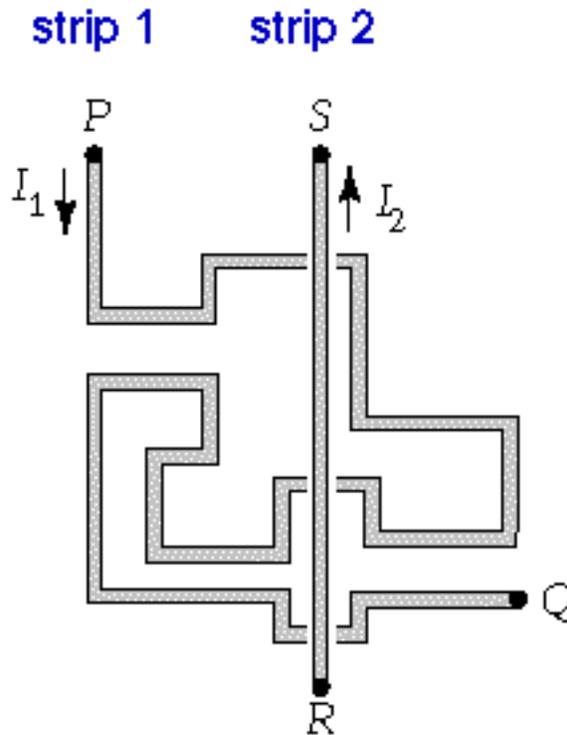


CPS lesson
Magnetism
ANSWER KEY

1.

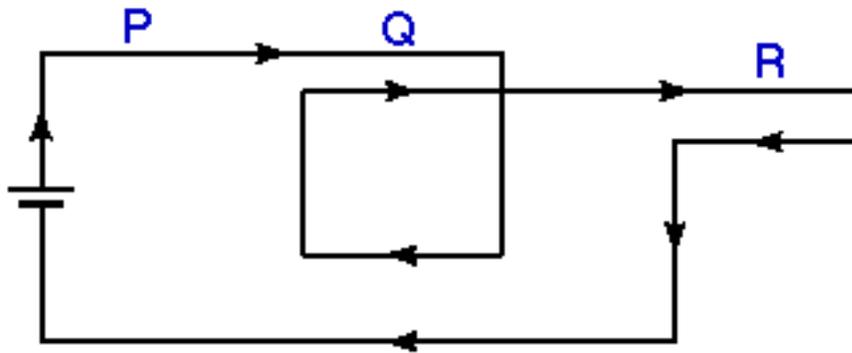
Two wire strips carry currents from P to Q and from R to S. If the current directions in both wires are reversed, the net magnetic force of strip 1 on strip 2:



- * A. remains the same
B. reverses direction only
C. changes magnitude only
D. both direction and magnitude change

2.

The magnetic field decreases in strength near the indicated points in the order:

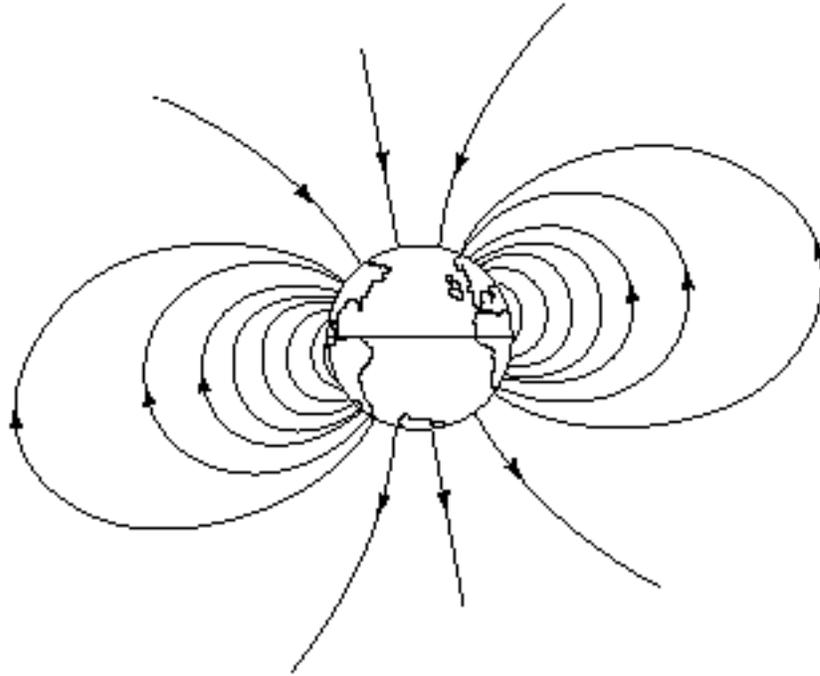


- A. P, Q, R
- B. Q, R, P
- C. R, Q, P
- D. P, R, Q
- * E. Q, P, R

3. A charged particle enters a mass spectrometer with velocity perpendicular to the uniform magnetic field inside the chamber. The particle's path inside the spectrometer is a portion of a:

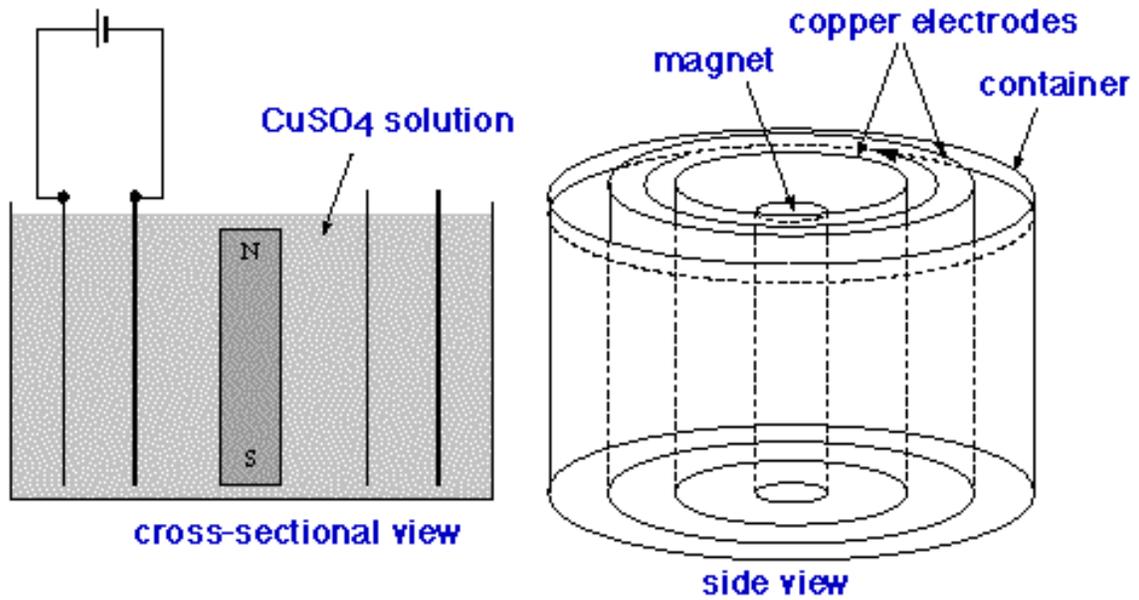
- A. parabola
- * B. circle
- C. straight line
- D. spiral

4. Ions from outer space are deflected by Earth's magnetic field. Consequently, the largest number of cosmic ions strike Earth's surface at:



- * A. the poles
- B. the equator
- C. mid-latitudes

5. A conducting (ionic) solution is placed between copper electrodes setting up an electric field and a bar magnet setting up a magnetic field. Seen from above, the solution circulates clockwise. Consequently, the mobile ions must be:

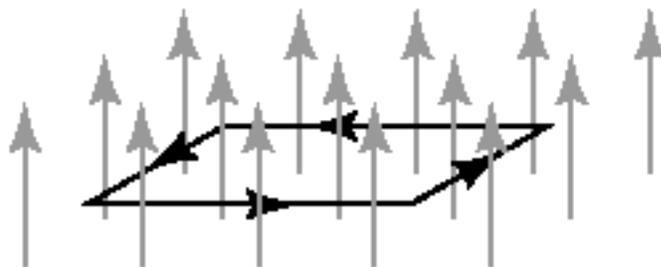


- A. positive
- B. negative
- * C. either sign of charge
- D. neutral

6. A rectangular loop is perpendicular to a uniform magnetic field.

Current flows counter-clockwise in the loop as seen from above.

The loop experiences a net:



- A. force only
- B. torque only

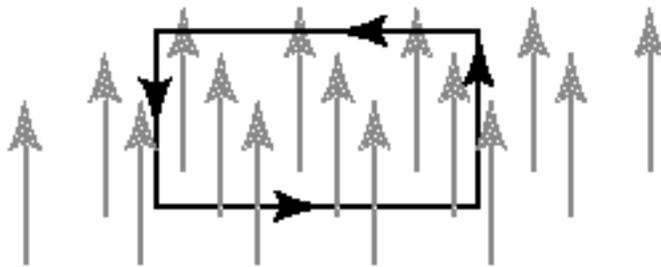
C. both force and torque

* D. neither force nor torque

7. A rectangular loop is parallel to a uniform magnetic field.

Current flows counter-clockwise in the loop.

The loop experiences a net:



A. force only

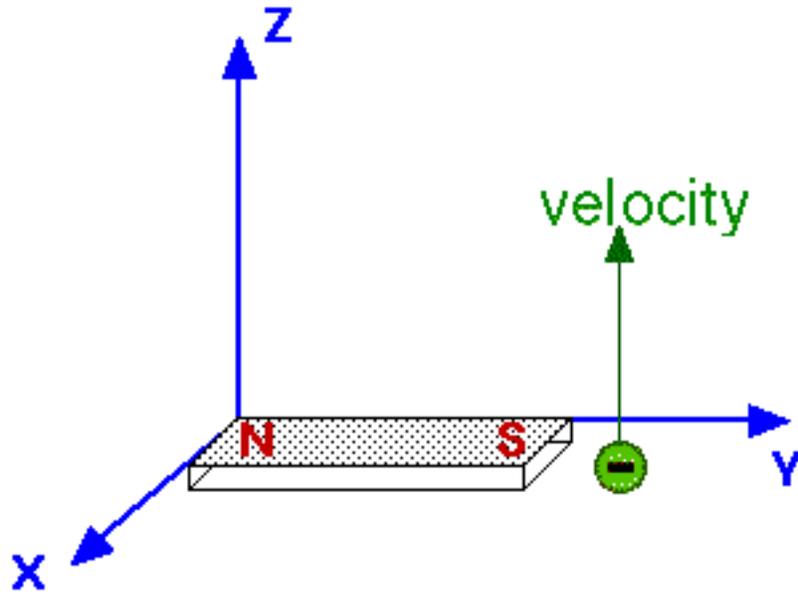
* B. torque only

C. both force and torque

D. neither force nor torque

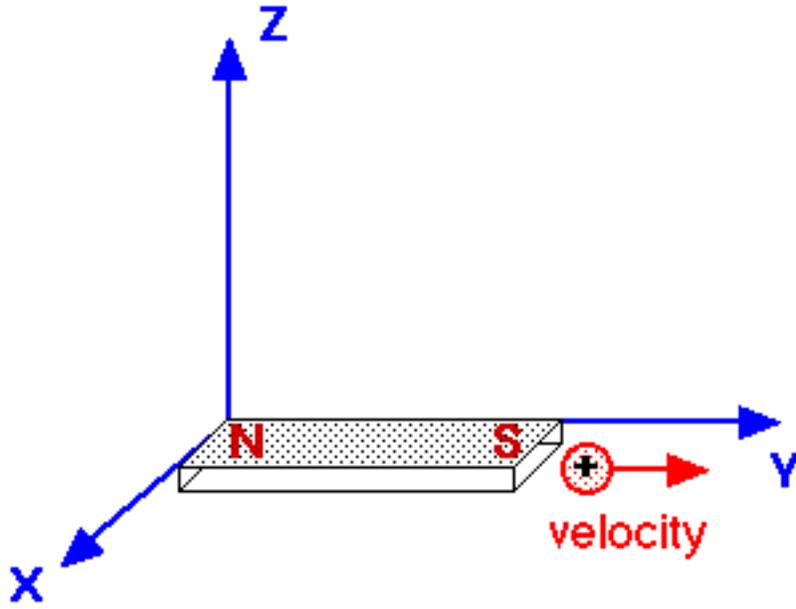
8.

In what direction is the magnetic force on the charged particle?



