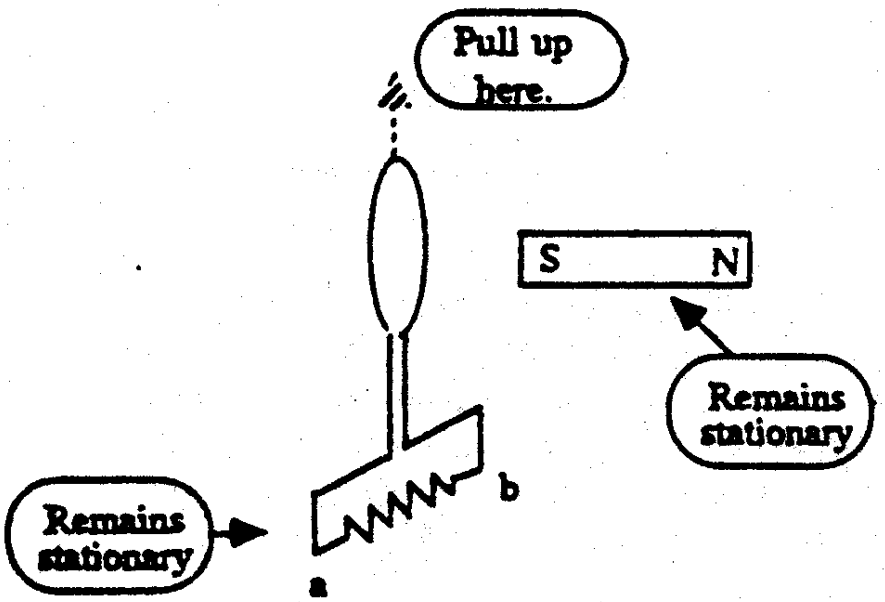
* B. from b to a

C. zero

D. it depends

31. The induced current in the resistor is:

(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.



* A. from a to b

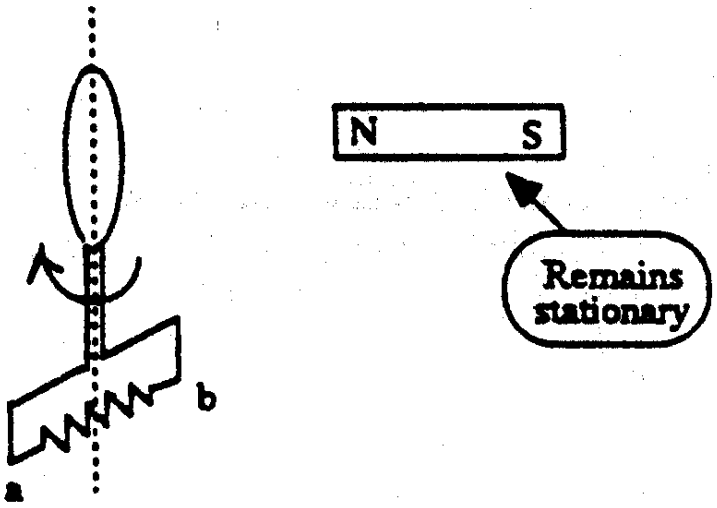
B. from b to a

C. zero

D. it depends

32. The induced current in the resistor is:

(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.



