

Chapter 4: Exploring Magnets

Case Study Based Questions (3 Practice Sets with Answers)

SET A — Case Study Based Worksheet

Name: _____ Date: _____

Class: _____ Section: _____

Read each case study carefully and answer the questions that follow.

Case Study 1. Reshma's Story of the Sailors

Reshma was writing a story about a ship carrying spices from Kerala for trade in olden days. In her story, the sailors got caught in a storm with an overcast sky, and the stars were not visible. Reshma researched and learnt that travellers used a special device to find directions in such situations.

1.1. What is the name of the device used by sailors to find directions when stars were not visible? [2 Marks]

1.2. On what principle does this device work? [2 Marks]

1.3. Why could the sailors not use stars during the storm? [2 Marks]

Case Study 2. The Iron Filings Experiment

A group of students spread iron filings on a sheet of paper and placed a bar magnet over them. They tapped the paper gently and carefully observed where the iron filings stuck.

2.1. Where did the maximum iron filings stick on the magnet? [2 Marks]

2.2. What are the two ends of the magnet, where filings stick the most, called? [2 Marks]

2.3. What conclusion can be drawn from this activity about the poles of a magnet? [2 Marks]

Case Study 3. Testing an Unknown Metal Bar

Aisha found a metal bar at home and wanted to check if it was a magnet. She tied a thread around its middle and suspended it freely so that it could rotate in the horizontal direction.

3.1. What should Aisha observe to know if the bar is a magnet? [2 Marks]

3.2. If the bar always comes to rest in the same north-south direction, what can she conclude? [2 Marks]

3.3. What would happen if the bar were just an ordinary iron bar and not a magnet? [2 Marks]

Case Study 4. Compass Needle and a Wooden Sheet

During Activity 4.7, students placed a compass near a bar magnet and observed the needle deflect. They then placed a piece of wood between the compass and the magnet, keeping both undisturbed.

4.1. What did the students observe about the needle's deflection after placing the wood? [2 Marks]

4.2. What does this experiment tell us about the magnetic effect and non-magnetic materials? [2 Marks]

4.3. Name two other non-magnetic materials that could be used in place of wood for this activity. [2 Marks]

Case Study 5. Storing Magnets Safely

Reshma's teacher explained that magnets should be handled and stored carefully. She said magnets should not be heated, dropped, or hammered, and should be kept in pairs with unlike poles on the same side.

5.1. Why should magnets not be kept near mobile phones or remote controls? [2 Marks]

5.2. How should a pair of bar magnets be stored safely? *[2 Marks]*

5.3. What is the purpose of placing pieces of soft iron across the ends of stored magnets? *[2 Marks]*

✓ ANSWER KEY — Set A**1. Reshma's Story of the Sailors**

- 1.1. Sailors used a magnetic compass to find directions.
- 1.2. It works on the principle that a freely suspended magnetic needle always comes to rest along the north-south direction because the Earth behaves like a giant magnet.
- 1.3. Because the sky was overcast during the storm, so the stars were not visible to them.

2. The Iron Filings Experiment

- 2.1. The maximum iron filings stuck near the two ends of the bar magnet.
- 2.2. These two ends are called the poles of the magnet — the North pole and the South pole.
- 2.3. The magnetic force of a magnet is strongest at its poles and much weaker in the middle portion.

3. Testing an Unknown Metal Bar

- 3.1. She should observe whether the bar always comes to rest along the same north-south direction after being rotated.
- 3.2. She can conclude that the bar is indeed a magnet.
- 3.3. An ordinary iron bar would come to rest in any random direction, not always along the north-south line.

4. Compass Needle and a Wooden Sheet

- 4.1. There was no appreciable change in the deflection of the needle even after placing the wood.
- 4.2. It tells us that the magnetic effect of a magnet can pass through non-magnetic materials without being blocked.
- 4.3. Cardboard and a thin plastic sheet (or a thin glass sheet) could also be used.

5. Storing Magnets Safely

- 5.1. Because magnets can affect and damage the working of such electronic devices.
- 5.2. They should be stored together with unlike poles on the same side, with a piece of wood placed in between.
- 5.3. The soft iron pieces help complete the magnetic circuit and preserve the strength of the stored magnets.