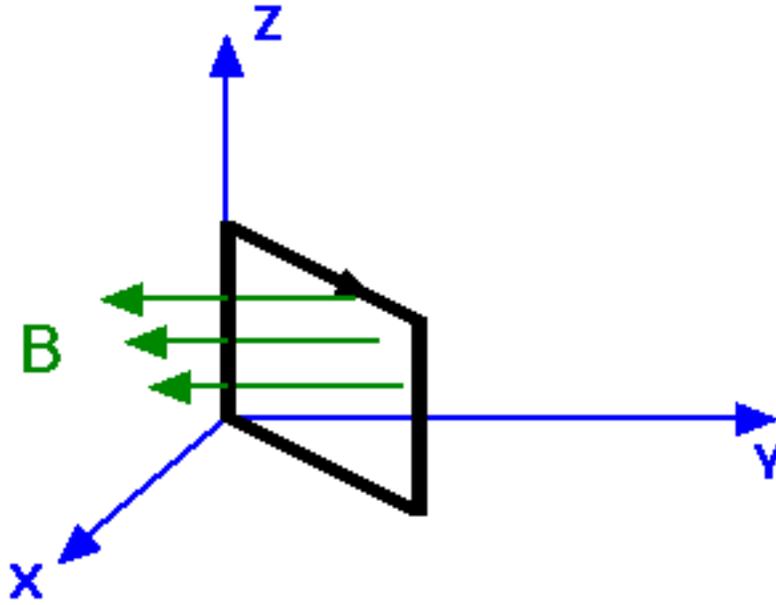
- A. +x
- * B. -x
- C. +y
- D. -y
- E. there is no force

9.
In what direction is the magnetic force on the charged particle?



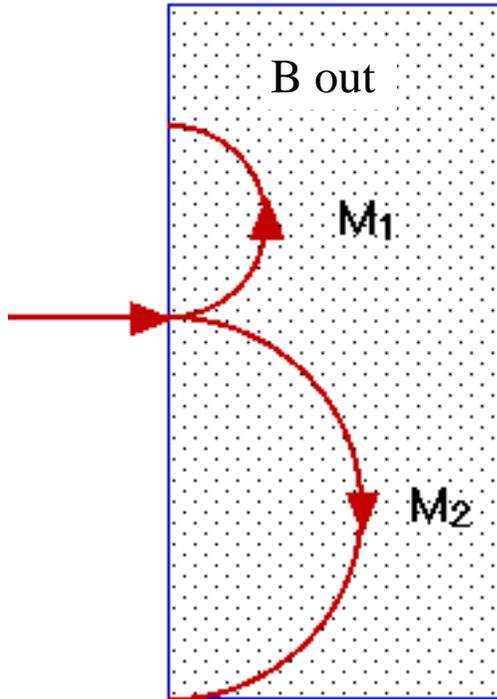
- A. +x
- B. -x
- C. +y
- D. -y
- * E. there is no force

10.
 In what direction is the torque on the current loop at 45 degrees due to the B field in the -y direction?



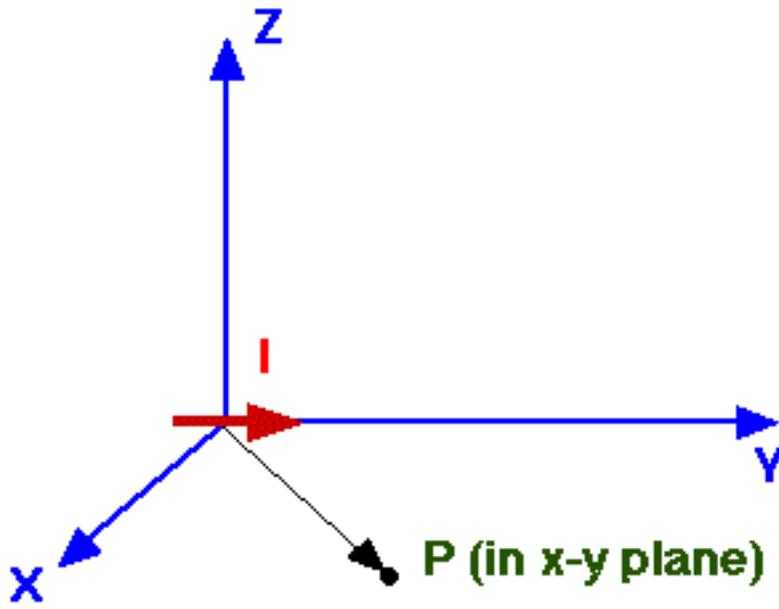
- * A. +z
B. -z
C. +x
D. +y
E. none of the above

11.
Two particles with equal magnitude charges and speeds enter a uniform B field pointing out of the page. One concludes about the relative masses and signs of the charges that:



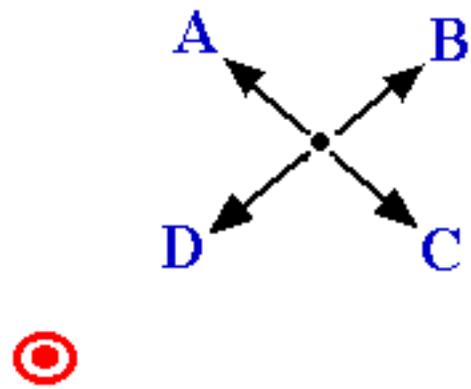
- A. $M_1 > M_2$, $Q_1 +$, $Q_2 -$
- B. $M_1 > M_2$, $Q_1 -$, $Q_2 +$
- C. $M_1 < M_2$, $Q_1 +$, $Q_2 -$
- * D. $M_1 < M_2$, $Q_1 -$, $Q_2 +$

12.
The direction of the magnetic field at P due to the indicated current element is:



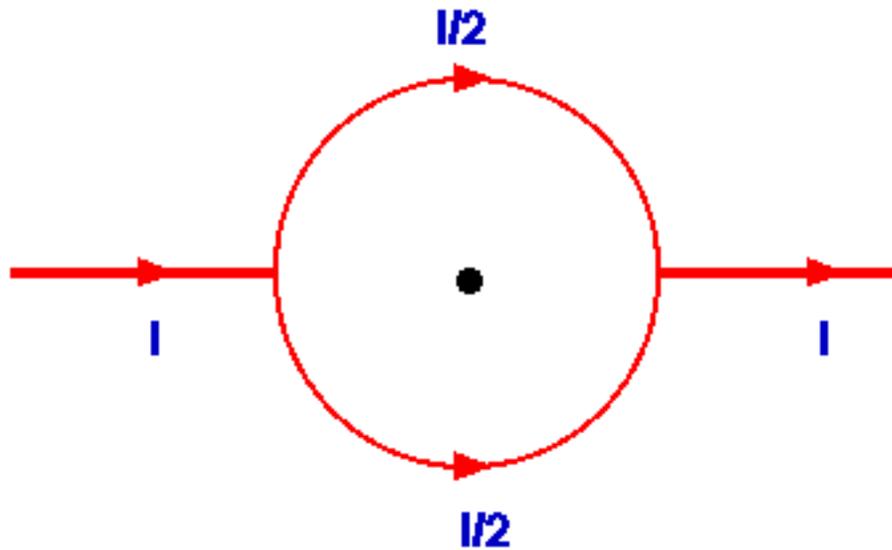
- A. +x
- B. -x
- C. +z
- * D. -z
- E. none of the above

13. The red wire carries current out of the page. What is the direction of the magnetic field at the black dot?



- * A.
- B.
- C.
- D.

14.
 Current I splits into two equal halves going around a circle.
 The magnetic field at the center of the loop is:



- A. out of the page
- B. into the page
- * C. zero

15.
 Two point charges q and Q move with nonzero velocities v and V . The magnetic force on q by Q must be:

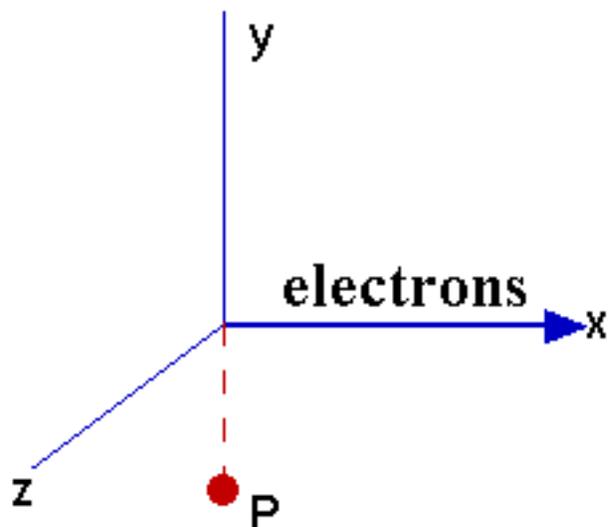
- A. perpendicular to v and depends in magnitude only on V

- * B. perpendicular to v and depends in magnitude on v and V
- C. perpendicular to V and depends in magnitude only on V
- D. perpendicular to V and depends in magnitude on v and V

16.

A beam of electrons travels in the $+x$ direction.

What is the direction of the magnetic field at a point on the $-y$ axis?



- * A. $+z$
- B. $-z$
- C. $+y$
- D. $-y$

17.

What is the direction of the magnetic field inside a solenoid?

- * A. parallel to the axis

- B. circular around the axis
- C. radially away from the axis

18.

Which of the following arise from permanent (rather than induced) magnetic dipoles in the material?

- A. diamagnetism only
- B. diamagnetism and paramagnetism
- * C. paramagnetism and ferromagnetism
- D. diamagnetism, paramagnetism, and ferromagnetism

19.

Rank paramagnetism (P), diamagnetism (D), and ferromagnetism (F) in order from repulsion to strongest attraction to a magnetic pole:

- A. P, D, F
- B. F, D, P
- * C. D, P, F
- D. F, P, D
- E. D, F, P

20.

Pivoted bars of which materials will align in (versus opposite to) the direction of an external magnetic field?

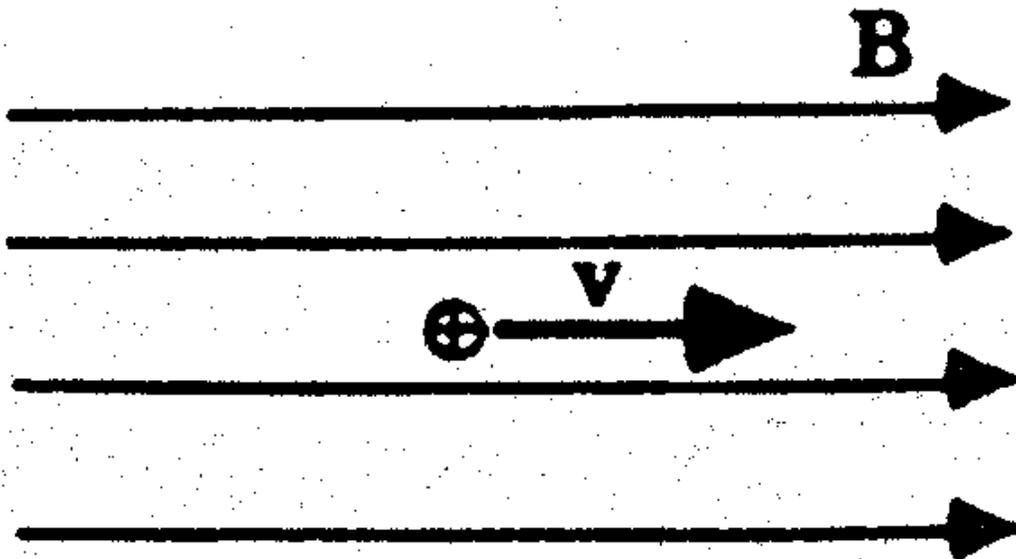
- A. diamagnetic and paramagnetic materials

B. diamagnetic and ferromagnetic

* C. paramagnetic and ferromagnetic

21. The magnetic force on the positive charge is:

(a)



A. rightward

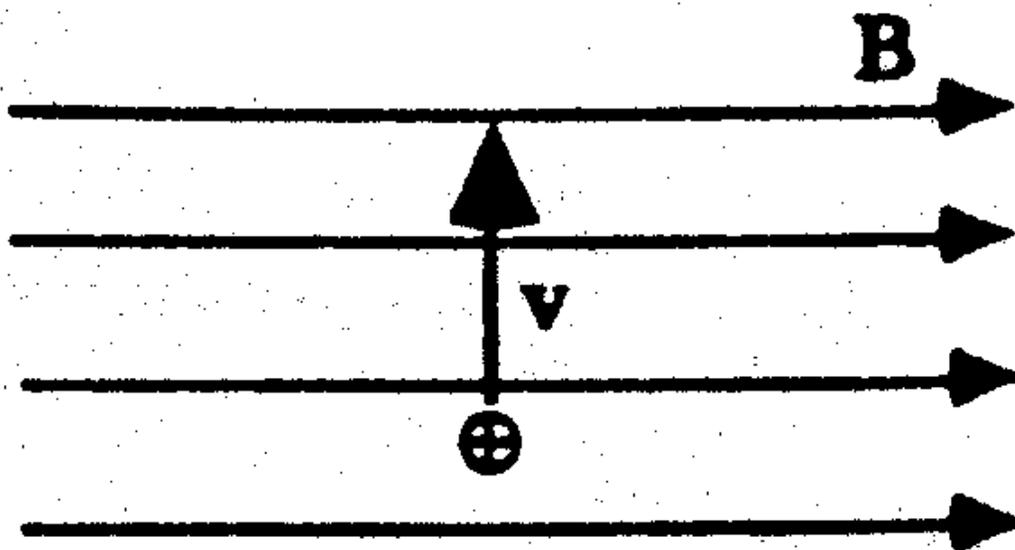
B. out of the page

C. into the page

* D. zero

22. The magnetic force on the positive charge is:

(b)



