SUBJECT : SCIENCE (PHY)

CHAPTER-13:
MAGNETIC EFFECT OF ELECTRIC CURRENT

TOPIC-3:

MAGNETIC FIELD DUE TO A CURRENT CARRYING CIRCULAR LOOP:

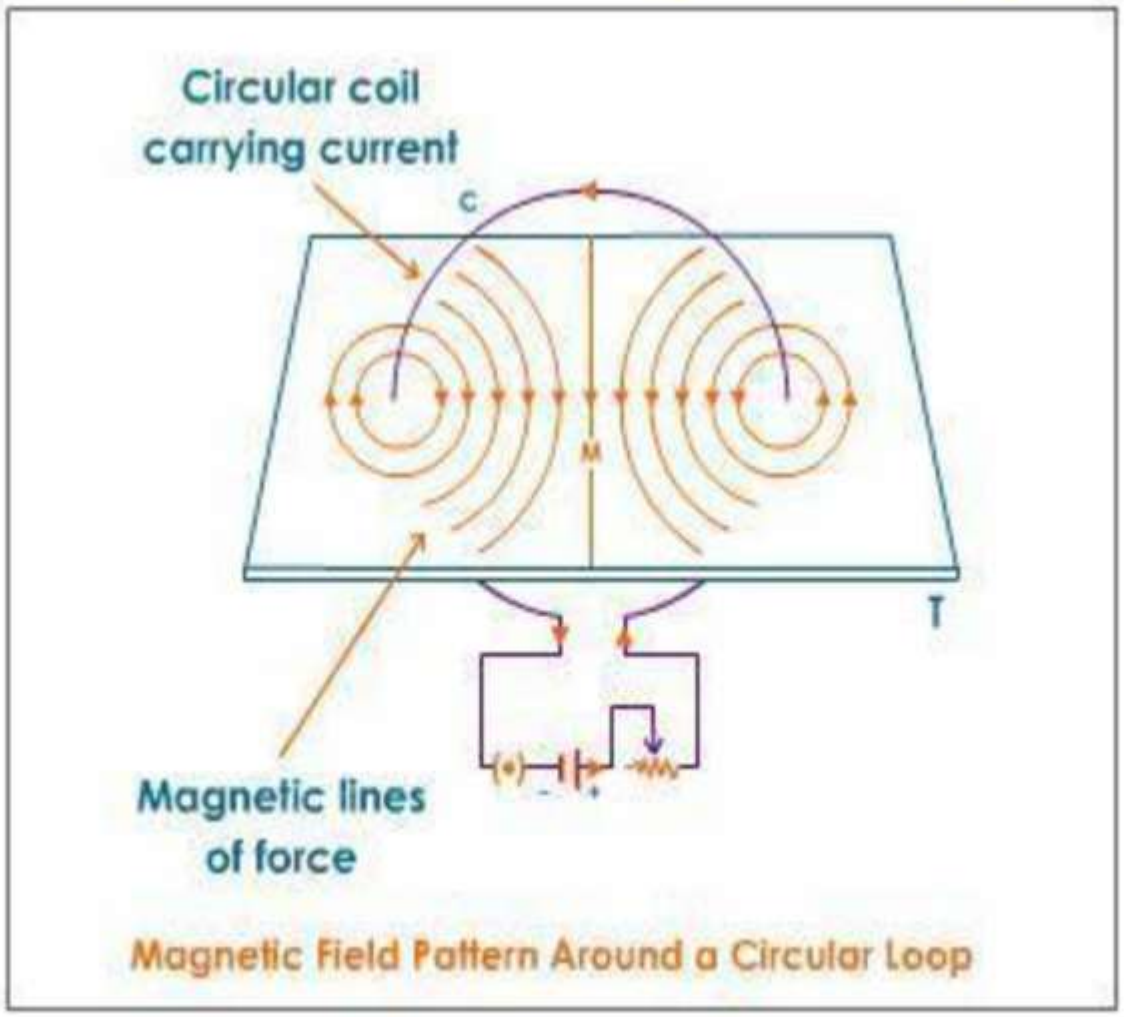
OBJECTIVES:

Upon completion of the topic, you will be able to

1. EXPLAIN WHAT HAPPEN WHEN CURRENT IS PASSED THROUGH A CIRCULAR LOOP.
2. DRAW THE MAGNETIC LINES OF FORCE AROUND IT.
3. EXPLAIN FACTORS ON WHICH THE MAGNITUDE OF FIELD DEPEND DUE TO CURRENT CARRYING CIRCULAR LOOP DEPENDS
4. EXPLAIN MAXWELL'S RIGHT HAND THUMB RULE

Magnetic field due to a current through a circular loop :-

When current is passed through a circular conductor (loop) the magnetic field produced is in the form of concentric circles around the conductor. Towards the centre the arcs of the circles become larger and appears as straight line.