SET B — Case Study Based Worksheet

Name: _____ Date: _____

Class: _____ Section: _____ Marks Obtained: _____ / _____

*Read each case study carefully and answer the questions that follow.***Case Study 1. The Matchbox Cars***Two matchbox cars were fitted with magnets such that their like poles faced each other. The children pushed the cars towards each other on a table and observed what happened.***1.1.** Did the cars move towards each other or away from each other? Why? [2 Marks]

1.2. What would happen if the unlike poles of the magnets on the two cars faced each other? [2 Marks]

1.3. Name the property of magnets that made the cars behave this way. [2 Marks]

Case Study 2. The Compass Needle Deflection*A student brought the North pole of a bar magnet close to the North pole of a compass needle and observed the needle move away. The student then brought the South pole of the bar magnet close to the North pole of the needle.***2.1.** What happened to the compass needle when the South pole of the bar magnet was brought near it? [2 Marks]

2.2. What can we conclude about the compass needle itself? [2 Marks]

2.3. State the rule of attraction and repulsion that explains this observation. [2 Marks]

Case Study 3. Reshma's Fun Activity at the School Fair*At her school fair, Reshma set up an activity in which visitors could pick up a steel paper clip that had fallen into a bowl of water using a magnet, without wetting their fingers or the magnet.*

3.1. How could a magnet be used to pick up the paper clip without touching the water? [2 Marks]

3.2. What property of magnets is being used here? [2 Marks]

3.3. Name one more fun activity with magnets that could be set up at a school fair. [2 Marks]

Case Study 4. Identifying the Odd One Out

Reshma bought three identical-looking metal bars from the market. Out of these, two were magnets and one was simply a piece of iron, but she could not tell which was which just by looking at them.

4.1. How can Reshma identify which two bars are magnets without using any other material? [2 Marks]

4.2. What key property of magnets would help her in this identification? [2 Marks]

4.3. Why can't she simply see which bars attract each other to decide? [2 Marks]

Case Study 5. The Mechanic's Problem

While repairing a gadget, a mechanic kept dropping small steel screws, which made his work slow and difficult.

5.1. How can the knowledge of magnets help the mechanic solve this problem? [2 Marks]

5.2. Why would a magnetised screwdriver be useful here? [2 Marks]

5.3. Would this solution work if the screws were made of plastic? Give a reason. [2 Marks]

✓ ANSWER KEY — Set B**1. The Matchbox Cars**

- 1.1. The cars moved away from each other because like poles of magnets repel each other.
- 1.2. The cars would move towards each other and stick together, since unlike poles attract each other.
- 1.3. This is the property of attraction and repulsion between the poles of magnets.

2. The Compass Needle Deflection

- 2.1. The needle moved closer towards the South pole of the bar magnet.
- 2.2. We can conclude that the compass needle is itself a small magnet, since it responds to attraction and repulsion just like a magnet.
- 2.3. Like poles repel each other, while unlike poles attract each other.

3. Reshma's Fun Activity at the School Fair

- 3.1. The magnet could be held close to the outside of the glass bowl, near the paper clip, so its magnetic effect passes through the glass and water to attract and lift the clip.
- 3.2. The property that the magnetic effect can act through non-magnetic materials such as glass and water.
- 3.3. Taking steel balls out of a maze by moving a magnet below the cardboard tray (or making a magnetic garland).

4. Identifying the Odd One Out

- 4.1. She can bring the ends of the bars close to each other in pairs; the two bars that repel each other when like poles face each other must be the magnets.
- 4.2. The property of repulsion between like poles, which only true magnets show.
- 4.3. Because the plain iron bar will be attracted by both magnets, so attraction alone cannot tell the magnets apart — only repulsion is a reliable test.

5. The Mechanic's Problem

- 5.1. He can use a magnetised screwdriver, which will hold the steel screws in place by attraction and prevent them from falling.
- 5.2. Because steel screws are magnetic materials and will stick to the magnetised tip of the screwdriver, making them easier to place and remove.
- 5.3. No, because plastic is a non-magnetic material and would not be attracted by the magnetised screwdriver.

SET C — Case Study Based Worksheet

Name: _____ Date: _____

Class: _____ Section: _____ Marks Obtained: _____ / _____

*Read each case study carefully and answer the questions that follow.***Case Study 1. Making a Compass with a Needle**

A group of students rubbed an iron sewing needle with one pole of a bar magnet, always in the same direction, about 30 to 40 times. They then passed the needle through a cork and floated it in a bowl of water.