A. rightward

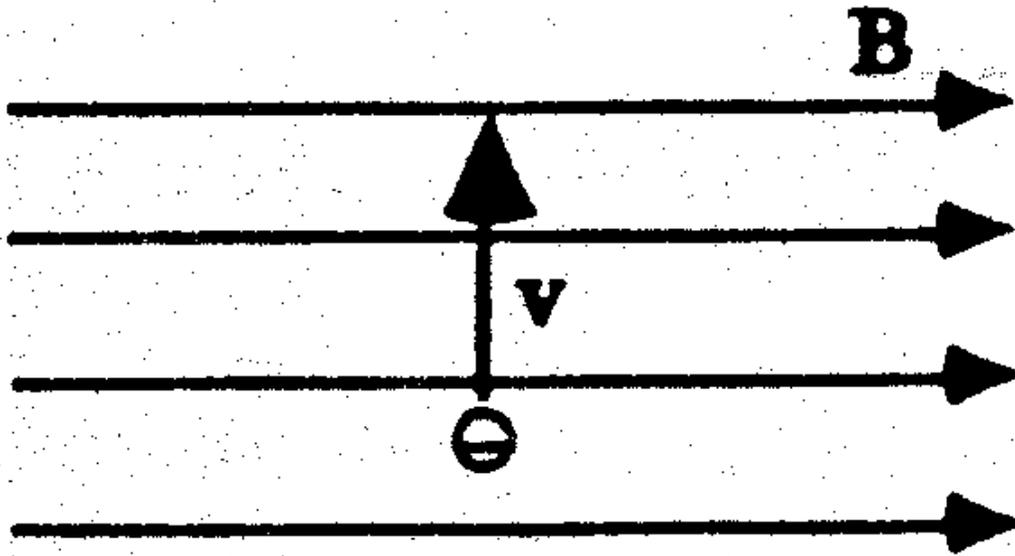
B. leftward

* C. into the page

D. out of the page

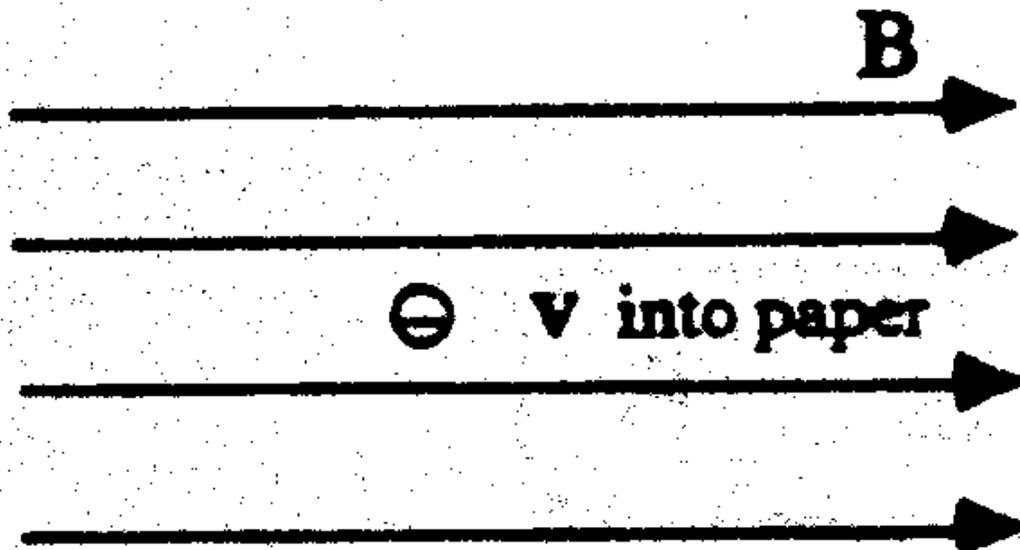
23. The magnetic force on the negative charge is:

(c)



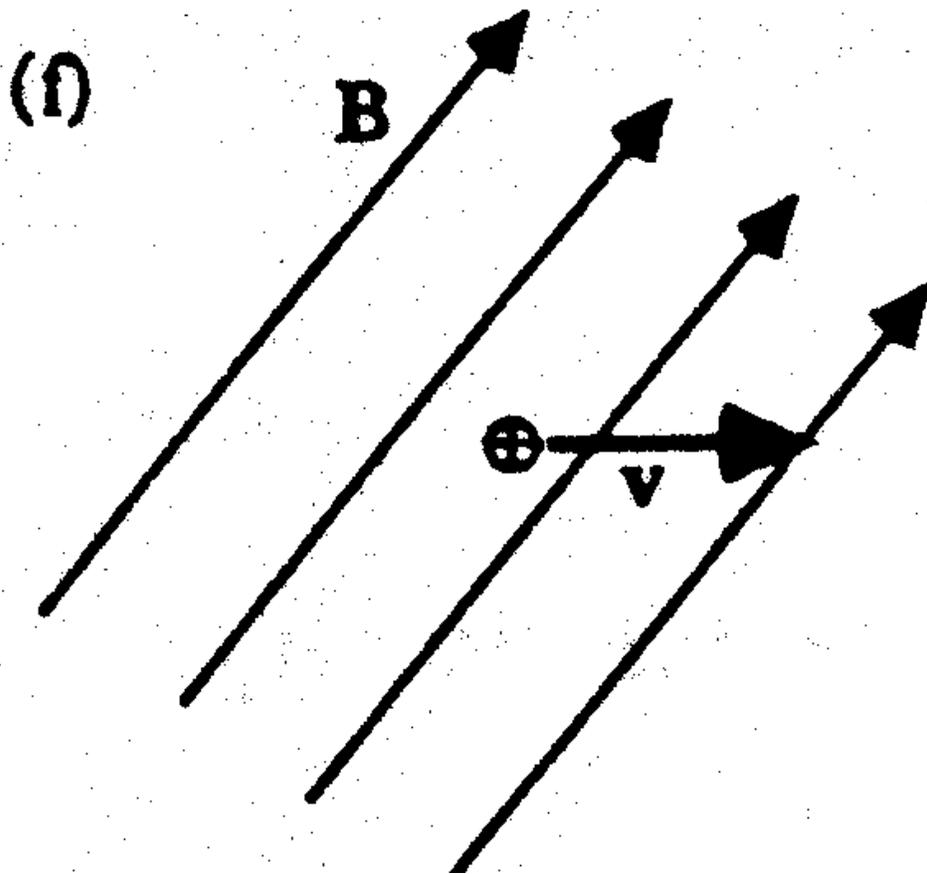
- A. rightward
- B. leftward
- C. into the page
- * D. out of the page

24. The magnetic force on the negative charge is:



- A. rightward
- B. leftward
- * C. upward
- D. downward

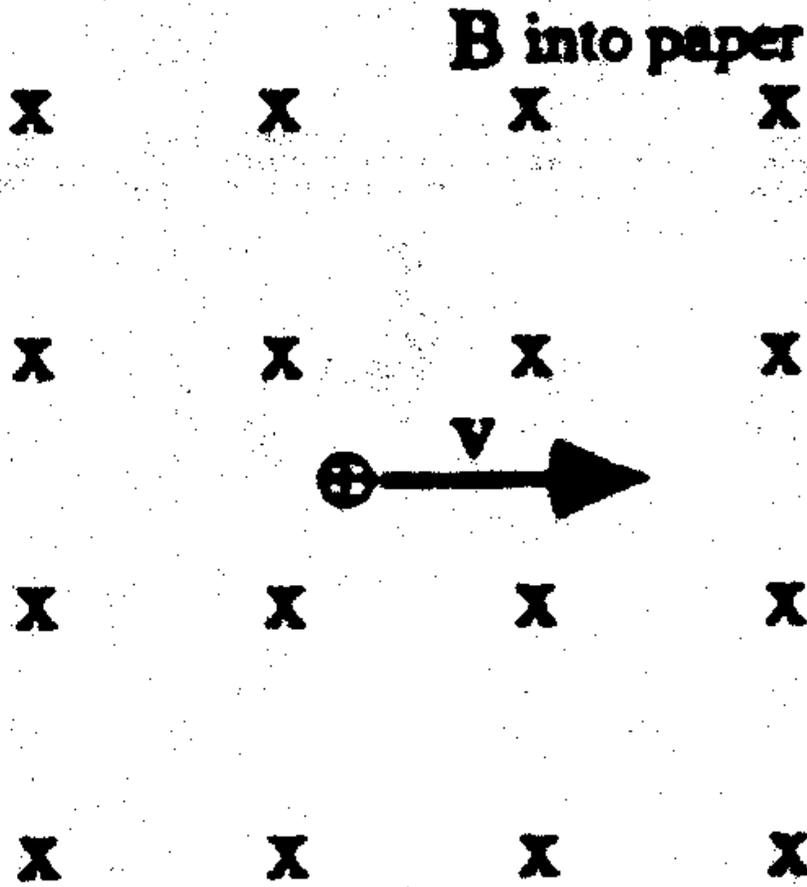
25. The magnetic force on the positive charge is:



- A. into the page
- * B. out of the page
- C. upward at an angle
- D. down at an angle

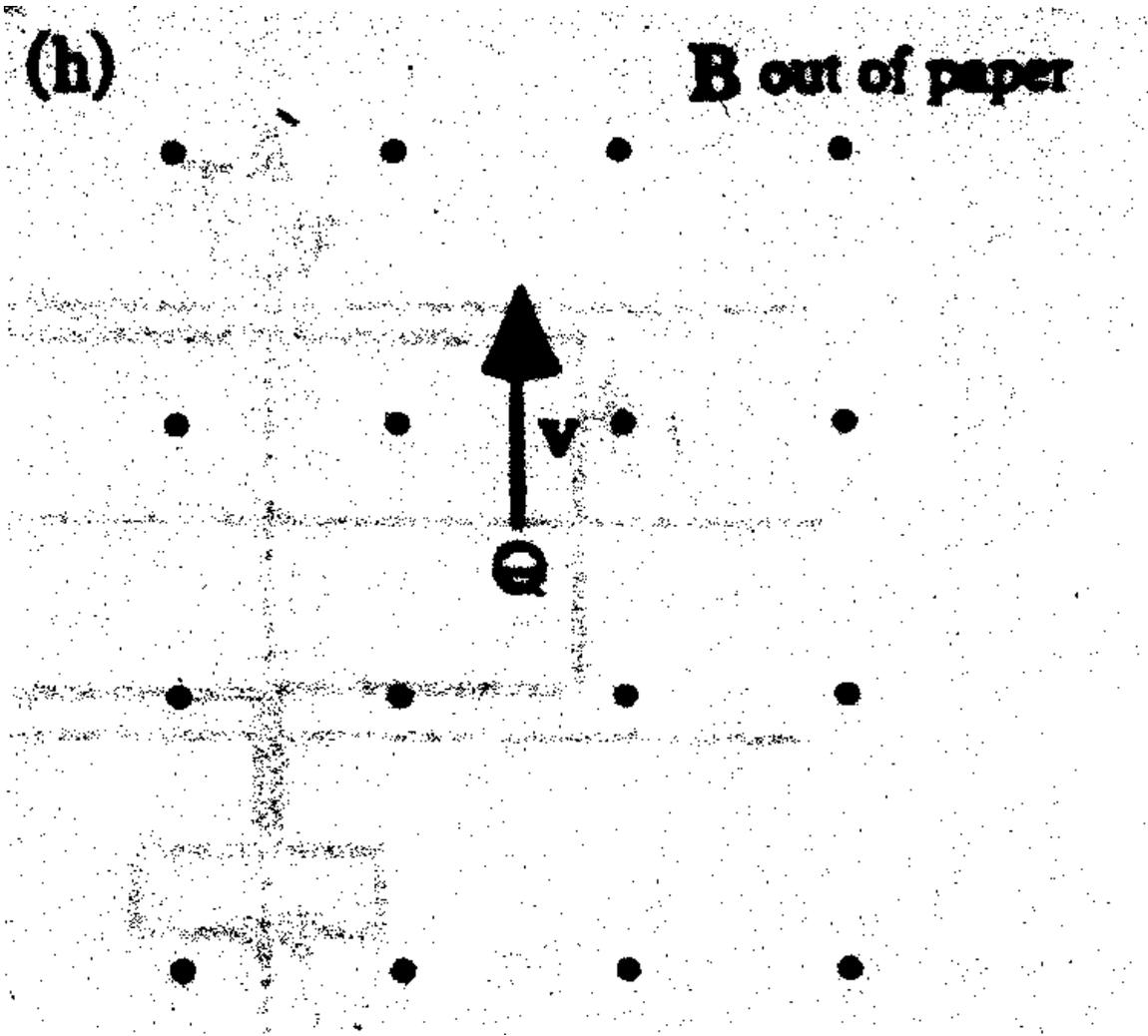
26. The magnetic force on the positive charge is:

(g)



- A. out of the page
- B. into the page
- * C. upward
- D. downward

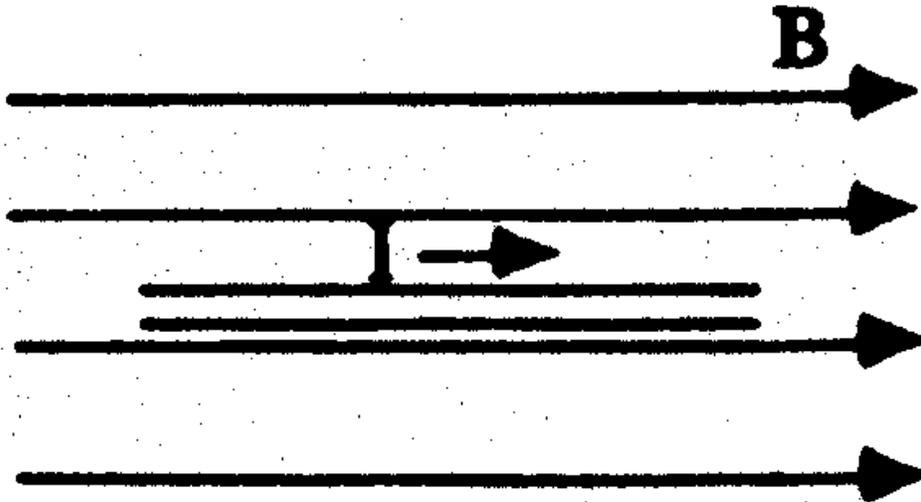
27. The magnetic force on the negative charge is:



- A. upward
- B. downward
- * C. leftward
- D. rightward

28. The magnetic force on the current segment is:

(a)



