MoSH

MAGNETS & MAGNETISM:
Suitcase Program [3-5]

TEACHER'S MANUAL

This Suitcase Program provides the materials and lesson plans for teachers of grades 3-5 with content and activities increasing in difficulty by grade level. Activities in this Suitcase Exhibit may assist in meeting the Tennessee State Standards.

ACTIVITIES

TENNESSEE STATE STANDARDS FOR 3-5

3.PS2.1	Explain the cause and effect relationship of magnets.
3.PS2.2	Solve a problem by applying the use of the interactions between two magnets.
3.PS3.3	Evaluate how magnets cause changes in the motion and position of objects, even when the objects are not touching the magnet.
5.PS2.2	Make observations and measurements of an object's motion to provide evidence that pattern can be used to predict future motion.
5.PS2.5	Explain how forces can create patterns within a system (moving in one direction, shifting back and forth, or moving in cycles), and describe conditions that affect how fast or slowly these patterns occur.
5.ETS1.3	Describe how failure provides valuable information toward finding a solution.

For the entire activity and materials and to reserve a Suitcase Exhibit, please call 901.636.2362.

ACTIVITY I: Polar Race

DURATION OF ACTIVITY: 30 minutes

LESSON OBJECTIVES

Students investigate the polarity of magnets and discover magnets are strongest at the poles. They demonstrate attraction and repulsion by devising methods to move two magnets while touching only one of them.

GUIDING QUESTIONS

What are the poles of a magnet? Why do magnets sometimes attract each other and other times repel each other?

TENNESSEE STATE STANDARDS

3.PS2.1	Explain the cause and effect relationship of magnets.
3.PS2.2	Solve a problem by applying the use of the interactions between two magnets.
3.PS3.3	Evaluate how magnets cause changes in the motion and position of objects, even when the objects are not touching the magnet.

MATERIALS INCLUDED

Compass
6" steel bar magnets
Book **The Mystery of Magnets**
Paperclips
Dowel stands with 4 magnets each
Polar Race boards

MATERIALS PROVIDED BY TEACHER

Chart to record students' concepts and introduce vocabulary

For the entire activity and materials and to reserve a Suitcase Exhibit, please call 901.636.2362.

ACTIVITY II: Testing the Force

DURATION OF ACTIVITY: 45 minutes

LESSON OBJECTIVES

Students use a balance to measure the force of attraction between two magnets. They discover magnetism acts at a distance and they observe what happens when the distance between two magnets increases.

GUIDING QUESTIONS

How can we measure the force (magnetic fields) of two magnets? What happens to magnetic force over distance?

TENNESSEE STATE STANDARDS

3.PS2.1	Explain the cause and effect relationship of magnets.
3.PS2.2	Solve a problem by applying the use of the interactions between two magnets.
3.PS3.3	Evaluate how magnets cause changes in the motion and position of objects, even when the objects are not touching the magnet.
4.ETS2.1	Use appropriate tools and measurements to build a model.

MATERIALS INCLUDED

Balance and fulcrum bases
Plastic cups
Ceramic ring magnets
Blue post magnets
Poker chips
Steel washers

MATERIALS PROVIDED BY TEACHER

Chart from previous activity
Sheet of paper for each team with two columns labeled:
- "Predictions"
- "Tested Results"

For the entire activity and materials and to reserve a Suitcase Exhibit, please call 901.636.2362.

ACTIVITY III: Mapping Invisible Lines of Force

DURATION OF ACTIVITY: 60 minutes

LESSON OBJECTIVES
Students work with a compass to map the magnetic field of a bar magnet.

GUIDING QUESTION
What is the shape of a magnetic field?

TENNESSEE STATE STANDARDS

3.PS2.1	Explain the cause and effect relationship of magnets.
3.PS2.2	Solve a problem by applying the use of the interactions between two magnets.
3.PS3.3	Evaluate how magnets cause changes in the motion and position of objects, even when the objects are not touching the magnet.
4.ETS2.1	Use appropriate tools and measurements to build a model.
5.PS2.2	Make observations and measurements of an object's motion to provide evidence that a pattern can be used to predict future motion.
5.ETS1.1	Research, test, re-test, and communicate a design to solve a problem.

MATERIALS INCLUDED
Cow magnet
Iron filings box
6" steel bar magnets
Compasses
Book **The Mystery of Magnets**
See Supplementary Materials for:
- Diagrams #1-5
- Compass placement diagram

MATERIALS PROVIDED BY TEACHER
Chart from previous activities
Sheets of 8 1/2" x 11" white paper
Tape
Pencils

For the entire activity and materials and to reserve a Suitcase Exhibit, please call 901.636.2362.

