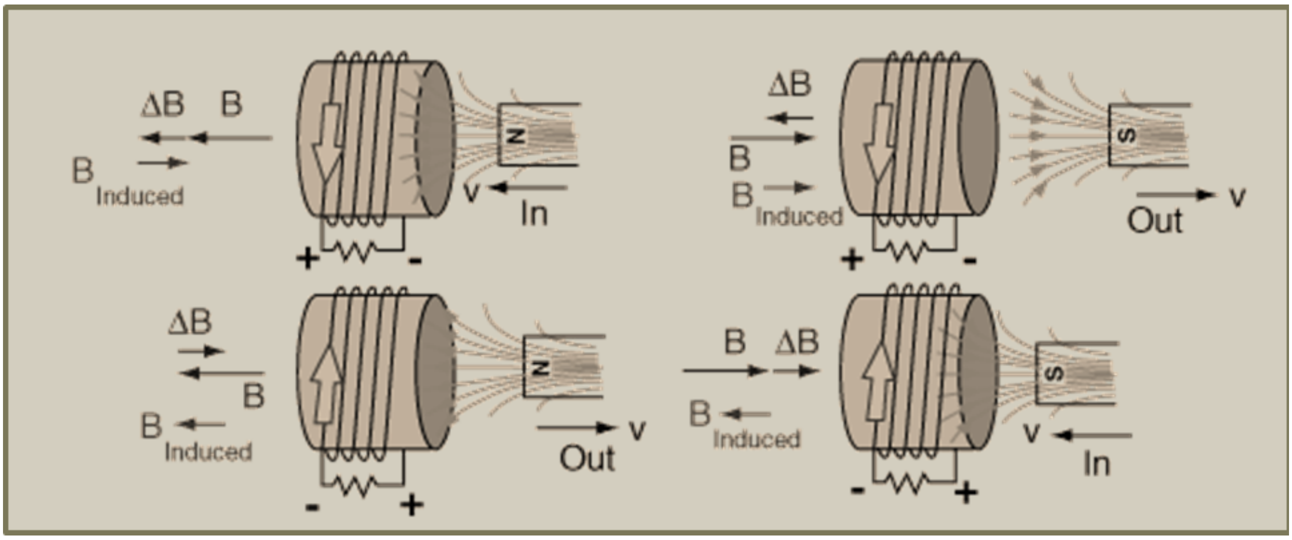
Physics Class 12 NCERT Solutions: Chapter 6 Electromagnetic Induction Part 1 (For CBSE, ICSE, IAS, NET, NRA 2022)



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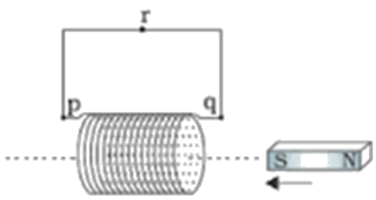
Q: 1. Predict the direction of induced in the situations described by the following figures (a) to (f) .

(A)



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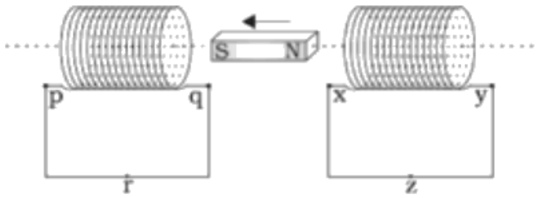
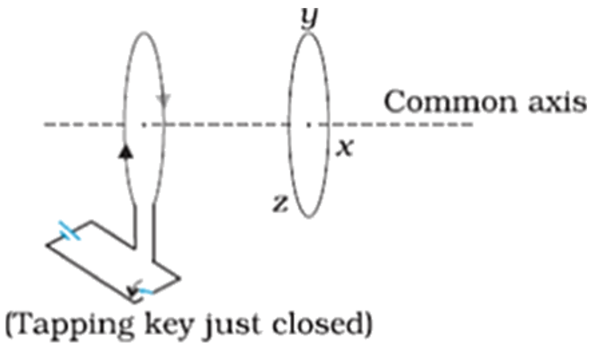
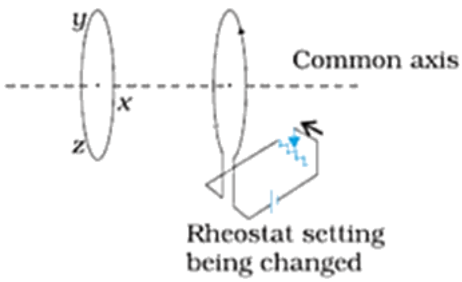
(B)