A. upward

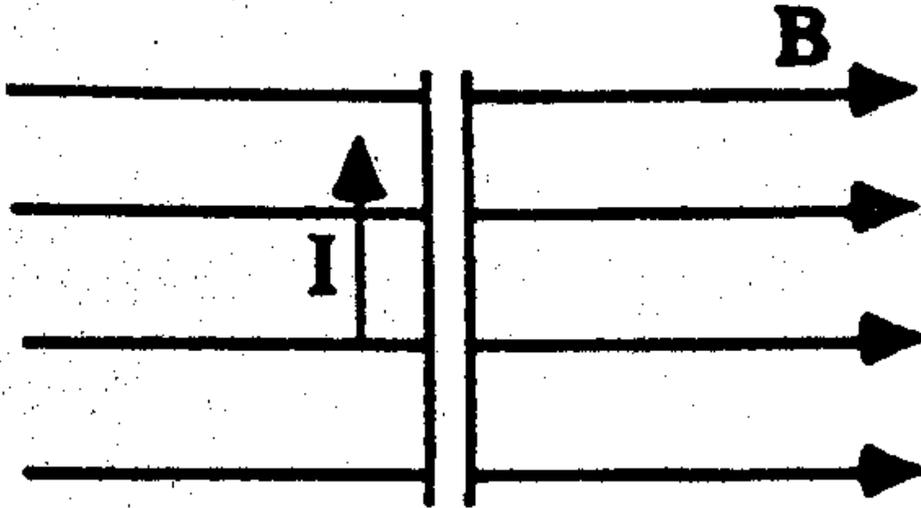
B. into the page

* C. zero

D. none of the above

29. The magnetic force on the current segment is:

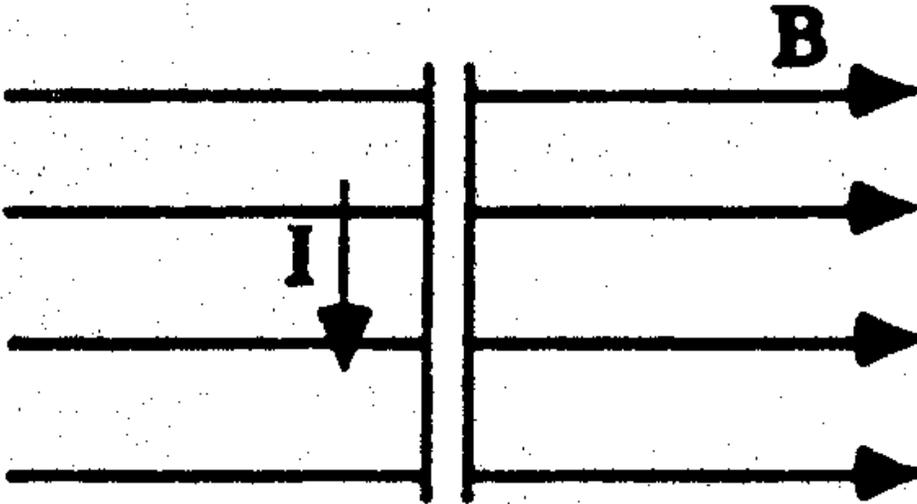
(b)



- A. leftward
- B. out of the page
- C. rightward
- * D. into the page

30. The magnetic force on the current segment is:

(c)



A. rightward

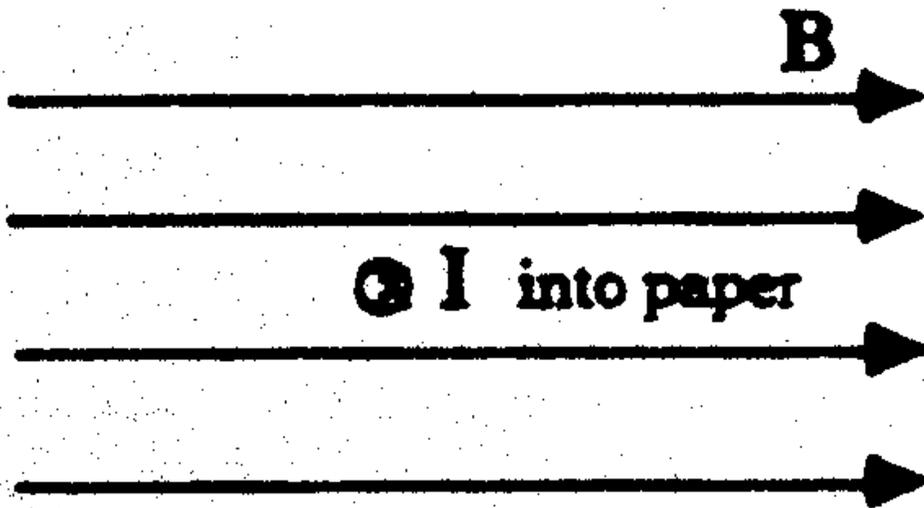
B. leftward

C. into the page

* D. out of the page

31. The magnetic force on the current segment is:

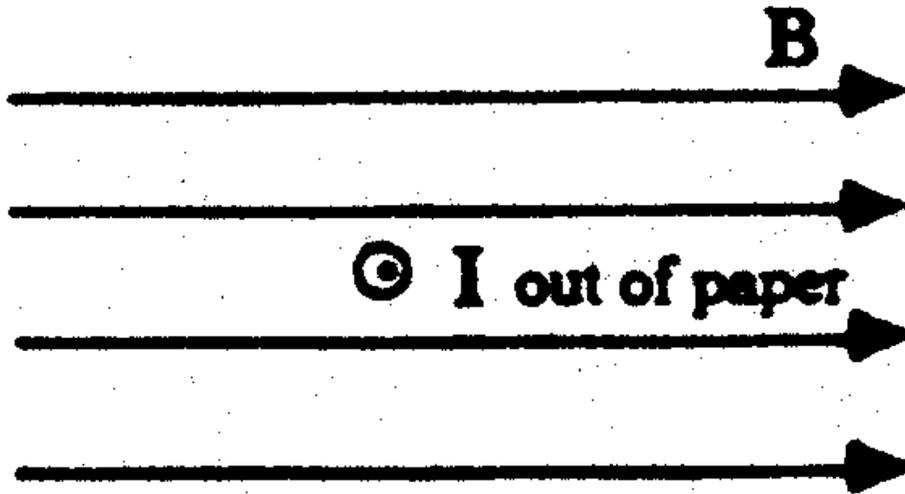
(d)



- * A. downward
- B. out of the page
- C. upward
- D. into the page

32. The magnetic force on the current segment is:

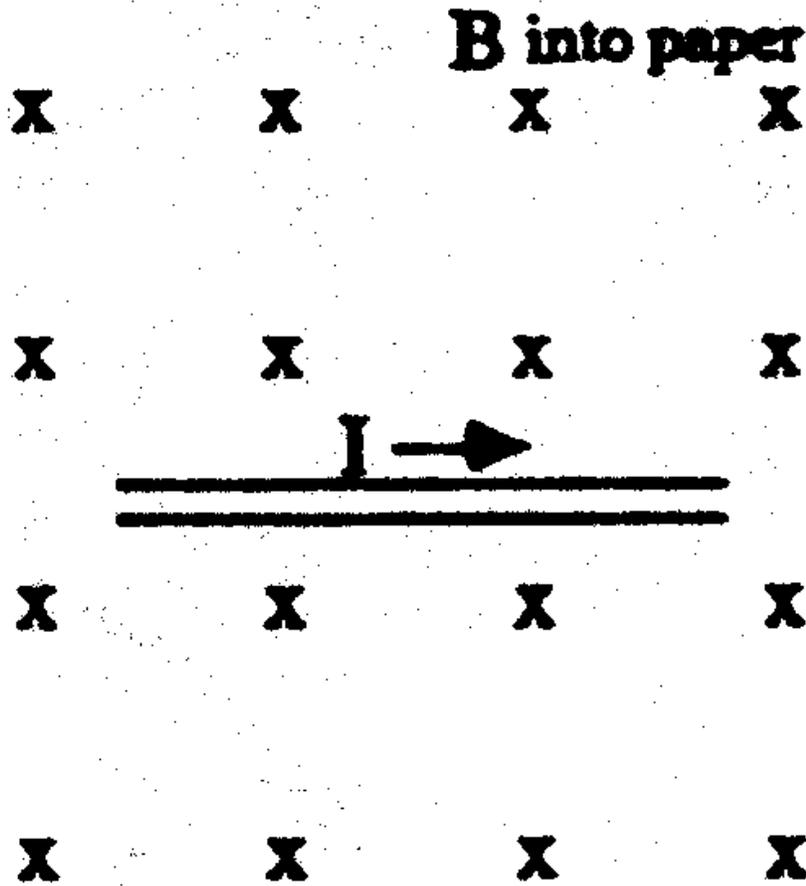
(e)



- A. downward
- * B. upward
- C. into the page
- D. out of the page

33. The magnetic force on the current segment is:

(g)

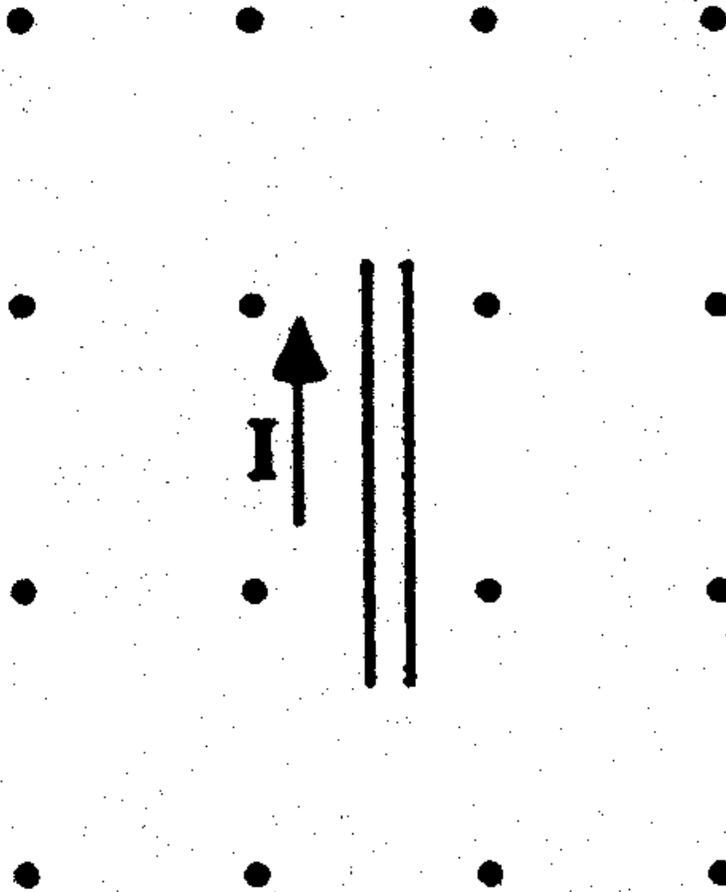


- A. into the page
- B. downward
- C. out of the page
- * D. upward

34. The magnetic force on the current segment is:

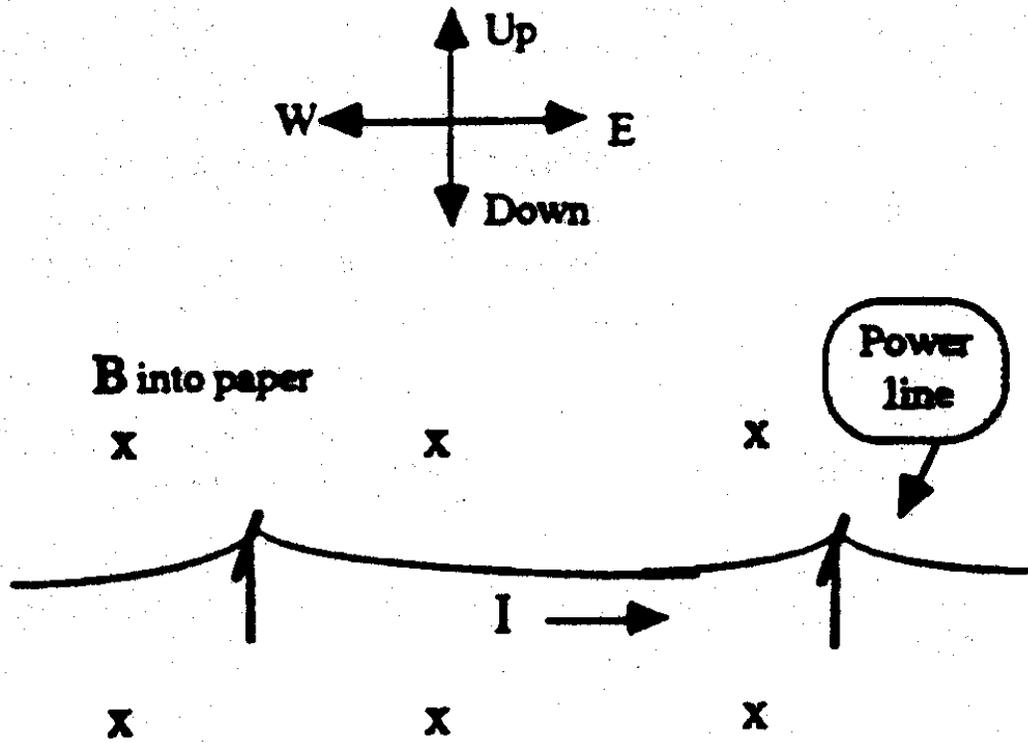
(h)

B out of paper



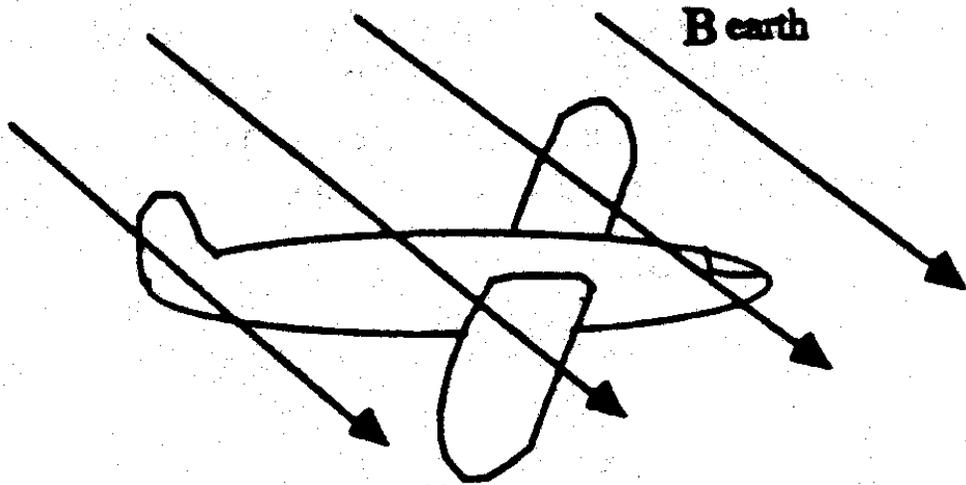
- * A. rightward
- B. into the page
- C. leftward
- D. out of the page

35. An electric power line carries current east. The Earth's magnetic field points into the screen (north). In which direction is the magnetic force?