A. from a to b

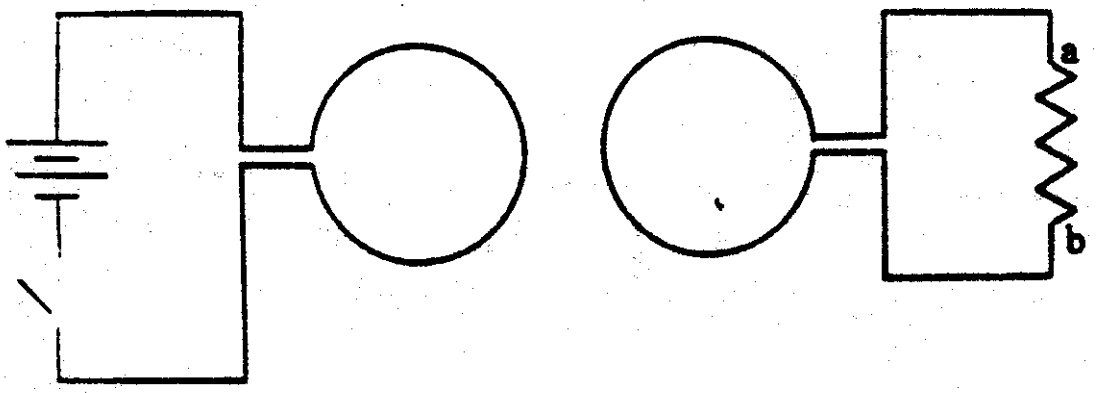
B. from b to a

C. zero

D. it depends

33. The induced current in the resistor is:

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



* A. from a to b

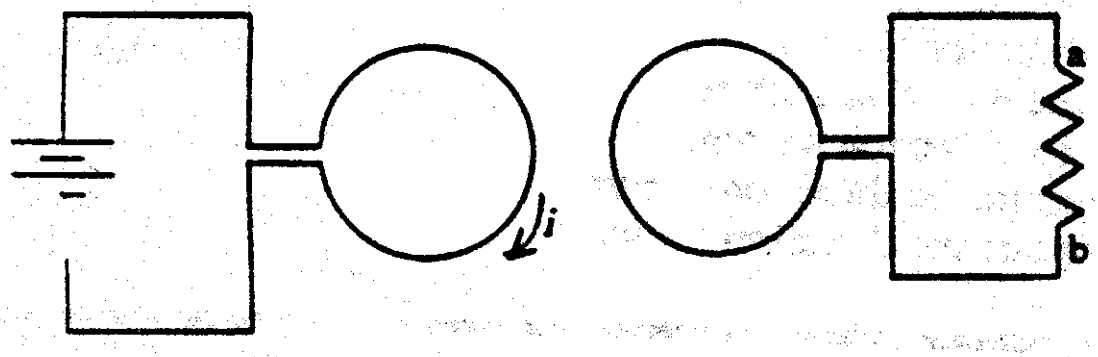
B. from b to a

C. zero

D. it depends

34. The induced current in the resistor is:

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



A. from a to b

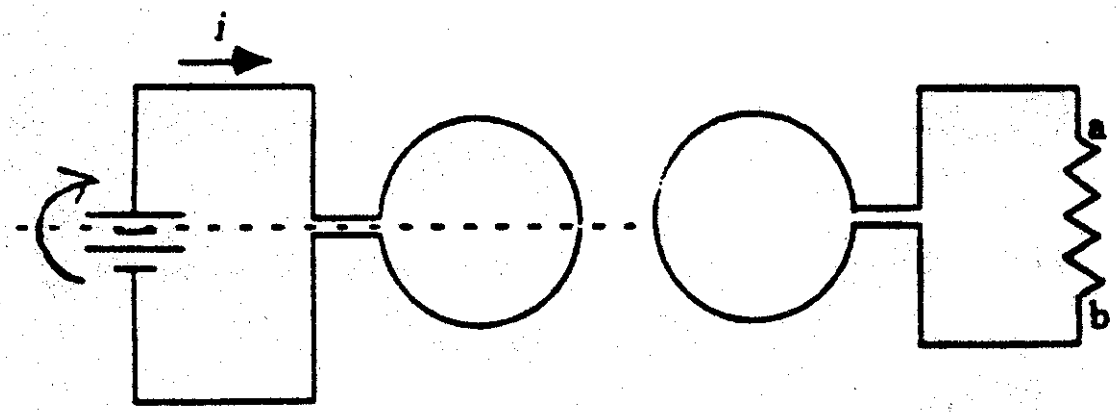
B. from b to a

* C. zero

D. it depends

