EXPERIMENT

To draw the magnetic lines of force due to a bar magnet keeping its (i) N-pole pointing to magnetic north of the earth (N-N) (ii) S-pole pointing to magnetic north of the earth (N-S). Locate neutral points.

MATERIAL REQUIRED

One bar magnet, compass needle, white paper, drawing board, drawing pins, pencil, chalk.

THEORY

The common bar magnet is a magnetised piece of iron. It has maximum attracting power near the ends. These are called the poles. To find which end is N and which is S, it is suspended freely with the help of a thread tied in the middle (Fig. 1).

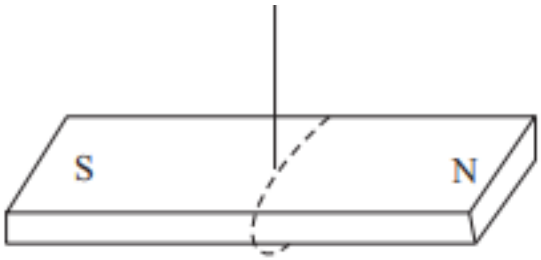

Fig. 1 Freely suspended magnetic needle

After some time, it will come to rest in N-S direction. The end which points toward geographic North is called N-pole and the other is S-pole The line joining N and S passing through the middle of magnet is usual its magnetic axis.

At a point in space around the bar magnet, where there are two equal opposite magnetic fields (earth and Bar magnet) cancelling each other, there is a neutral point Here there will be no magnetic field. In our experiment, one of the two fields is produced by the bar magnet and the other is earth's horizontal magnetic field. These two combine together to give the neutral point.

The lines of force are the paths on which a hypothetical N-pole set free will move in the given magnetic field. These are supposed to come out of N-pole and enter the S-pole and form closed lines. These are curves around the bar magnet (Fig. 2). The line of symmetry AB, which is a straight line of force passing through the poles is the magnetic axis of the magnet.

Earth's magnetic field being uniform in the small region of your laboratory, gives parallel lines of force.

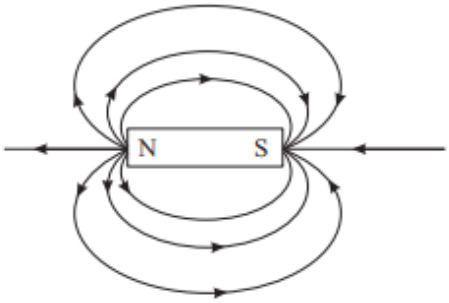

Fig. 2

PROCEDURE

(i) Find the N-pole-of the bar magnet and mark the end with ink.

(ii) Fix a white paper on the drawing board.

(iii) Draw a line in pencil through the middle of paper along the short edge for performing the I part of experiment i.e. N-pole of magnet toward north as shown in Fig. 3. For the II part of the experiment line will have to be drawn parallel to long edge as shown in Fig. 4.

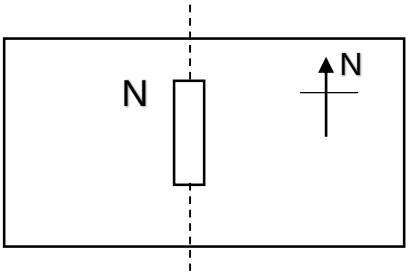

Fig. 3

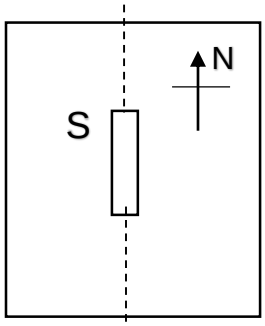

Fig. 4

(iv) Draw the outline of the magnet in the middle of line also shown above. Now remove the magnet.

(v) Place a compass needle along this line (magnet outline) and move wooden board such that magnetic needle becomes parallel to line drawn. This is the required position i.e. magnetic meridian. Don't move board/paper.

(vi) Now remove the compass needle and place the magnet according to your objective.

HOW TO PERFORM THE EXPERIMENT?

a) N-Pole facing North (N-N)

(i) Place magnet within its outline such that North of magnet points towards North of earth.