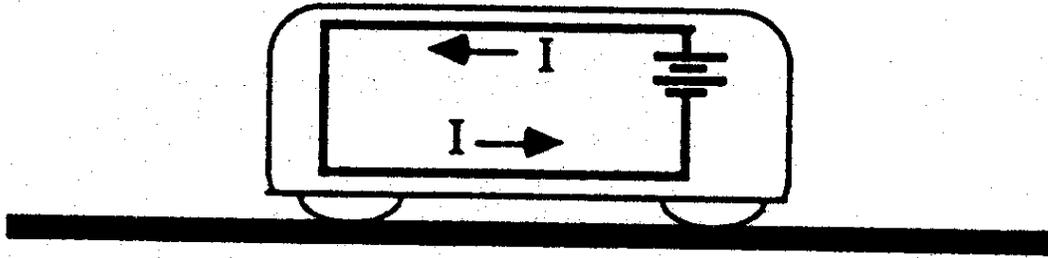
- * A. upward
 B. eastward
 C. downward
 D. westward

36. An airplane flies north in the Earth's magnetic field. Toward what part of the airplane's metal shell would free electrons tend to move?



- A. left wing
- * B. right wing
- C. nose
- D. tail

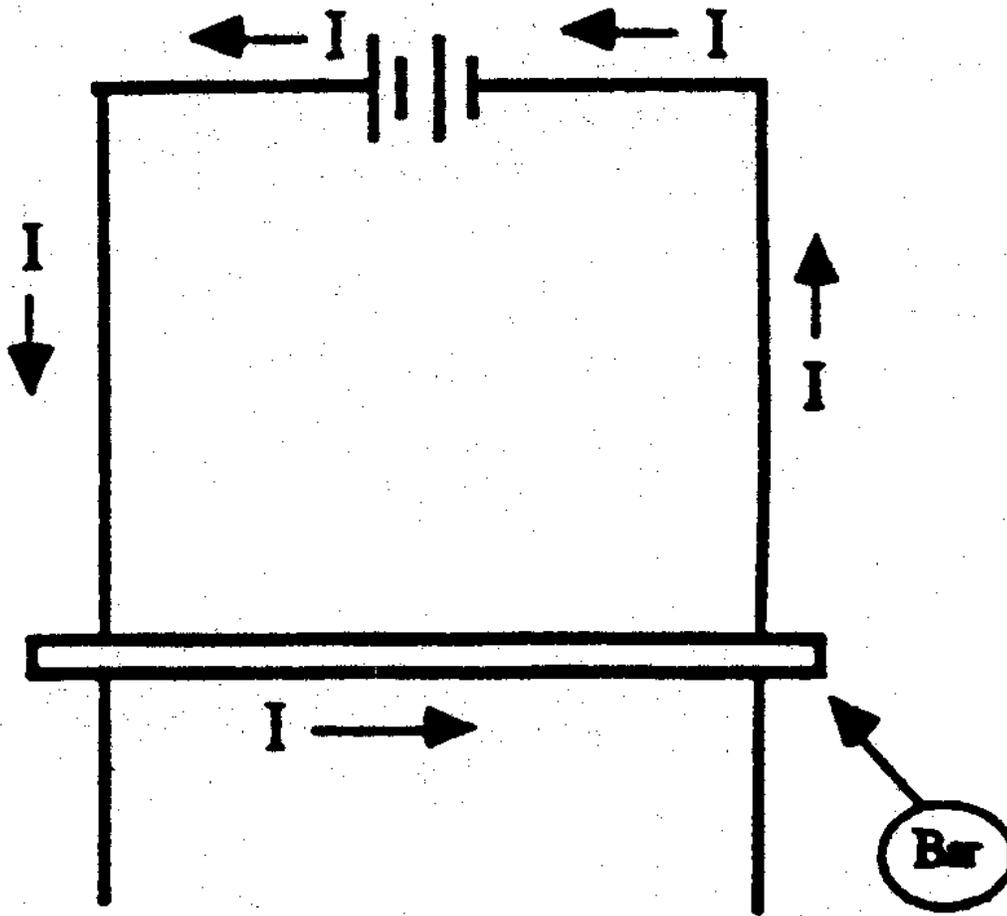
37. A maglev train has a large coil with current flowing as shown. In which direction should current flow in the track rails to levitate the train?



A. to the right

* B. to the left

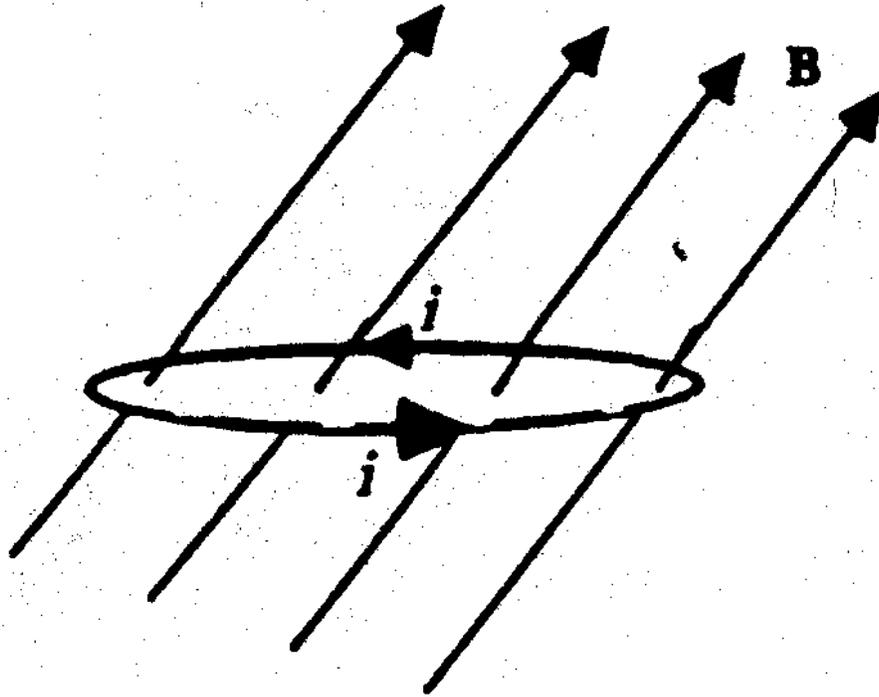
38. A horizontal current-carrying bar slides on a pair of vertical rails. In what direction should an external magnetic field be applied to lift the bar vertically?



- A. upward
- B. downward
- * C. into the page
- D. out of the page

39. The torque on the current-carrying loop is:

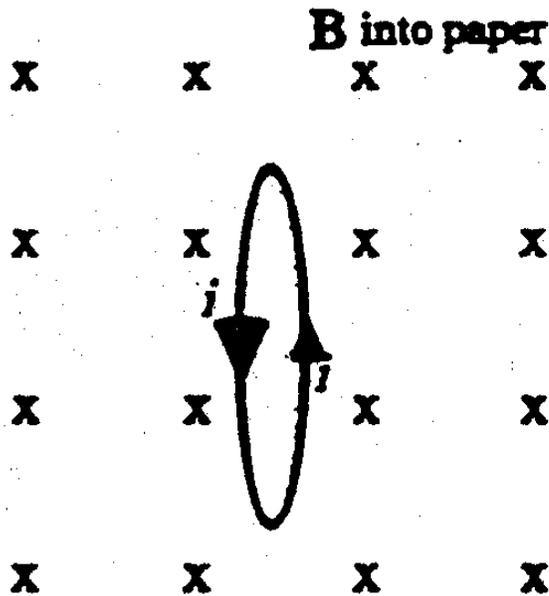
- (a) The plane of the loop is perpendicular to the page and the magnetic field is in the plane of the paper.



- A. leftward
- B. rightward
- * C. into the page
- D. out of the page

40. The torque on the current-carrying loop is:

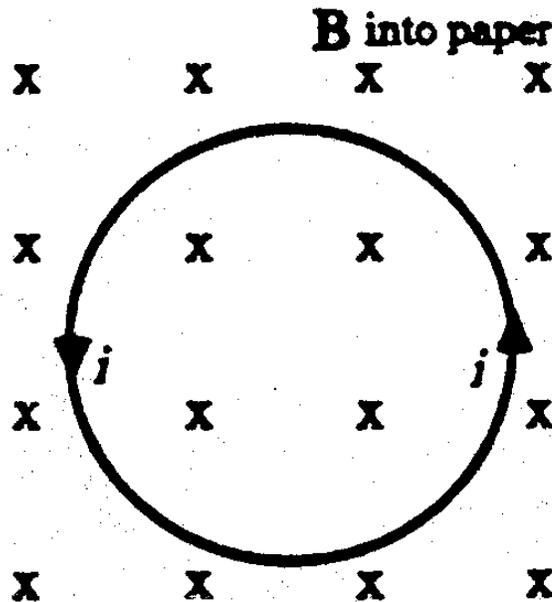
(b) The plane of the circular loop and the magnetic field are both perpendicular to the plane of the paper.



- A. into the page
- B. out of the page
- * C. upward
- D. downward

41. The torque on the current-carrying loop is:

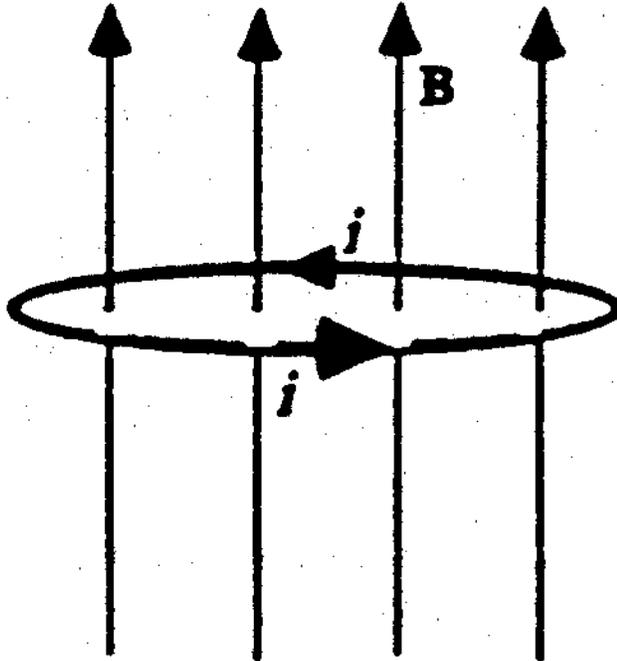
- (c) The current loop is in the plane of the paper and the field is perpendicular to the paper.



- A. up or downward
- B. right or leftward
- C. in or out of page
- * D. zero

42. The torque on the current-carrying loop is:

(d) The plane of the loop is perpendicular to the page and the magnetic field is in the plane of the paper.

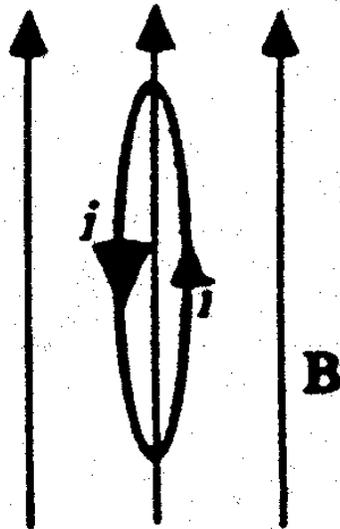


- A. up or downward
- B. right or leftward
- C. in or out of page

* D. zero

43. The torque on the current-carrying loop is:

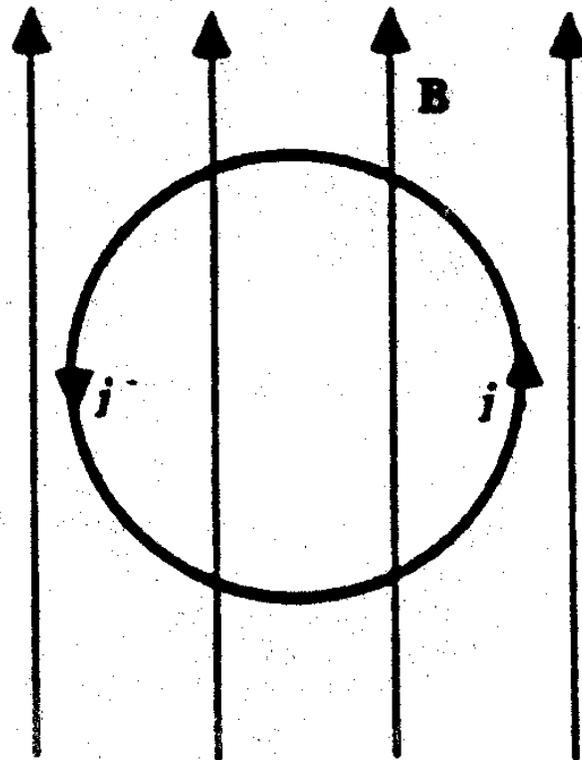
- (e) The plane of the circular loop is perpendicular to the page and the magnetic field is in the plane of the paper.