35. The induced current in the resistor is:

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



A. from a to b

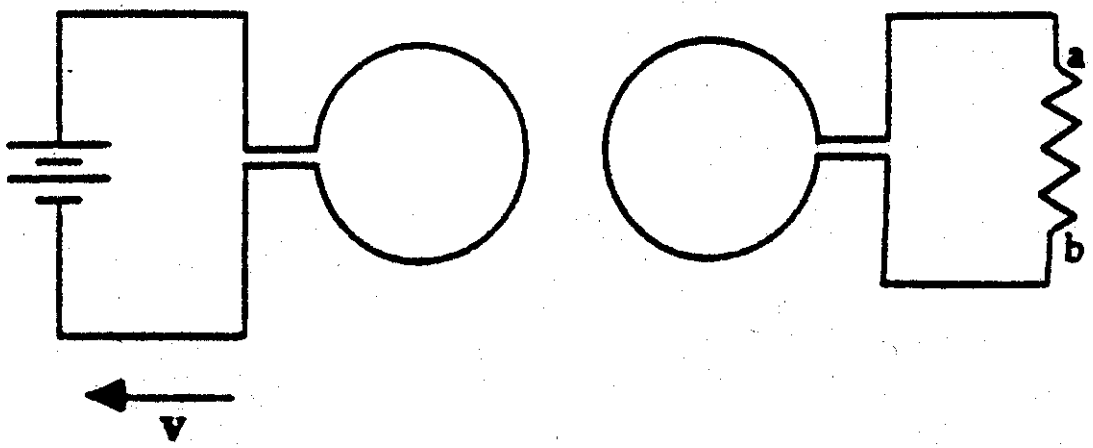
* B. from b to a

C. zero

D. it depends

36. The induced current in the resistor is:

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



A. from a to b

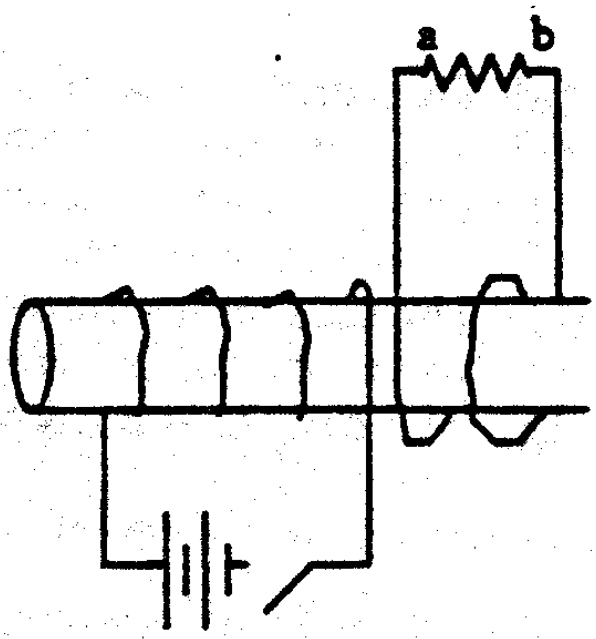
* B. from b to a

C. zero

D. it depends

37. The induced current in the resistor is:

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



* A. from a to b

