ENTANGLED TIMES

THE MAGNETISM ISSUE

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WHAT IS MAGNETISM?

MAGNETISM IS AN INVISIBLE FORCE THAT CAN PUSH OR PULL OBJECTS WITHOUT TOUCHING THEM. IT COMES FROM TINY PARTICLES INSIDE MATERIALS CALLED ELECTRONS. WHEN THESE ELECTRONS MOVE IN A SPECIAL WAY, THEY CREATE A MAGNETIC FIELD. THIS MAGNETIC FIELD IS STRONGEST AT THE ENDS OF A MAGNET, WHICH ARE CALLED POLES. SOME MATERIALS, LIKE IRON, NICKEL, AND COBALT, ARE ATTRACTED TO MAGNETS, WHILE OTHERS, LIKE WOOD AND PLASTIC, ARE NOT. MAGNETISM IS A FUNDAMENTAL FORCE OF NATURE THAT HELPS US IN EVERYDAY LIFE, FROM KEEPING REFRIGERATOR DOORS CLOSED TO RUNNING POWERFUL MACHINES.

MAGNETIC POLES

NORTH POLE

WHEN TWO LIKE POLES (NORTH-NORTH OR SOUTH-SOUTH) ARE BROUGHT CLOSE TOGETHER, THEY REPEL EACH OTHER, MEANING THEY PUSH AWAY. BUT WHEN OPPOSITE POLES (NORTH-SOUTH) ARE NEAR EACH OTHER, THEY ATTRACT AND PULL TOGETHER. THIS IS WHY MAGNETS STICK TO SOME OBJECTS AND NOT OTHERS!
LIKE POLES REPEL EACH OTHER (PUSH AWAY), WHILE OPPOSITE POLES ATTRACT (PULL TOWARD EACH OTHER). THIS IS WHY TWO MAGNETS CAN EITHER STICK TOGETHER OR PUSH APART!

SOUTH POLE

TYPES OF MAGNETS

PERMANENT MAGNETS

PERMANENT MAGNETS ARE SPECIAL MATERIALS THAT CREATE A MAGNETIC FIELD ON THEIR OWN. THEY ARE MADE FROM SUBSTANCES THAT RETAIN THEIR MAGNETISM FOR A LONG TIME.

TEMPORARY MAGNETS

SOME MATERIALS ACT LIKE MAGNETS ONLY WHEN PLACED NEAR A STRONG MAGNET. PAPER CLIPS AND NAILS BECOME TEMPORARY MAGNETS WHEN THEY STICK TO A PERMANENT MAGNET.

ELECTROMAGNETS

THESE ARE MAGNETS THAT WORK WHEN ELECTRICITY FLOWS THROUGH THEM. WHEN YOU TURN OFF THE ELECTRICITY, THEY STOP BEING MAGNETIC. THEY ARE USED IN DOORBELLS, MRI MACHINES, AND EVEN JUNKYARD CRANES TO LIFT HEAVY METAL OBJECTS!

HOW DO WE USE IT?

COMPASSES

A SMALL MAGNET INSIDE POINTS NORTH, HELPING PEOPLE FIND DIRECTION, EVEN IN REMOTE AREAS WITHOUT GPS.

TRAINS

MAGNETIC LEVITATION (MAGLEV) TRAINS USE POWERFUL MAGNETS TO FLOAT ABOVE TRACKS, REDUCING FRICTION AND ALLOWING THEM TO TRAVEL EXTREMELY FAST

ELECTRONICS

COMPUTERS, TVS, AND PHONES USE MAGNETS IN THEIR HARD DRIVES, SPEAKERS, AND EVEN CHARGING CABLES.

MEDICAL MACHINES

MRI (MAGNETIC RESONANCE IMAGING) SCANNERS USE STRONG MAGNETS TO CREATE DETAILED IMAGES OF THE INSIDE OF THE HUMAN BODY, HELPING DOCTORS DIAGNOSE ILLNESSES.

MAGNETIC FIELDS

A MAGNETIC FIELD IS THE INVISIBLE AREA AROUND A MAGNET WHERE ITS FORCE WORKS. YOU CAN SEE A MAGNETIC FIELD IN ACTION USING IRON FILINGS—THEY ARRANGE THEMSELVES IN PATTERNS THAT SHOW THE MAGNETIC FIELD LINES! THE STRENGTH OF THE FIELD IS STRONGEST AT THE POLES AND WEAKER AS YOU MOVE AWAY FROM THE MAGNET.