- A. rightward
- B. leftward
- C. into the page
- * D. out of the page

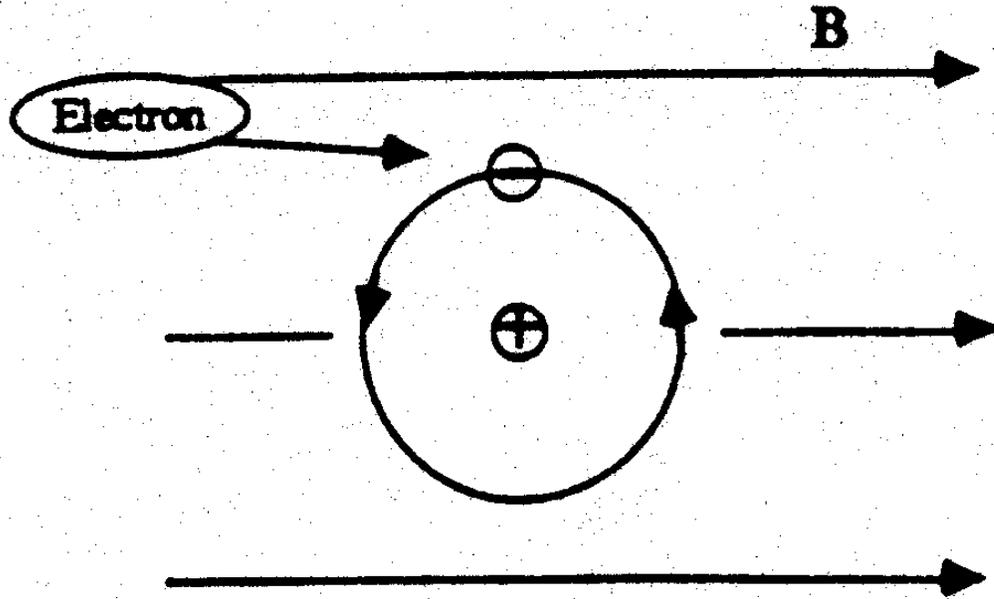
44. The torque on the current-carrying loop is:

(f) The current loop and the magnetic field are both in the plane of the paper.



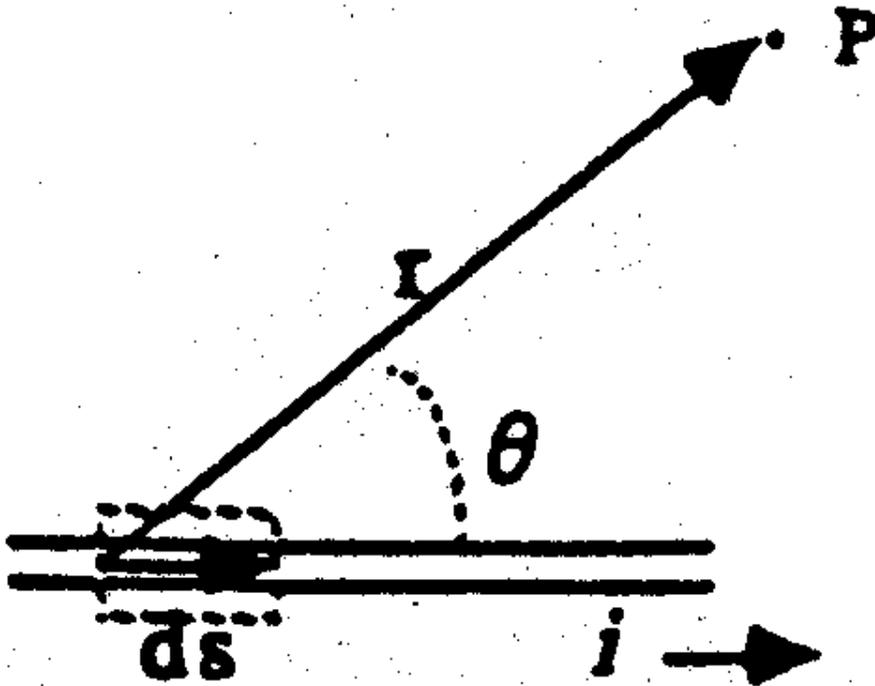
- A. rightward
- * B. leftward
- C. upward
- D. downward

45. The torque on the electron points:



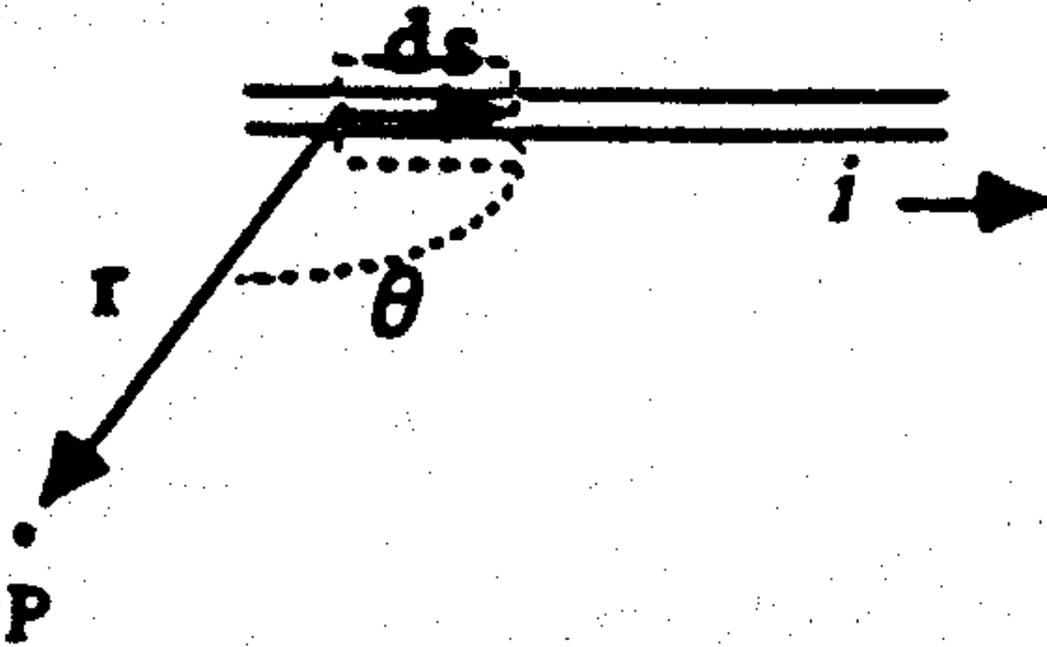
- A. rightward
- B. leftward
- C. upward
- * D. downward

46. The magnetic field at P due to current element ds is:



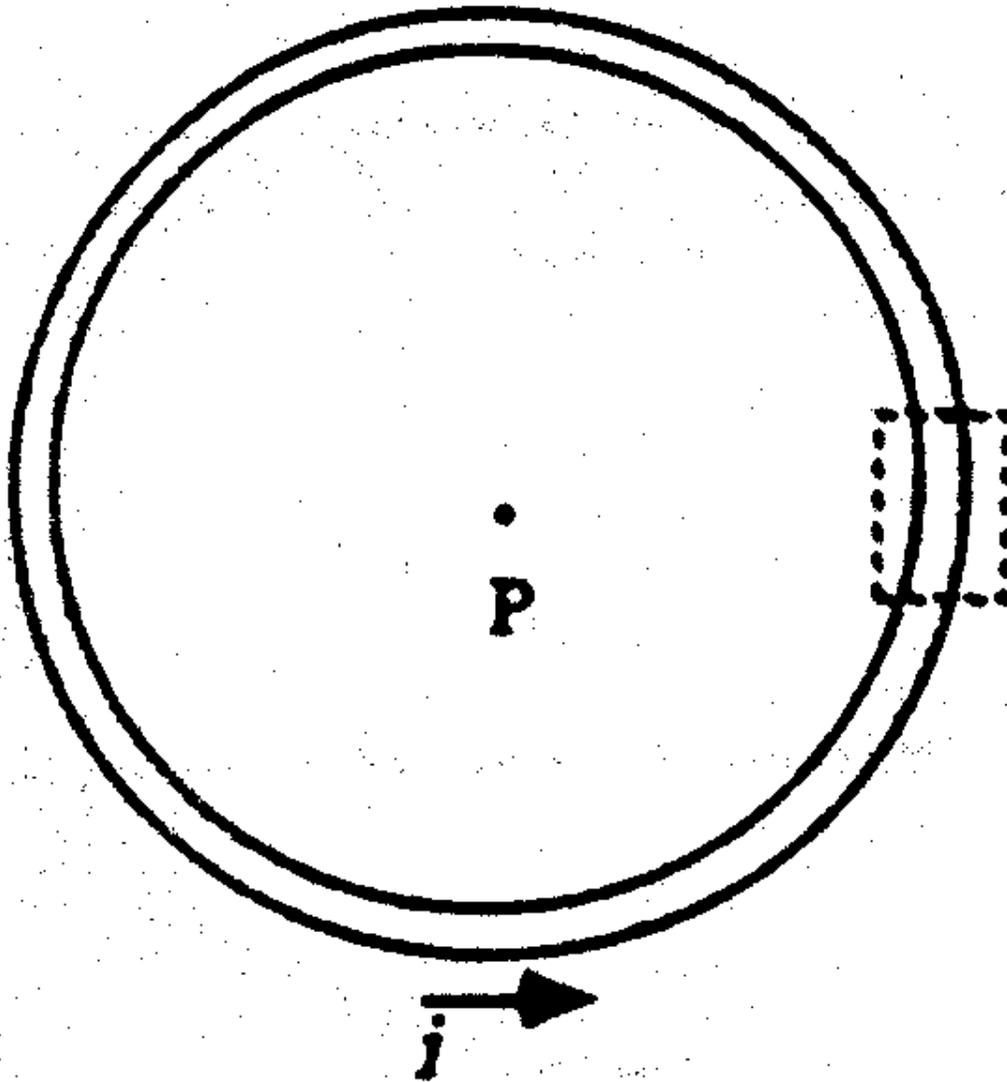
- A. into the page
- * B. out of the page
- C. to the right
- D. to the left

47. The magnetic field at P due to current element ds is:



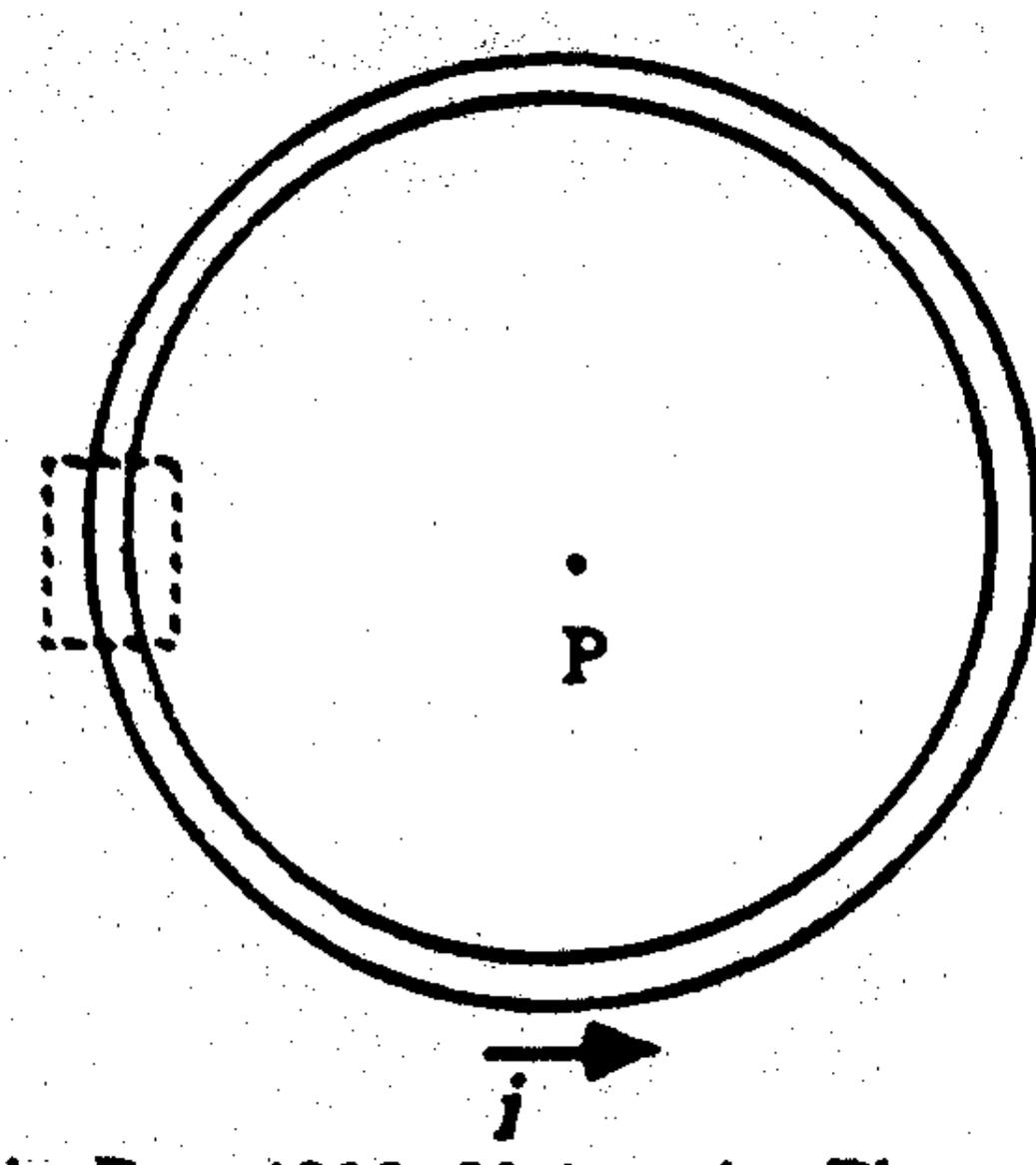
- * A. into the page
- B. out of the page
- C. to the right
- D. to the left