S
N
p
q
r
x
y
z

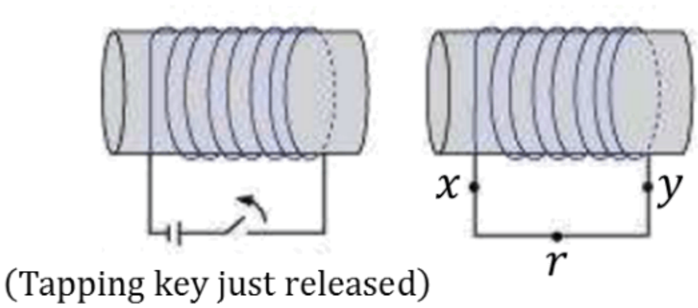
(C)


y
Common axis
x
z
(Tapping key just closed)

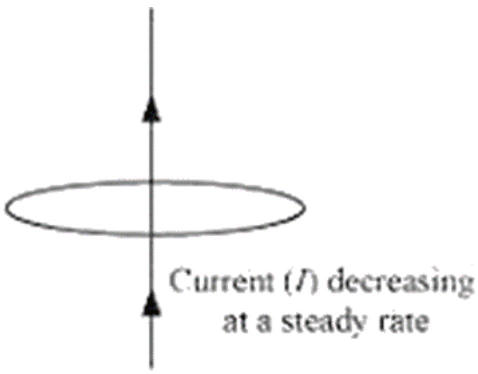
(D)


y
Common axis
x
z
Rheostat setting
being changed

(E)

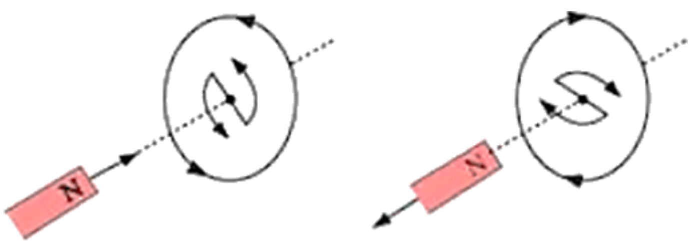


(F)



Answer:

The direction of the induced current in a closed loop is given by Lenz's law. The given pairs of figures the direction of the induced current when the North pole of a bar magnet is moved towards and away from a closed loop respectively.



Using Lenz's rule, the direction of the induced current in the given situations can be predicted as follows:

(A) The direction of the induced current is along qrpq .

(B) The direction of the induced current is along prqp .

(C) The direction of the induced current is along yzxy .

(C) The direction of the induced current is along zyxz .

(E) The direction of the induced current is along xryx .

(F) No current is induced since the field lines are lying in the plane of the closed loop.

Q: 2. A $1.0m$ long metallic rod is rotated with an angular frequency of $400 \text{ rad } s^{-1}$ about an axis normal to the rod passing through its one end. The other end of the rod is in contact with a circular metallic ring. A constant and uniform magnetic field of $0.5T$ parallel to the axis exists everywhere. Calculate. The emf developed between the centre and the ring.

Answer:

Length of the rod, $l = 1m$

Angular frequency, $\omega = 400 \frac{\text{rad}}{s}$

Magnetic field strength, $B = 0.5T$

One end of the rod has zero linear velocity, while the other end has a linear velocity of $l\omega$.

Average linear velocity of the rod, $v = \frac{l\omega + 0}{2} + \frac{\text{lw}}{2}$

Emf developed between the centre and the ring,

$$e = \text{Blv} = \text{Bl}\left(\frac{l\omega}{2}\right) = \frac{\text{Bl}^2\ \omega}{2}$$

$$= \frac{0.5 \times (1)^2 \times 400}{2} = 100V$$

Hence, the emf developed between the centre and the ring is $100V$.