1.1. What happened to the iron needle after being rubbed with the magnet repeatedly? [2 Marks]

1.2. How did the students test whether the needle had become a magnet? [2 Marks]

1.3. In which direction did the floating needle come to rest, and why? [2 Marks]

Case Study 2. The Ring Magnets Puzzle

Two ring magnets X and Y were placed on a vertical stand, one above the other. It was observed that magnet X did not move down to touch magnet Y, even though gravity should pull it down.

2.1. What could be the reason that magnet X does not move down further? [2 Marks]

2.2. How can magnet X be brought in contact with magnet Y without pushing it? [2 Marks]

2.3. What does this activity demonstrate about magnetic poles? [2 Marks]

Case Study 3. Bar Magnet and Steel U-clips

Atharv rolled a bar magnet over a heap of steel U-clips and observed how many clips stuck at different positions along the magnet — near the two ends and in the middle.

3.1. At which positions along the magnet would you expect the maximum number of clips to stick? [2 Marks]

3.2. Why do fewer clips stick near the middle of the magnet? [2 Marks]

3.3. What does this experiment tell us about the pole regions of a magnet? [2 Marks]

Case Study 4. The Hopping Frog Toy

As a class activity, students made a toy called the 'Hopping Frog' using ring magnets fixed in an alternate North-South fashion along a scale, and a paper frog with a ring magnet glued to it, resting on a flexible plastic strip.

4.1. Why does the frog appear to hop when the plastic strip is slid over the scale? [2 Marks]

4.2. Why were the ring magnets fixed in an alternate North-South pattern? [2 Marks]

4.3. Which property of magnets makes the frog jump up? [2 Marks]

Case Study 5. Ancient Sailors and the Matsya-Yantra

Long before the modern magnetic compass became common, Indian sailors used a device called the matsya-yantra, which consisted of a magnetised fish-shaped iron piece kept in a vessel of oil, to navigate at sea.

5.1. What was the matsya-yantra made of, and how was it used? [2 Marks]

5.2. How is the matsya-yantra similar to the simple magnetic compass made using a needle and cork? [2 Marks]

5.3. Why was a device like this important for sailors travelling far from land? [2 Marks]

✓ ANSWER KEY — Set C

1. Making a Compass with a Needle

- 1.1. The iron needle became magnetised, that is, it turned into a magnet.
- 1.2. They brought iron filings or steel pins near the needle; since these got attracted, it confirmed that the needle had become a magnet.
- 1.3. It came to rest along the north-south direction, because the Earth behaves like a giant magnet.

2. The Ring Magnets Puzzle

- 2.1. The facing poles of the two ring magnets are alike, so they repel each other, and this repulsion balances the pull of gravity on X.
- 2.2. Magnet X can be flipped over so that its unlike pole faces magnet Y; the two will then attract and come together.
- 2.3. It demonstrates that like poles repel while unlike poles attract, and that this force can be strong enough to counter gravity.

3. Bar Magnet and Steel U-clips

- 3.1. The maximum number of clips would stick near the two ends (poles) of the magnet.
- 3.2. Because the magnetic force is weakest in the middle region of the magnet, away from its poles.
- 3.3. It tells us that the poles are the regions of a magnet where its attractive force is strongest.

4. The Hopping Frog Toy

- 4.1. As the frog's magnet passes over magnets of alternating poles fixed on the scale, it experiences alternating attraction and repulsion, making it bounce or hop.
- 4.2. So that the frog's magnet repeatedly meets like poles (causing repulsion/lift) and unlike poles (causing attraction) as it moves along, producing the hopping effect.
- 4.3. The property of repulsion between like magnetic poles.

5. Ancient Sailors and the Matsya-Yantra

- 5.1. It was made of a magnetised fish-shaped iron piece, kept floating in a vessel of oil to indicate directions.
- 5.2. Both use a freely floating or freely suspended magnetised object that aligns itself along the north-south direction to show directions.
- 5.3. Because far out at sea, with no landmarks and sometimes no visible stars, sailors needed a reliable way to know directions to reach their destination safely.