48. The magnetic field at P due to current element ds is:



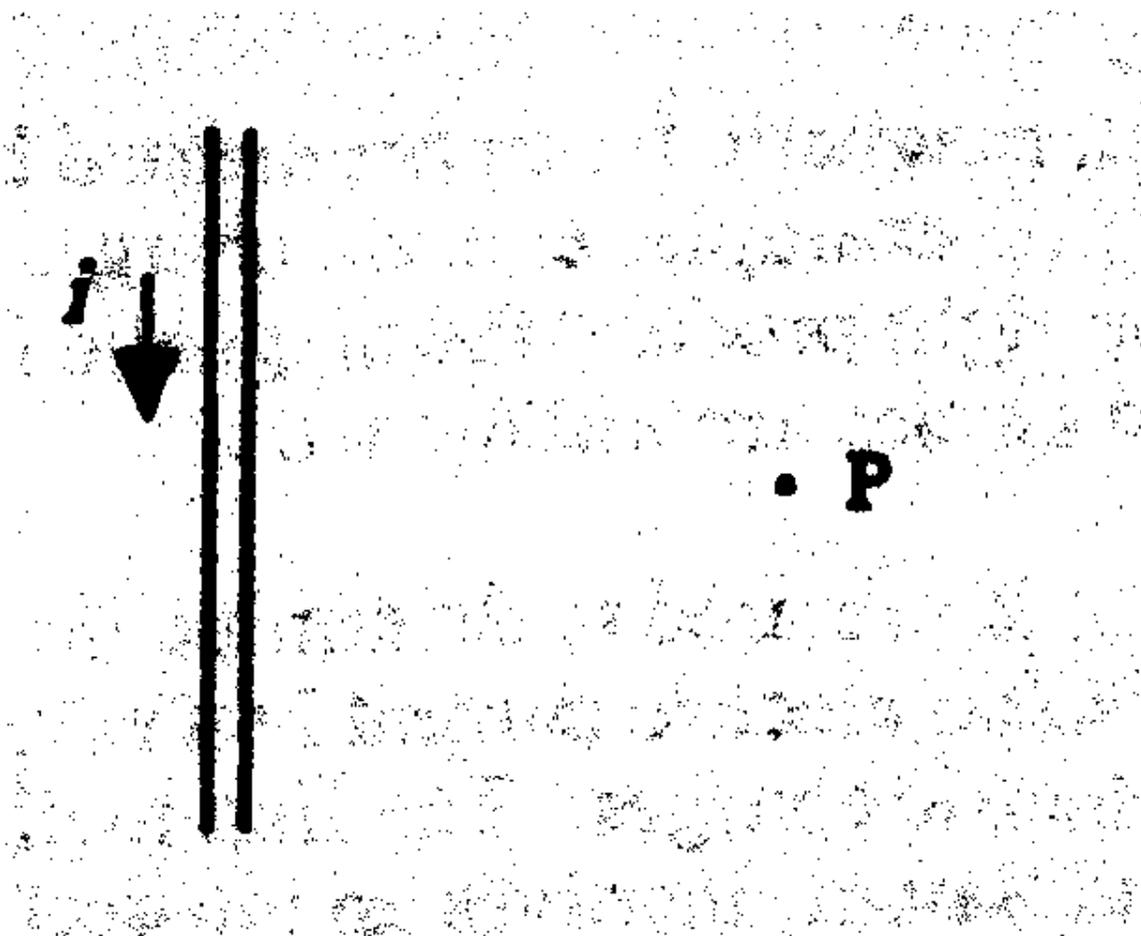
- A. into the page
- * B. out of the page
- C. to the right
- D. to the left

49. The magnetic field at P due to current element ds is:



- A. into the page
- * B. out of the page
- C. to the right
- D. to the left

50. The magnetic field at P is:



A. into the page

* B. out of the page

C. to the right

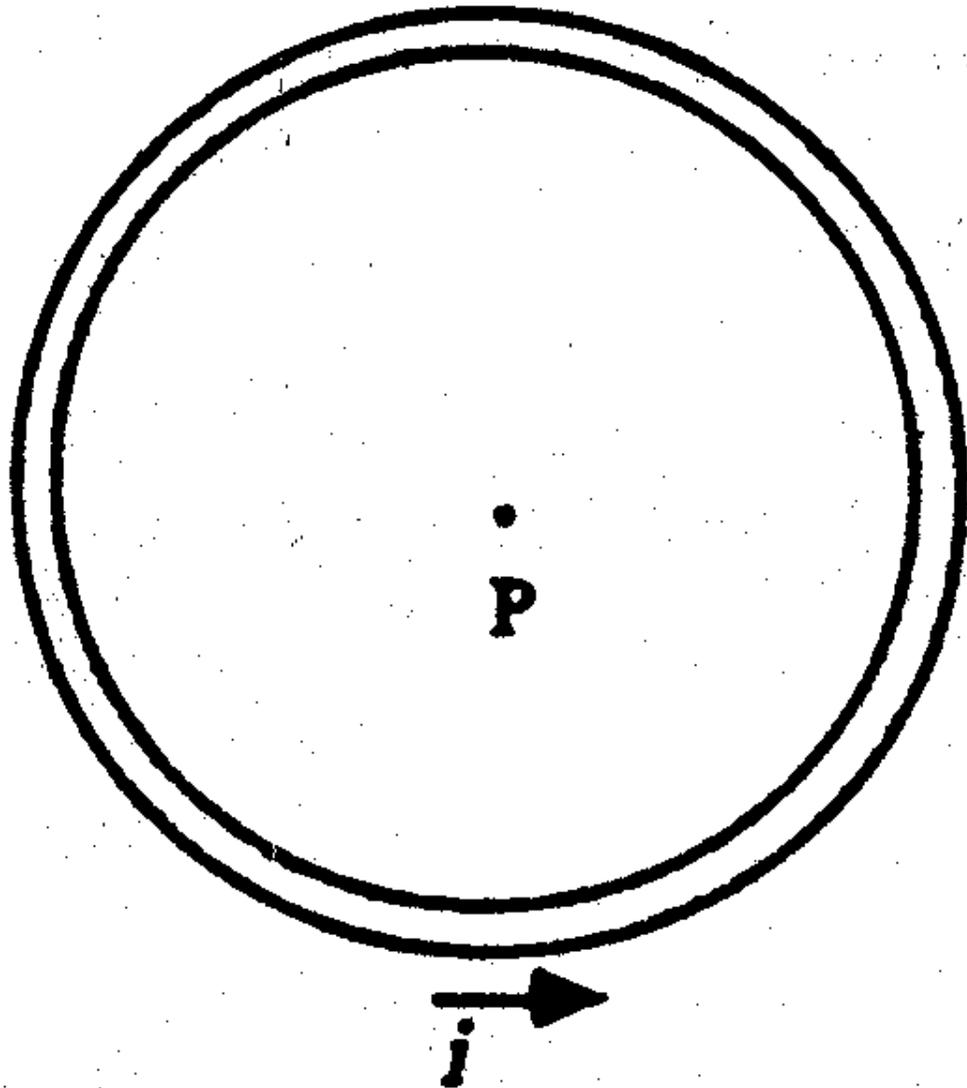
D. to the left

51. The magnetic field at P is:



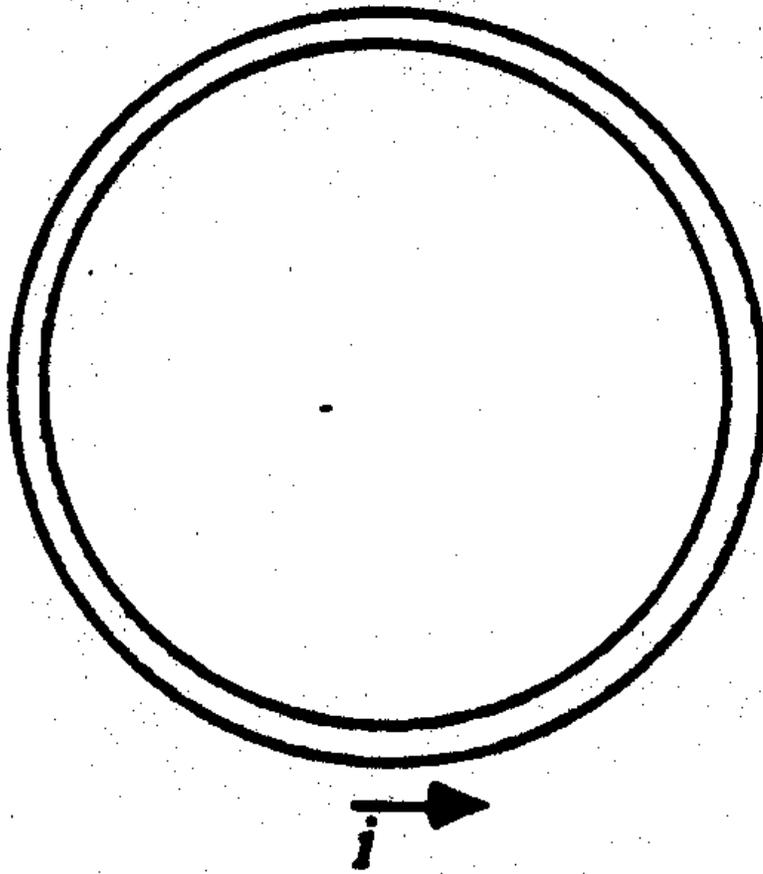
- A. into the screen
- B. to the right
- C. to the left
- * D. none of the above

52. The magnetic field at P is:



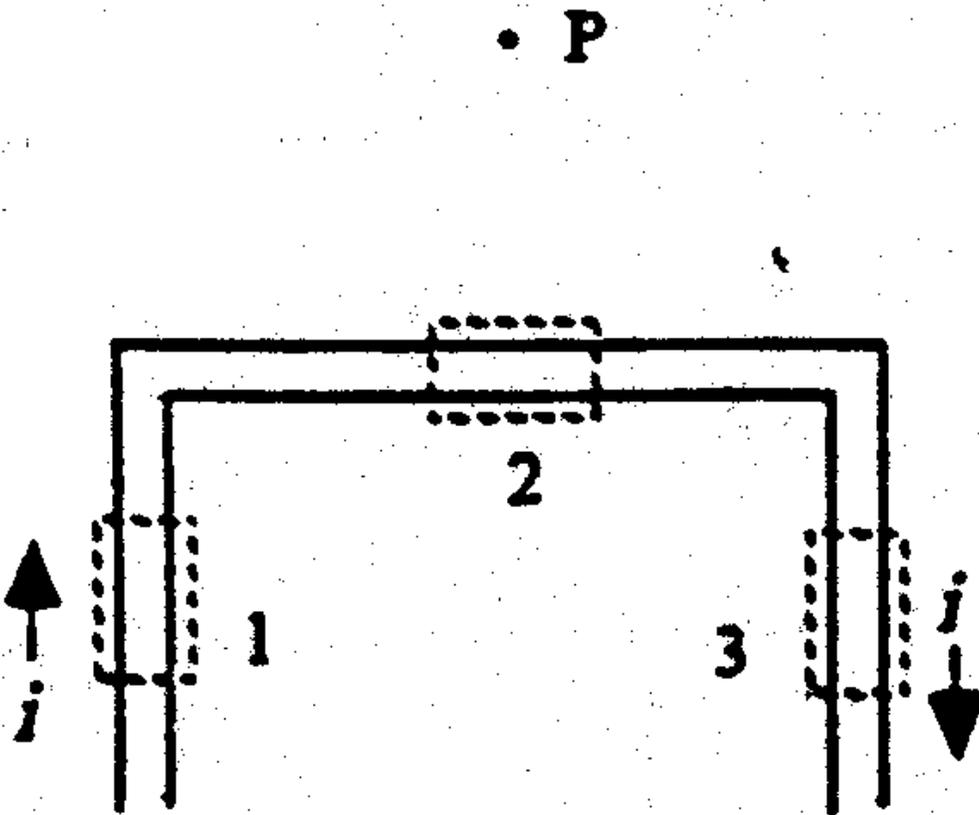
- A. into the page
- * B. out of the page
- C. clockwise
- D. counterclockwise