(ii) Take a small compass box. Place it near the N-pole of the bar magnet with it pointer pointing towards the pencil dot marked near the N-pole (Fig. 5). Mark the dot on the other side of needle. Move the compass box to the second marked dot, again mark a dot near the far end of needle. Repeat this process till you reach the S-pole. You will get a chain of dots which can be joined by a smooth curved line, as shown in Fig. 5.

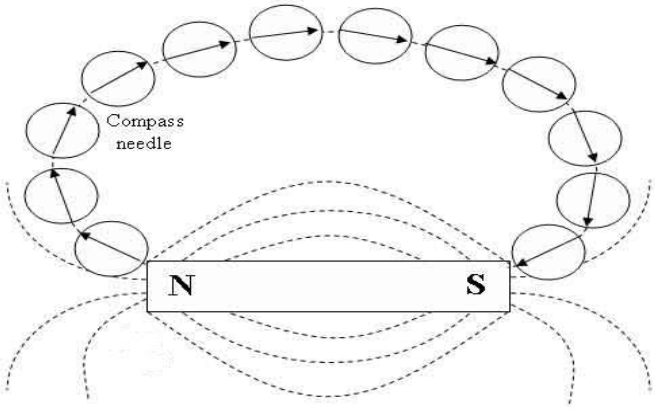

Fig. 5

(iii) Join these dots with free hand. This gives the line of force. Mark arrow head on it pointing away for N-pole as shown

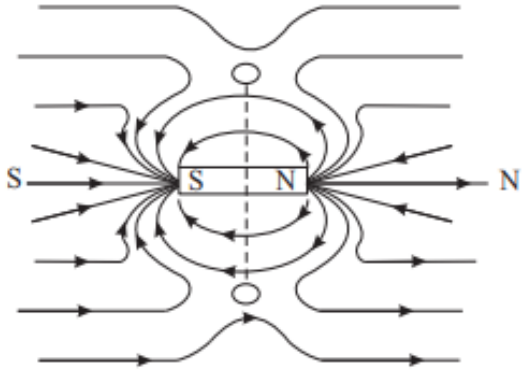

Fig. 6

(iv) Draw such lines for different starting points and you will get large number of lines of force around the magnet. Their shape will be as shown in Fig. 6.

Neutral Points: -

These lines will not cut each other. You will get two regions on the equatorial line shown by small circles in Fig.6, where there will be no line of force. These are the neutral points. There are two **neutral points**, one on each side (Equatorial position) of the magnet. If you place the compass here in the circle with its centre at the **neutral point**, the needle will not point in any fixed direction. It can come to rest in any

orientation. That shows that no force is acting on it. If magnet is properly placed, each of these points will be equidistant from the two poles and lie exactly on equatorial line.

b) N-facing South (N-S)

(i) For drawing the magnetic field in this case and locating neutral points place the drawing board with pencil line on paper parallel to long edge of board, along the N-S line of earth, as shown in the Fig. 4.

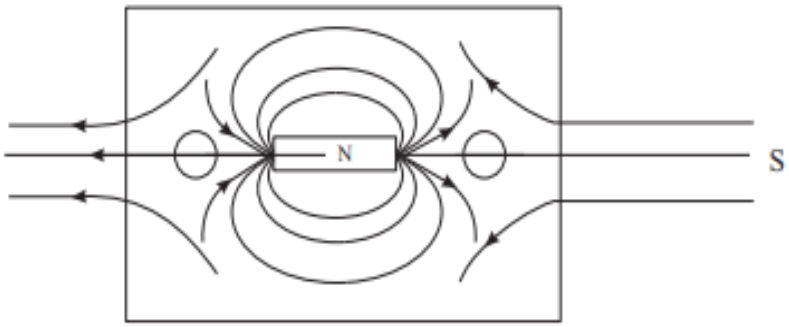

Fig. 7

(ii) Now follow the same procedure as in the last experiment. The lines of force will look as shown in Fig.7 above. Here we see that the two neutral points are located on the axial line of the magnet. Because it is at these points where the earth's horizontal field and the magnetic field of magnet balance each other.