Magnetic Field Pattern Around a Circular Loop

FIG-1

CIRCULAR CONDUCTOR(LOOP):

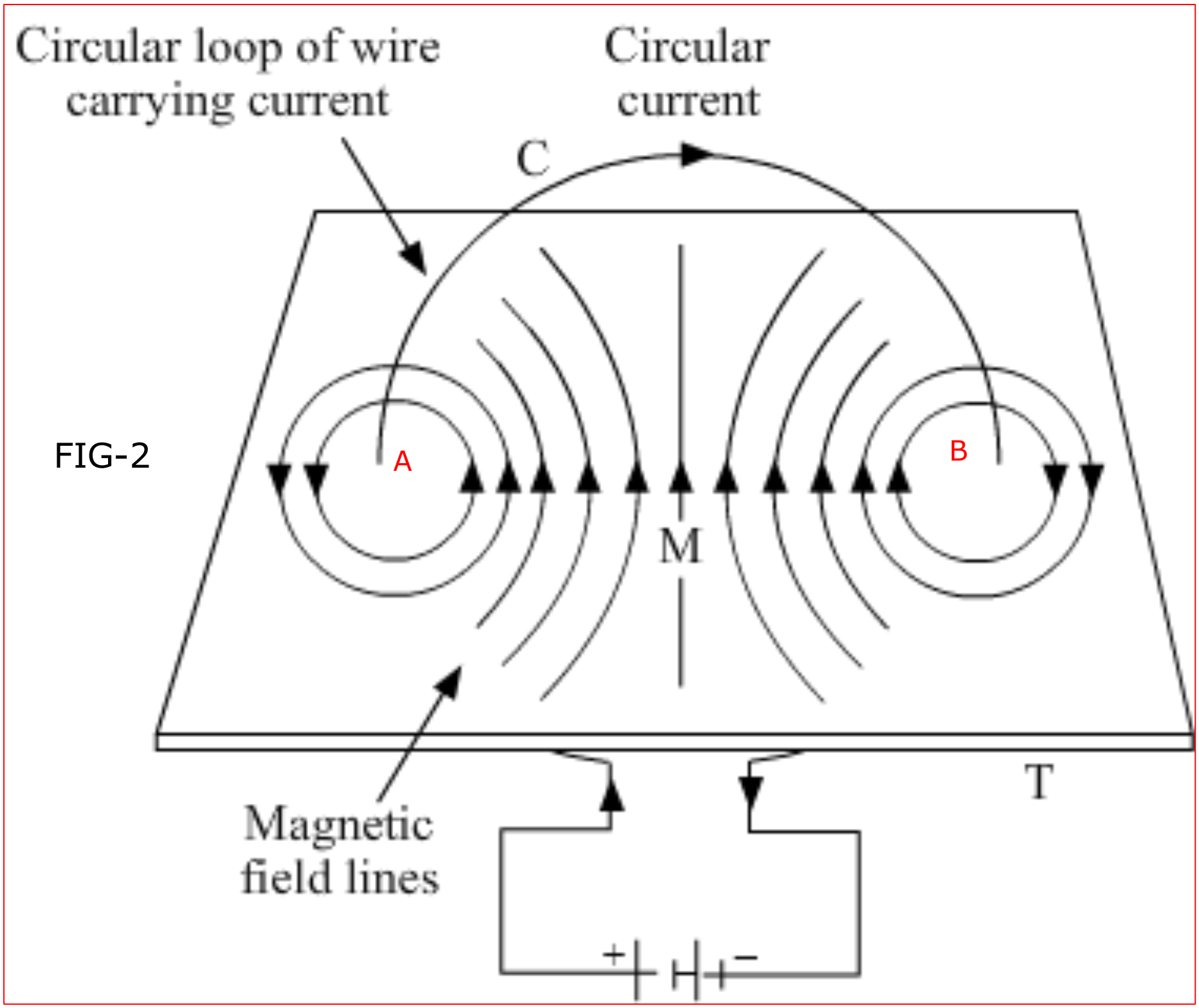


FIG-2

CIRCULAR CONDUCTOR/LOOP

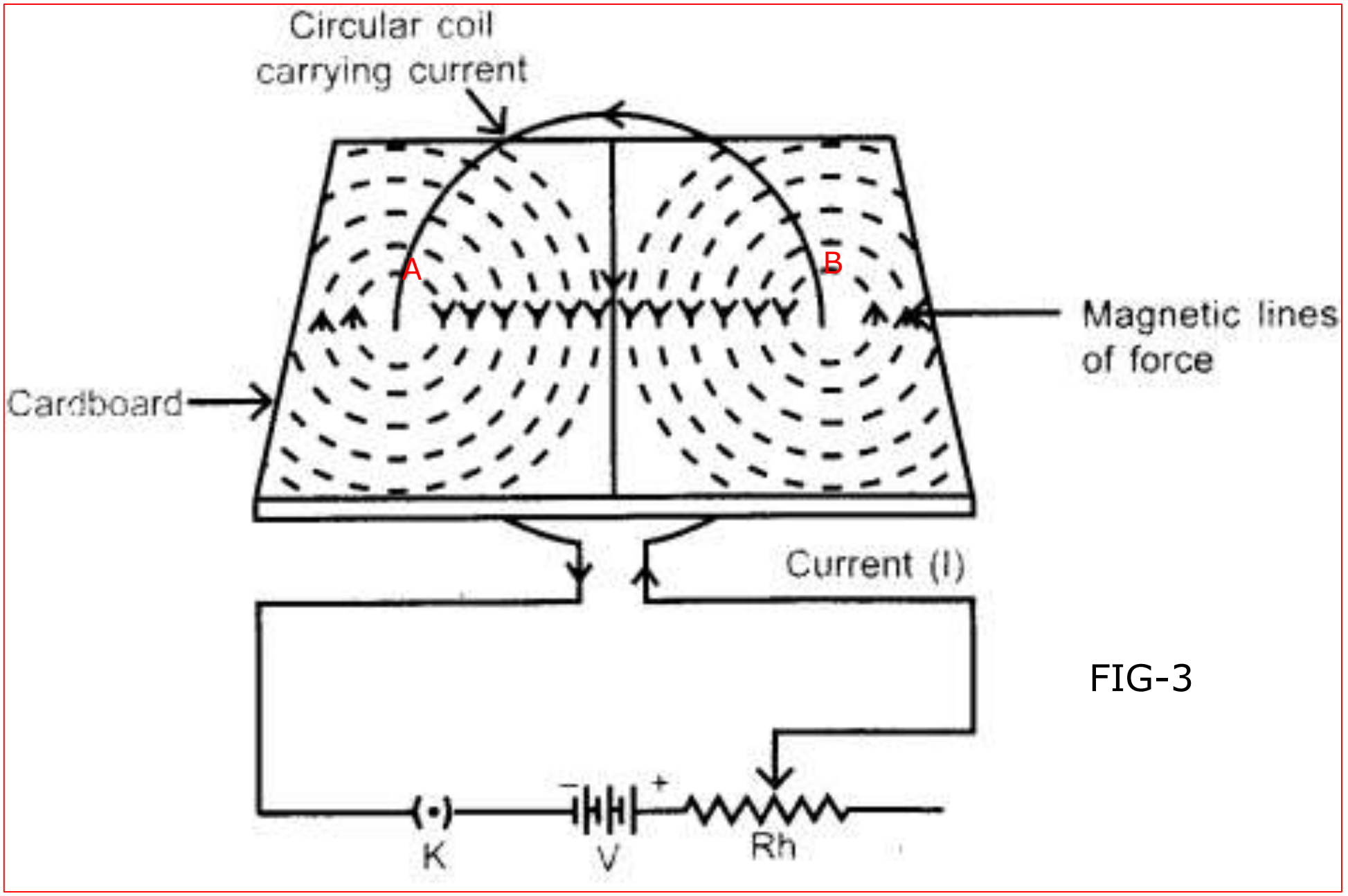


FIG-3

CIRCULAR LOOP

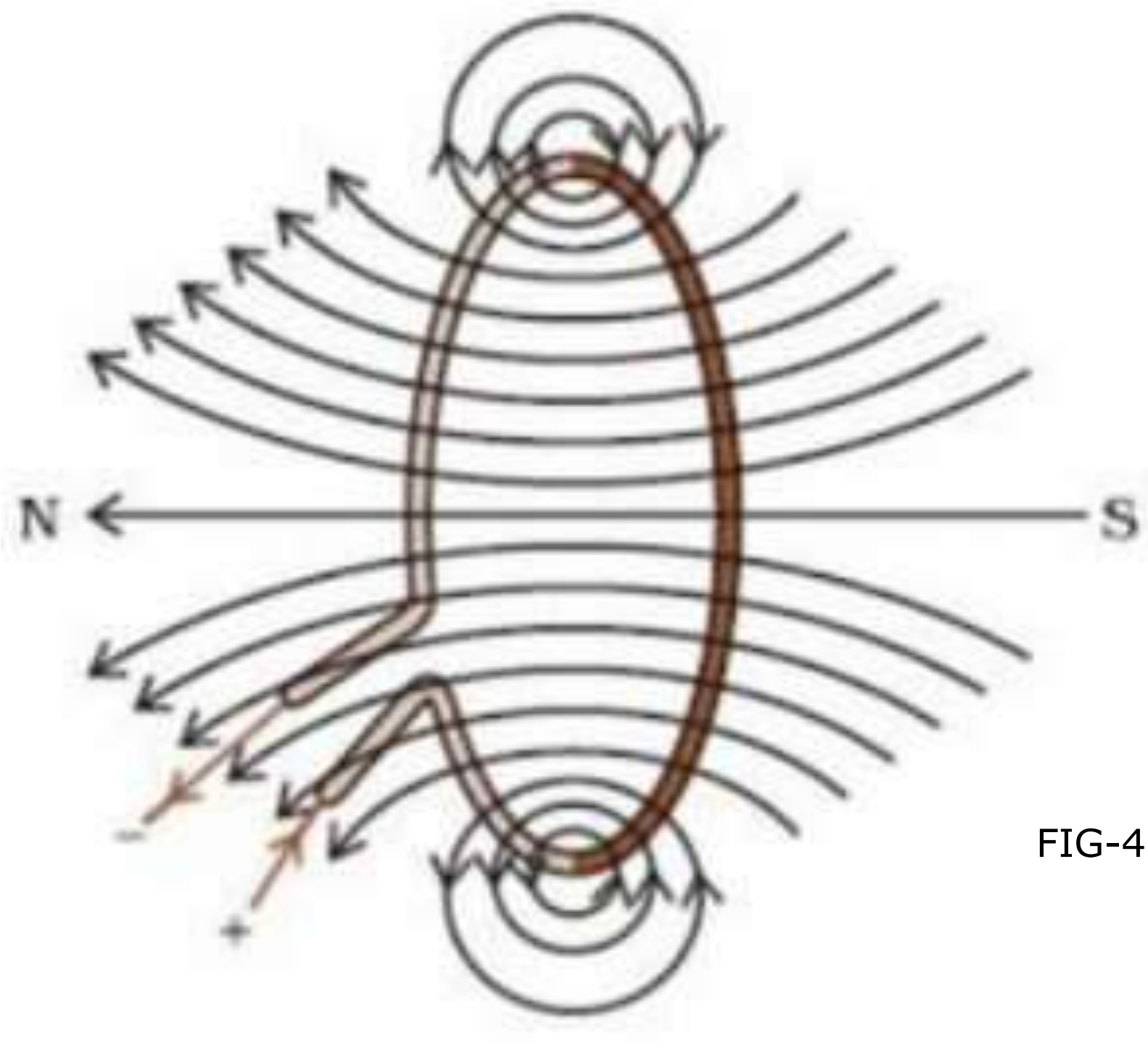


FIG-4

All the 4 figures (Fig-1, Fig-2, Fig-3, Fig-4) shown above carry the same demonstration of magnetic field due to current carrying circular loop. The pattern of magnetic lines of force due to a current carrying circular loop are shown in different way.

FACTORS ON WHICH STRENGTH OF FIELD DEPENDS(FOR CIRCULAR LOOP)

1. The amount of electric current(I): Field strength (B) is directly proportional to electric current(I) passing through it

   $B \propto I$

2. The radius of the circular loop (r): Field strength (B) at centre is inversely proportional to radius of the circular loop(r)

   $B \propto 1/r$

3. The number of turns of the circular loop (n): Field strength (B) at centre is directly proportional to the number of turns of the circular loop(n)

   $B \propto n$

Note: magnetic field due to circular loop decreases on both sides along the axis of the circular wire.

HOME-WORK:

Q1:Draw a diagram to show the pattern of magnetic lines of force due to current carrying circular loop.

Q2: Name the factors on which strength of magnetic field at centre due to current carrying circular loop depend.

Q3: Which rule is used to find the direction of magnetic field due to current carrying circular loop?

Q4: Current is flowing anticlockwise in a circular coil lying in the plane of a table. Using Right Hand Thumb Rule, state the direction of the magnetic field inside and outside the coil.

Q5: Current is flowing clockwise in a circular coil lying in the plane of a table. Using Right Hand Thumb Rule, state the direction of the magnetic field inside and outside the coil.

Q6: How does the field strength at the centre of a current carrying circular loop depend on

(a) number of turns

(b) radius of the loop

(c) electric current