Learning Target S8P5.a: I can construct an argument using evidence to support the claim that magnetic fields exist between objects exerting forces on each other even when the objects are not in contact.

FSI 8th Grade Science Reading for Meaning – Magnetic Fields & Magnetic Forces

The Mystery of the Invisible Force

Have you ever noticed how a magnet can pull a paperclip toward it even though they never touch? To the naked eye, nothing seems to connect them—no rope, no air current, no visible link. Yet, something very real is happening in the space around the magnet. Scientists call this invisible region a **magnetic field**.

A **magnetic field** is an area around a magnet where magnetic forces can be detected. The field extends in all directions, though its strength decreases with distance. This means that a paperclip will feel a stronger pull when it is close to a magnet and a weaker pull as it moves farther away. The **field lines**, which can be mapped using iron filings, form curved patterns that leave one pole of the magnet and loop toward the opposite pole. These lines help visualize where the magnetic force acts, even though the field itself is invisible.

In the early 1800s, **Hans Christian Ørsted** made a surprising discovery that connected electricity and magnetism. While demonstrating an electric circuit to his students, he noticed that a nearby compass needle moved whenever the current was turned on. This meant that the electric current was producing a magnetic field strong enough to affect the compass. Ørsted's observation led to the field of **electromagnetism**, showing that moving charges—like those in an electric current—create magnetic fields.

Later, **Michael Faraday** expanded this understanding by showing that magnetic fields can also create electric currents. He found that moving a magnet through a coil of wire could produce an electrical current in the wire, even without the two objects touching. This process, called **electromagnetic induction**, became the foundation for generators that power modern cities. Every time you turn on a light, you are benefiting from forces that act at a distance.

The existence of magnetic fields can also be observed on a much larger scale. **Earth itself acts like a giant magnet**, with a magnetic field that protects us from harmful solar radiation. This field causes compasses to point north and helps migratory animals navigate across continents. Just like a bar magnet, Earth's field exerts a force on magnetic materials and moving charged particles—even when they are thousands of kilometers away from the surface.

Through experiments and observations, scientists have gathered **evidence** that magnetic fields are real and powerful, even though we cannot see them. Whether it's a compass needle moving near a wire, a paperclip jumping toward a magnet, or the auroras glowing in Earth's sky, the effects of these invisible fields remind us that not all forces require contact to cause change.

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DOK 3–4 Multiple-Choice Questions

1. Which observation provides the strongest evidence that magnetic fields exist between objects that are not in contact? (DOK 3)
A. A bar magnet attracts only certain types of metals.
B. Iron filings form visible patterns around a magnet.
C. A magnet can be demagnetized by heating.
D. The north pole of one magnet repels the north pole of another.

2. Based on the passage, what conclusion can be drawn about the relationship between distance and magnetic field strength? (DOK 3)
A. Field strength increases with distance from the magnet.
B. Field strength remains constant regardless of distance.
C. Field strength decreases as the distance increases.
D. Distance has no measurable effect on field strength.

3. How did Ørsted's experiment demonstrate that electric currents can produce magnetic fields? (DOK 3)
A. The compass needle pointed north only when the circuit was broken.
B. The compass needle moved when electric current flowed through the wire.
C. The wire became magnetized after the current was turned off.
D. The current stopped flowing when the magnet was removed.

4. What evidence best supports Faraday's claim that changing magnetic fields can create electric currents? (DOK 3)
A. A compass needle moves near a wire carrying current.
B. Moving a magnet through a wire coil produces a measurable current.
C. A paperclip sticks to a permanent magnet.
D. Two magnets repel each other when close together.

5. Which statement from the passage most strongly supports the claim that magnetic fields exert forces at a distance? (DOK 3)
A. "The field extends in all directions."
B. "A paperclip will feel a stronger pull when it is close to a magnet."
C. "Earth itself acts like a giant magnet."
D. "Field lines form curved patterns that leave one pole and loop toward the opposite pole."

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6. Suppose an experiment is conducted where a magnet is slowly moved toward a stationary paperclip. What would be the most likely explanation for the paperclip moving before contact occurs? (DOK 3)

A. Air pressure changes push the paperclip forward.
B. Friction between surfaces increases magnetic attraction.
C. The magnetic field around the magnet exerts a pulling force at a distance.
D. The paperclip generates its own magnetic field spontaneously.

7. How do the discoveries of Ørsted and Faraday support the claim that magnetic fields are real even if invisible? (DOK 4)

A. Both scientists measured visible changes in magnet color.
B. Both experiments demonstrated effects caused by unseen forces.
C. Their work proved that all metals have permanent magnetism.
D. Their experiments showed that magnets cannot affect electric currents.

8. Earth's magnetic field helps migratory animals navigate. What does this suggest about the strength and reach of magnetic fields? (DOK 4)

A. Magnetic fields are limited to very small distances.
B. Only artificial magnets can produce long-range effects.
C. Some magnetic fields can extend great distances and influence living systems.
D. Magnetic fields exist only near poles of magnets.

9. A student claims, "Magnets can only attract objects when they touch." Based on evidence from the passage, which reasoning best refutes this claim? (DOK 4)

A. Magnets lose strength after repeated contact with other metals.
B. Field lines show the region where magnets can exert forces without touching.
C. Only electromagnets attract objects at a distance.
D. Heating a magnet changes its field pattern.

10. Which of the following scenarios best illustrates a non-contact magnetic force similar to those described in the passage? (DOK 4)

A. A balloon sticks to a wall after being rubbed on hair.
B. A nail becomes magnetized after being placed inside a coil with current.
C. A book falls from a table due to gravity.
D. A block slides down an inclined plane.

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