FUN FACT!

EARTH ITSELF IS LIKE A GIANT MAGNET! THAT'S WHY COMPASSES WORK—THEY ALIGN WITH EARTH'S MAGNETIC FIELD TO POINT NORTH.

EXPERIMENTS

MAGNETIC FIELD VISUALIZATION

SPRINKLE IRON FILINGS ON A PAPER PLACED OVER A BAR MAGNET. THE FILINGS ALIGN ALONG THE MAGNETIC FIELD LINES, REVEALING THE INVISIBLE FORCES AROUND THE MAGNET.

TEMPORARY VS. PERMANENT MAGNETS

RUB A STEEL NAIL WITH A BAR MAGNET AND USE IT TO PICK UP PAPER CLIPS. THE NAIL TEMPORARILY BECOMES MAGNETIC BUT LOSES ITS MAGNETISM AFTER A WHILE.

MAGNETIC MAZE

PLACE A SMALL PAPERCLIP UNDER A PIECE OF PAPER AND MOVE IT USING A MAGNET ON TOP. TRY CREATING A MAZE WITH LINES AND GUIDE THE PAPERCLIP THROUGH IT USING ONLY THE MAGNET!

QUIZ YOURSELF!

FILL IN THE BLANKS:

1. A MAGNET HAS TWO _____, WHICH ARE CALLED THE NORTH AND SOUTH _____.
2. THE _____ POLE OF A MAGNET ALWAYS ALIGNS WITH THE EARTH'S GEOGRAPHIC NORTH WHEN FREELY SUSPENDED.
3. WHEN TWO MAGNETS ARE BROUGHT CLOSE TOGETHER, OPPOSITE POLES _____ EACH OTHER, WHILE LIKE POLES _____ EACH OTHER.
4. A COMPASS WORKS BECAUSE IT CONTAINS A _____ THAT ALIGNS WITH THE EARTH'S MAGNETIC FIELD, HELPING US FIND DIRECTION.
5. AN ELECTROMAGNET NEEDS _____ TO WORK AND LOSES ITS MAGNETISM WHEN _____ IS TURNED OFF.

MATCH THE PAIRS:

PERMANENT MAGNET → (A) A FORCE THAT OCCURS WHEN LIKE POLES OF TWO MAGNETS PUSH AWAY FROM EACH OTHER DUE TO MAGNETIC INTERACTIONS.
ELECTROMAGNET →. (B) A NAVIGATION TOOL THAT CONTAINS A SMALL MAGNETIZED NEEDLE THAT ALIGNS WITH EARTH'S MAGNETIC FIELD
COMPASS → (C) A FORCE THAT OCCURS WHEN OPPOSITE POLES OF TWO MAGNETS PULL TOWARD EACH OTHER BECAUSE OF THEIR MAGNETIC PROPERTIES
REPEL → (D) A MAGNET THAT REMAINS MAGNETIZED INDEFINITELY AND DOES NOT REQUIRE ELECTRICITY TO FUNCTION.
ATTRACT → (E) A MAGNET THAT ONLY WORKS WHEN ELECTRIC CURRENT FLOWS THROUGH IT AND LOSES ITS MAGNETISM WHEN SWITCHED OFF.

TRUE OR FALSE?

DECIDE IF THE STATEMENTS BELOW ARE TRUE OR FALSE:

- ALL METALS CAN BE ATTRACTED TO A MAGNET.
- THE NORTH POLE OF A MAGNET IS ATTRACTED TO THE EARTH'S MAGNETIC SOUTH POLE.
- WHEN A BAR MAGNET IS CUT IN HALF, ONE PIECE WILL HAVE ONLY A NORTH POLE AND THE OTHER ONLY A SOUTH POLE.
- OPPOSITE POLES OF TWO MAGNETS WILL REPEL EACH OTHER.
- A COMPASS NEEDLE MOVES BECAUSE IT IS A TINY MAGNET THAT ALIGNS WITH THE EARTH'S MAGNETIC FIELD.

ABOUT THE AUTHORS

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