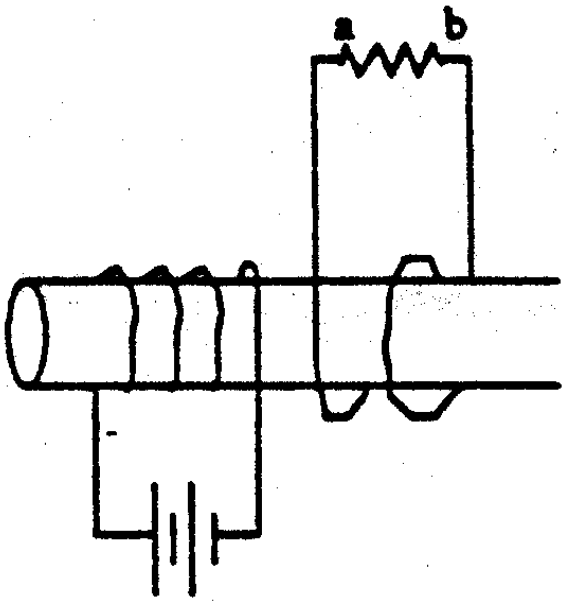
B. from b to a

C. zero

D. it depends

38. The induced current in the resistor is:

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



A. from a to b

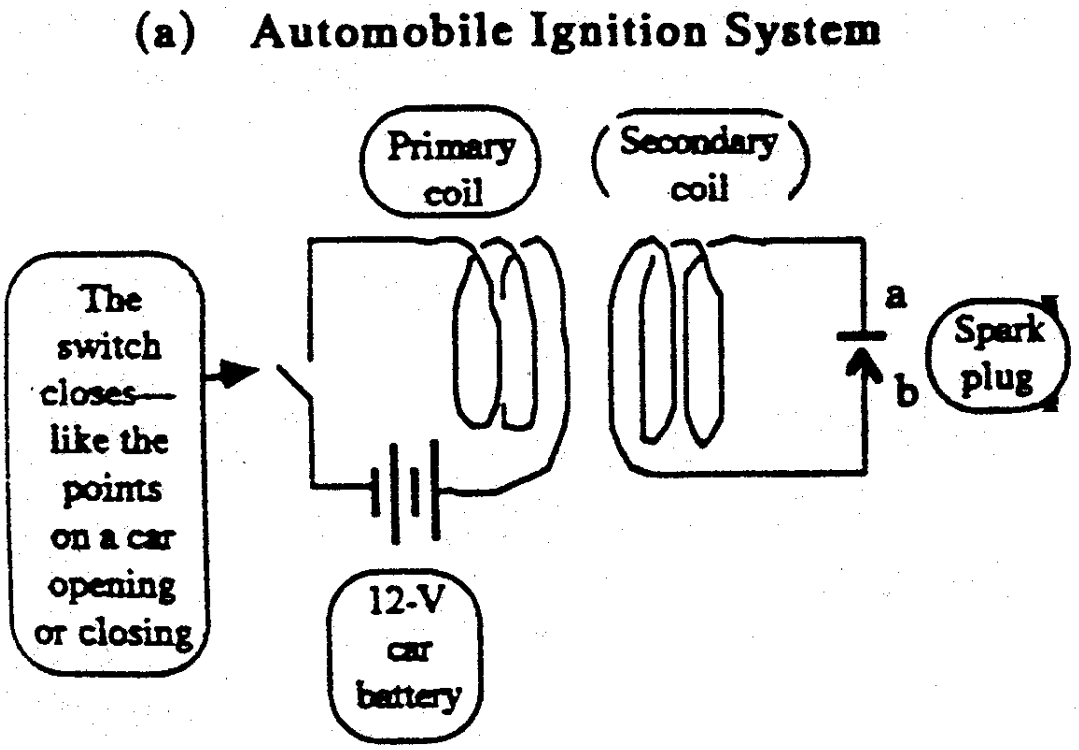
B. from b to a

* C. zero

D. it depends

39.

Determine whether point a or b is at a higher potential.



* A. point a

B. point b

C. same potential

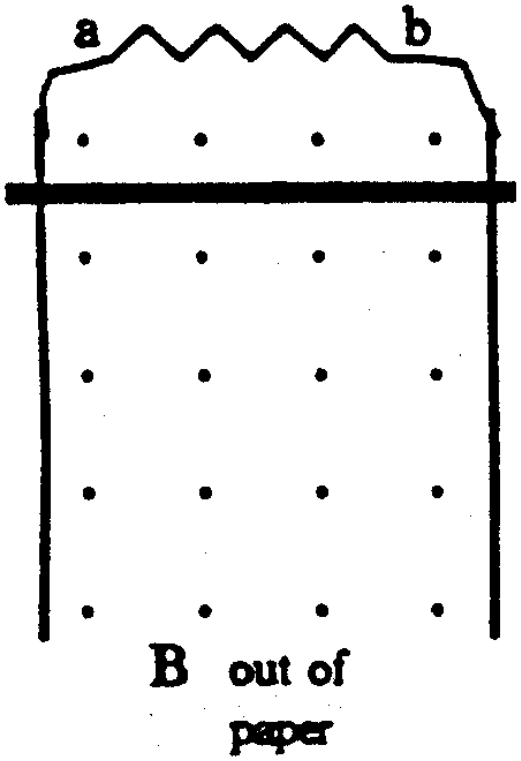
D. it depends

40.

Determine whether point a or b is at a higher potential.

