University of Al-Mustaqbal
College of Science
Department of Medical Physics

Magnetism

the practical aspect

Second Stage

Mapping Magnetic Field Lines Using Iron Filings

Lec 7

Asst. lec. Ali Jaafar

Asst. lec. Zainab jassim

Mohammed abdulzahra

The objective of the experiment :

The purpose of this experiment is to visualize and map the magnetic field lines produced by different magnetic sources, such as bar magnets, U-shaped magnets, or pairs of magnets. Iron filings are used to reveal the pattern and direction of the magnetic field, allowing a better understanding of magnetic field behavior and interaction between magnetic poles.

Equipment used in the experiment :

1. Bar magnet or U-shaped magnet
2. Iron filings
3. Transparent plastic sheet or glass plate
4. White paper (for better visibility)
5. Compass (to identify direction of field lines)
6. Soft brush (for cleaning filings)
7. Light source (optional, to enhance visibility)

Theory of the Experiment :

Magnetic Field Lines

Magnetic field lines represent the direction and strength of the magnetic field around a magnet. They follow these properties:

- They emerge from the North pole and enter the South pole.
- They never intersect.
- Their spacing indicates field strength:

— Close lines → strong field

— Wide lines → weak field

Behavior with Iron Filings

When iron filings are sprinkled around a magnet, they align themselves along the magnetic field direction. Each tiny piece of iron becomes a small temporary magnet due to induction, forming a visible map of the field.

The method of work :

1. Place a sheet of white paper on the table.
2. Put the magnet at the center of the page.
3. Place a transparent plastic sheet or glass plate over the magnet.
4. Gently sprinkle iron filings over the sheet.
5. Tap the sheet lightly so the filings align with the magnetic field lines.
6. Observe the field pattern around:
    - A single bar magnet
    - Two bar magnets placed side-by-side
    - Opposite poles facing
    - Like poles facing
7. Use a compass to check the direction of the lines.
8. Draw the observed patterns on the lab sheet.
9. Clean the filings using a soft brush.

Trial	Magnet Type	Distance from Magnet (cm)	Expected Field Pattern	Field Strength (Qualitative: Strong/Medium/Weak)	Notes
1	Bar Magnet				
2	Bar Magnet				
3	Two Magnets (N–S)				
4	Two Magnets (N–N)				
5	U-Magnet	_____	_____	_____	_____

Discussion

1. Magnetic field lines originate from:
A. South pole
B. North pole
C. Both poles
D. Earth's core
E. Magnet's center

2. Magnetic field lines always:
A. Intersect
B. Start and end anywhere
C. Form closed loops
D. Change direction randomly
E. Flow only in air

3. Iron filings reveal magnetic fields because they:
A. Are charged
B. Become temporarily magnetized
C. Repel the magnet
D. Produce electricity
E. Glow in the field

4. The spacing between field lines indicates:
A. Temperature
B. Color
C. Field strength
D. Magnet size
E. Mass

5. The direction of magnetic field lines is:
A. S → N
B. N → S
C. Random
D. Circular
E. Vertical

6. The strongest magnetic field appears:
A. At the center
B. At the poles
C. At the edges
D. Behind the magnet
E. Far from the magnet

7. A compass aligns itself with:
A. Electric field
B. Gravity
C. Magnetic field
D. Sound waves
E. Light rays

8. Two like poles placed facing each other will:
A. Attract
B. Repel
C. Cancel magnetism
D. Form circular fields
E. Lose magnetic strength

9. Field lines never intersect because:
A. They are invisible
B. They represent unique directions
C. Magnets are weak
D. Iron filings cannot cross
E. Earth's field prevents it

10. The pattern of iron filings around a bar magnet shows:
A. Electric charge lines
B. Heat flow
C. Magnetic field lines
D. Sound vibrations
E. Light reflection

11. Which material is used to visualize magnetic fields?
A. Sand
B. Copper powder
C. Iron filings

D. Plastic beads
E. Water

12. When two opposite poles face each other, the field lines:
A. Bend away
B. Disappear
C. Join smoothly
D. Form circles
E. Repel

13. Iron filings align because of:
A. Gravitational pull
B. Electrostatic forces
C. Magnetic induction
D. Chemical reaction
E. Light exposure

14. A magnetic field is strongest where:
A. Field lines are closest
B. Field lines are far apart
C. Color is brightest
D. Magnet is scratched
E. Magnet is heated

15. The experiment helps visualize:
A. Voltage distribution
B. Sound propagation
C. Magnetic field structure
D. Water pressure
E. Electric resistance