53. The magnetic field at P is:



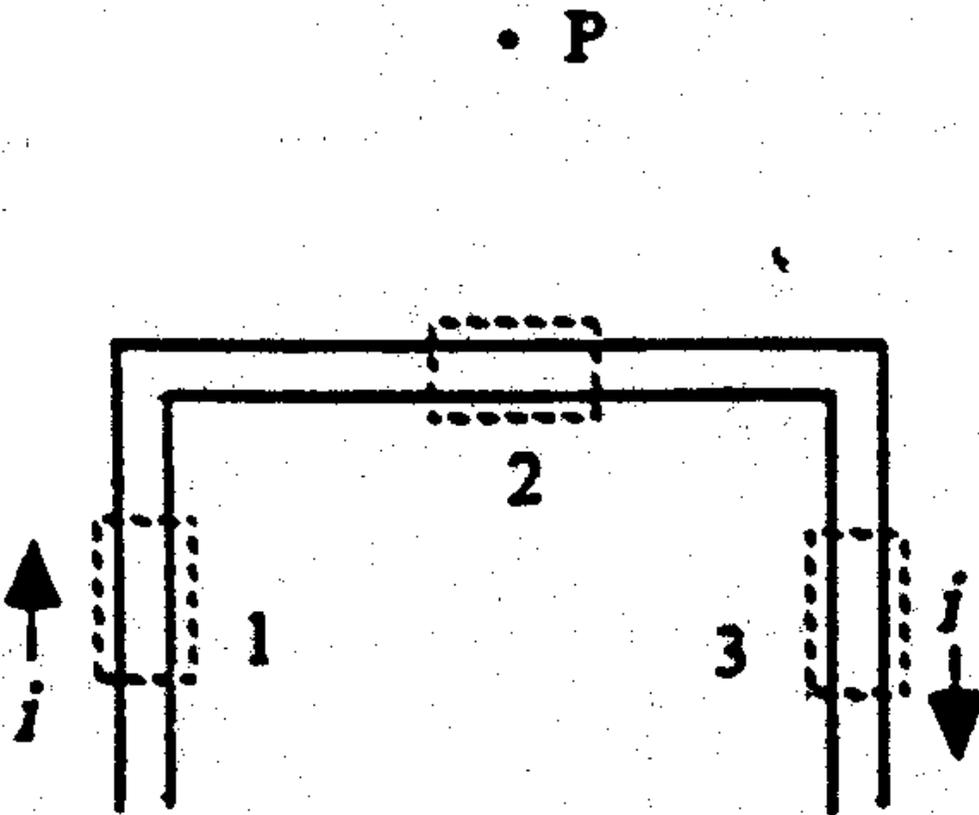
- * A. into the page
- B. out of the page
- C. clockwise
- D. counterclockwise

54. The magnetic field at P due to current element 1 is:



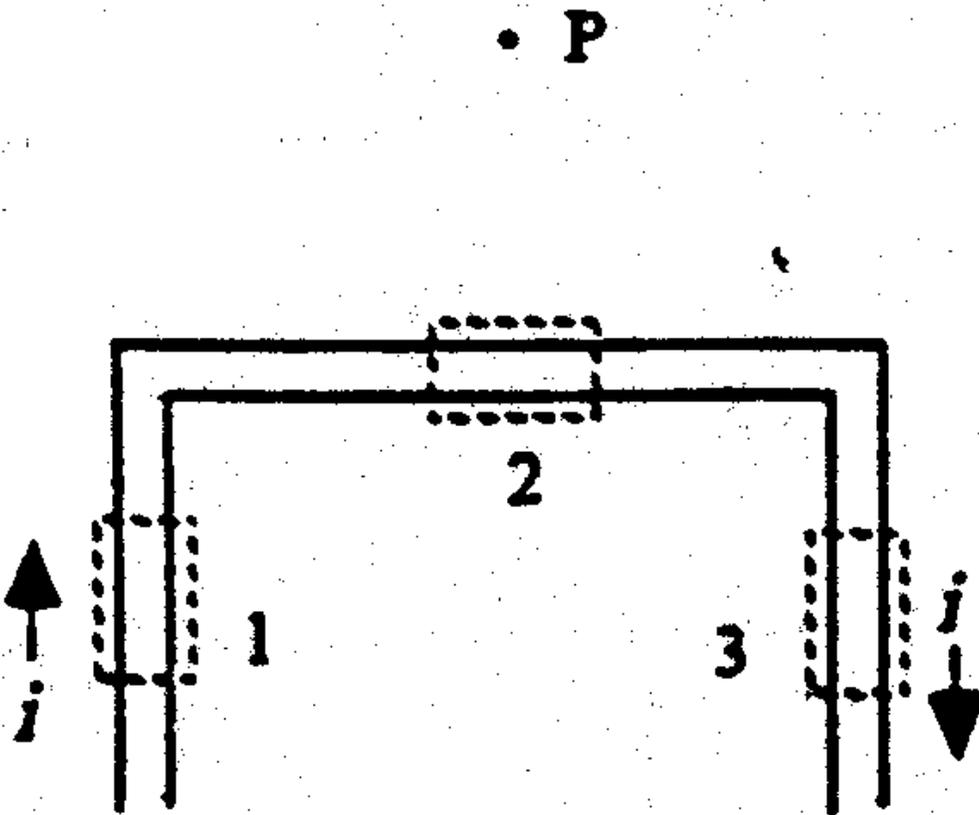
- A. none of the above
- * B. into the page
- C. out of the page
- D. zero

55. The magnetic field at P due to current element 2 is:



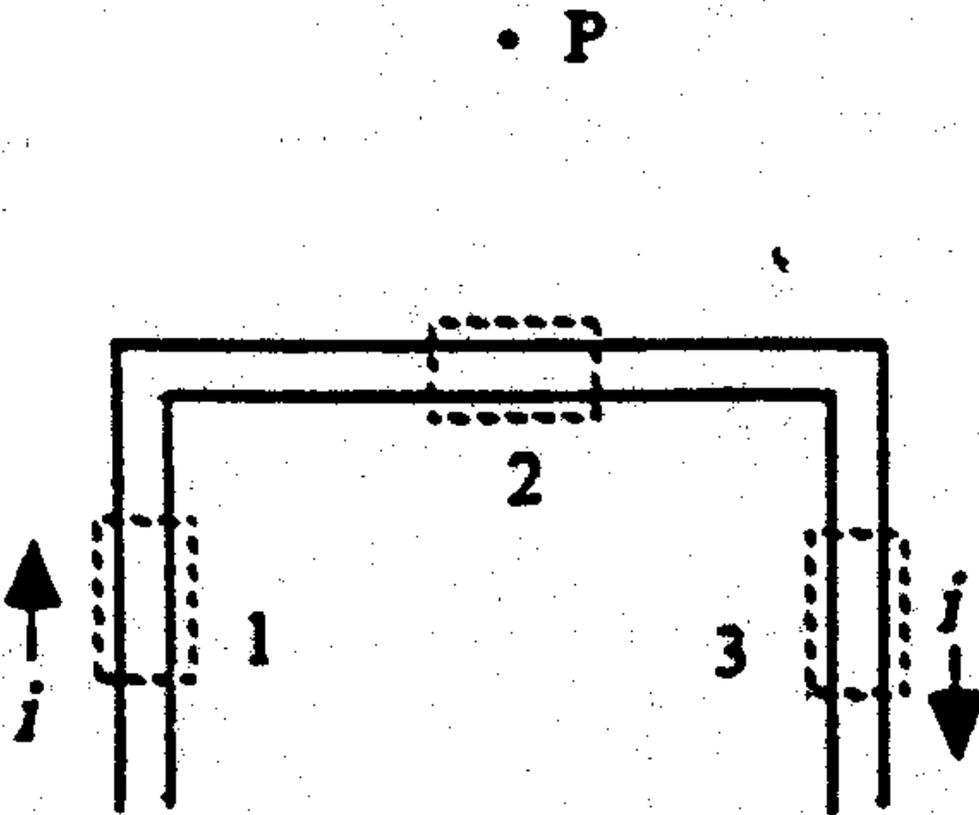
- A. none of the above
- B. into the page
- * C. out of the page
- D. zero

56. The magnetic field at P due to current element 3 is:



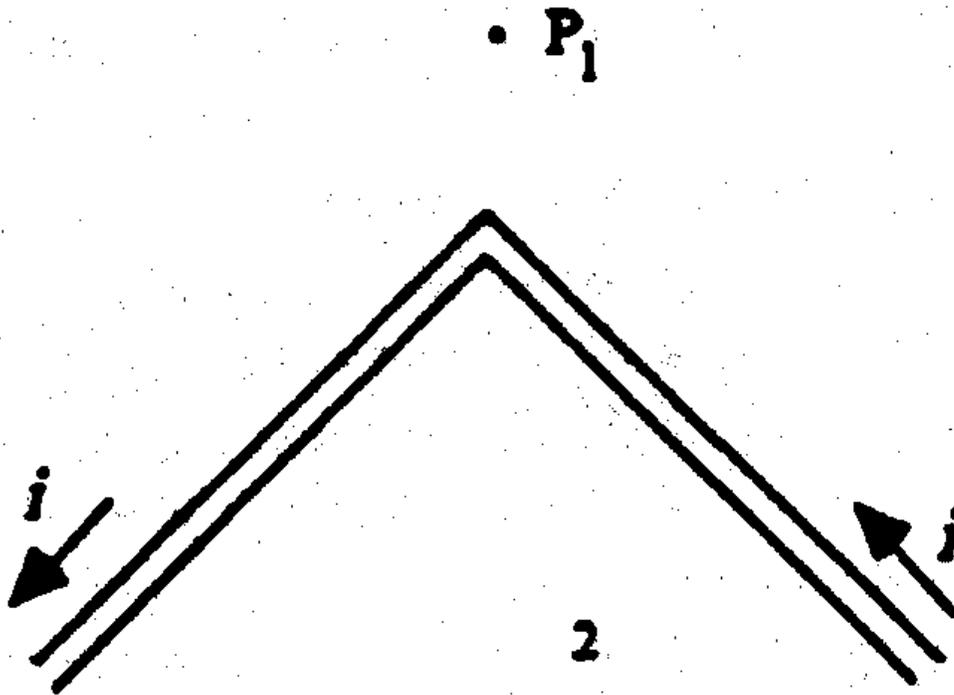
- A. none of the above
- * B. into the page
- C. out of the page
- D. zero

57. The net magnetic field at P is:



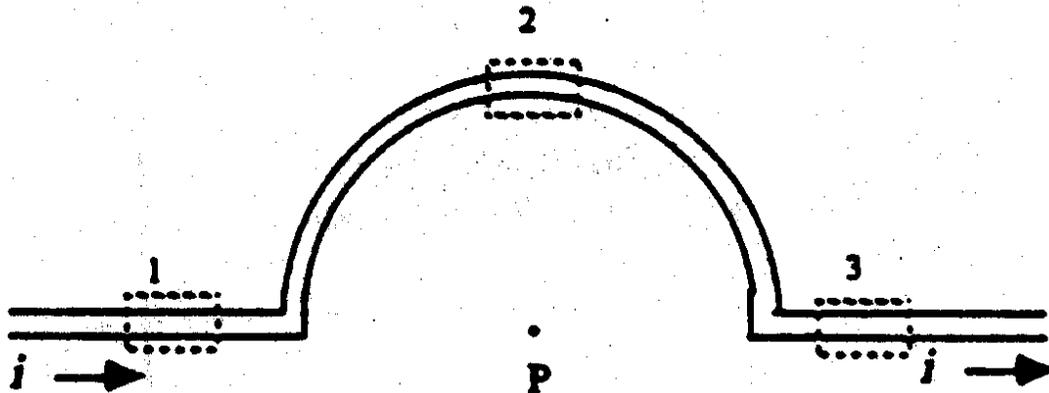
- A. none of the above
- B. into the page
- * C. out of the page
- D. zero

58. The magnetic field at P is:



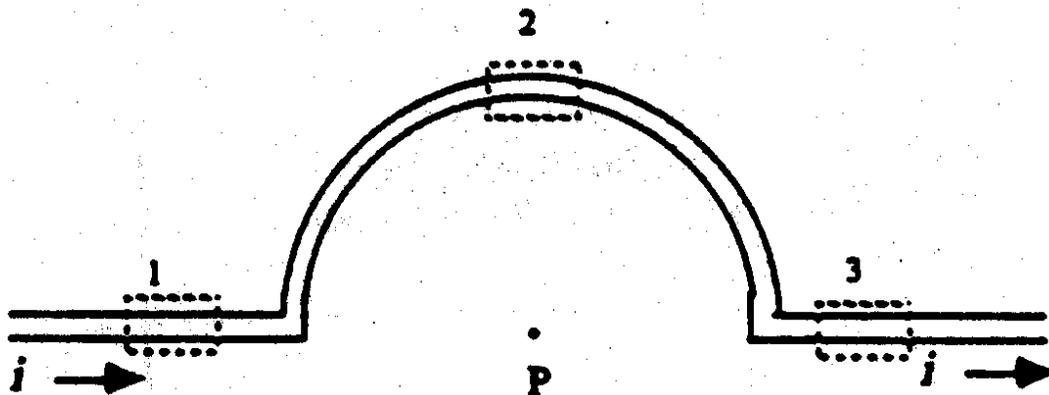
- A. none of the above
- * B. into the page
- C. out of the page
- D. zero

59. The magnetic field at P due to current element 1 is:



- A. none of the above
- B. into the page
- C. out of the page
- * D. zero

60. The magnetic field at P due to current element 2 is:



A. none of the above

* B. into the page

C. out of the page

D. zero