(b) Falling Bar Inductor

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



* A. point a

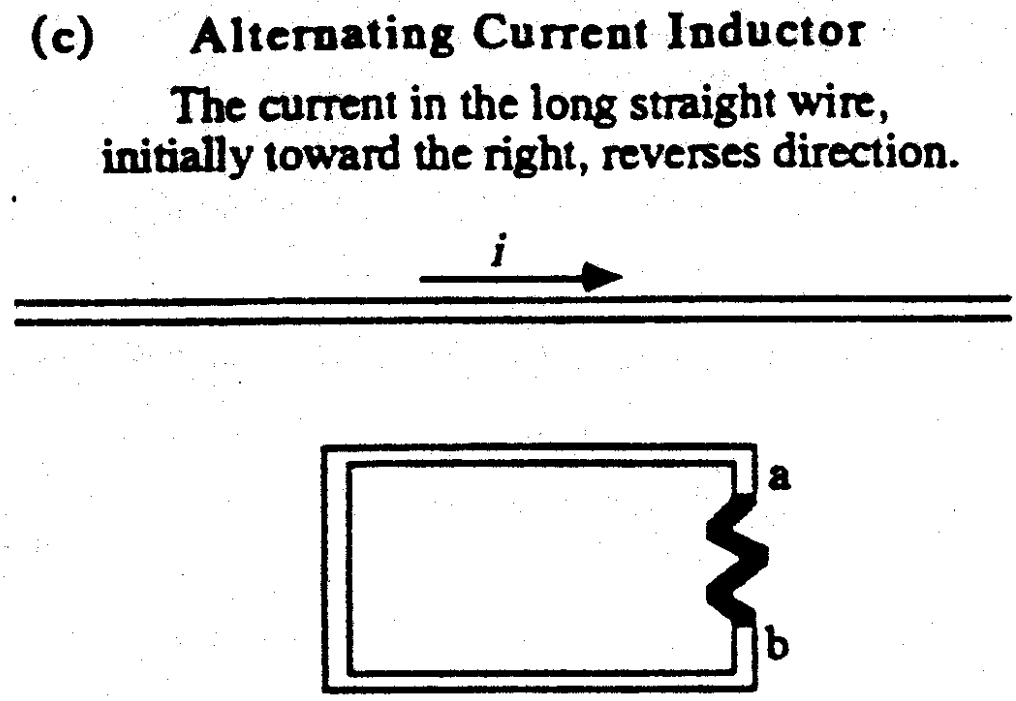
B. point b

C. same potential

D. it depends

41.

Determine whether point a or b is at a higher potential.



* A. point a

B. point b

C. same potential

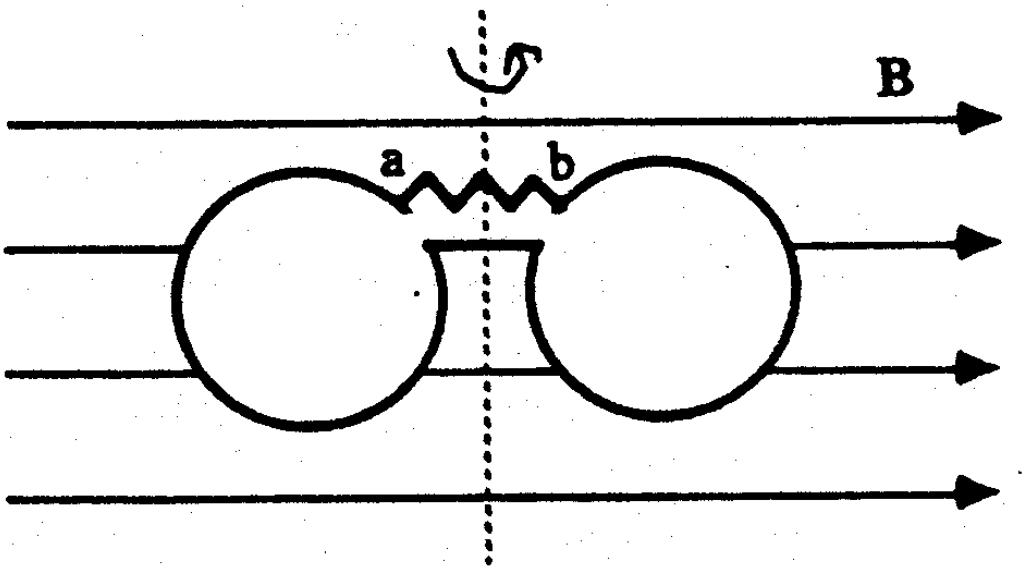
D. it depends

42.

Determine whether point a or b is at higher potential.

(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.



* A. point a

B. point b

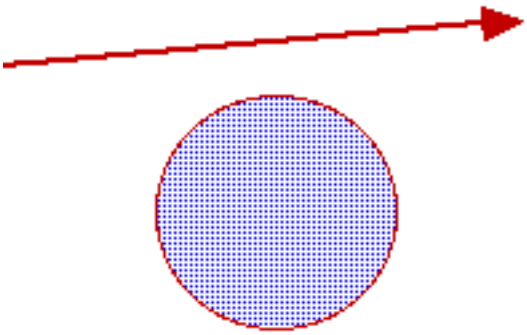
C. same potential

D. it depends

43.

A sphere of radius R is placed near a long straight wire carrying steady current I.

The total magnetic flux passing through the surface of the sphere is:



A. m0I

B. m0I/4pR2

C. 4pR2m0I

* D. zero