ACTIVITY IV: Now Showing in 3D: The Force Field

DURATION OF ACTIVITY: 45 minutes

LESSON OBJECTIVES

Students use magnets of different shapes and iron fillings to view the patterns of magnetic lines of force. They examine, in two and three dimensions, the magnetic fields of magnets as they attract or repel at the poles. A 3-D magnetic field visualizer allows students to see iron filing surround a magnet on all sides.

GUIDING QUESTION

How can we view magnetic fields as they surround an object?

TENNESSEE STATE STANDARDS

3.PS2.1	Explain the cause and effect relationship of magnets.
3.PS2.2	Solve a problem by applying the use of the interactions between two magnets.
3.PS3.3	Evaluate how magnets cause changes in the motion and position of objects, even when the objects are not touching the magnet.
5.PS2.2	Make observations and measurements of an object's motion to provide evidence that a pattern can be used to predict future motion.
5.PS2.5	Explain how forces can create patterns within a system (moving in one direction, shifting back and forth, or moving in cycles), and describe conditions that affect how fast or slowly these patterns occur.
5.ETS1.1	Research, test, re-test, and communicate a design to solve a problem.

MATERIALS INCLUDED

Iron filings boxes
Ceramic rings magnets
Wand magnets
Cow magnets
3-D magnetic field visualizers

MATERIALS PROVIDED BY TEACHER

Chart from previous activities
Sheets of white paper

For the entire activity and materials and to reserve a Suitcase Exhibit, please call 901.636.2362.

ACTIVITY V: Crazy Compasses

DURATION OF ACTIVITY: 60 minutes

LESSON OBJECTIVES
Students explore Earth's magnetic field using lodestones and bar magnets. They detect north and use a nail to disrupt Earth's magnetic field as measured by a compass.

GUIDING QUESTION
What makes a compass point to north?

TENNESSEE STATE STANDARDS

3.PS2.1	Explain the cause and effect relationship of magnets.
3.PS2.2	Solve a problem by applying the use of the interactions between two magnets.
3.PS3.3	Evaluate how magnets cause changes in the motion and position of objects, even when the objects are not touching the magnet.
5.PS2.2	Make observations and measurements of an object's motion to provide evidence that a pattern can be used to predict future motion.
5.PS2.5	Explain how forces can create patterns within a system (moving in one direction, shifting back and forth, or moving in cycles), and describe conditions that affect how fast or slowly these patterns occur.

MATERIALS INCLUDED
Small Polar Race board
6" steel bar magnets
Compasses
Large steel nails
Loadstones
String
Red Card labeled "North"
Grey Card labeled "South"
Book **Magnetic Science**
See Supplementary Materials for:
Diagram of Magnetic Field of Earth

MATERIALS PROVIDED BY TEACHER
Chart from previous activities
One pair of scissors
Tape
Rulers

For the entire activity and materials and to reserve a Suitcase Exhibit, please call 901.636.2362.

ACTIVITY VI: Now Showing in 3D: The Force Field

DURATION OF ACTIVITY: 45 minutes

LESSON OBJECTIVES

Students use magnets of different shapes and iron fillings to view the patterns of magnetic lines of force. They examine, in two and three dimensions, the magnetic fields of magnets as they attract or repel at the poles. A 3-D magnetic field visualizer allows students to see iron filing surround a magnet on all sides.

GUIDING QUESTION

How can we view magnetic fields as they surround an object?

TENNESSEE STATE STANDARDS

3.PS2.1	Explain the cause and effect relationship of magnets.
3.PS2.2	Solve a problem by applying the use of the interactions between two magnets.
3.PS3.3	Evaluate how magnets cause changes in the motion and position of objects, even when the objects are not touching the magnet.
5.PS2.2	Make observations and measurements of an object's motion to provide evidence that a pattern can be used to predict future motion.
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5.ETS1.1	Research, test, re-test, and communicate a design to solve a problem.

MATERIALS INCLUDED

Iron filings boxes
Ceramic rings magnets
Wand magnets
Cow magnets
3-D magnetic field visualizers

MATERIALS PROVIDED BY TEACHER

Chart from Previous activities
Sheets of white paper

For the entire activity and materials and to reserve a Suitcase Exhibit, please call 901.636.2362.

SUITCASE EXHIBIT INVENTORY CHECKLIST

School: _____
Check Out: _____
Return Date: _____

MoSH Check In:	Teacher Check In:	Item	Books/Videos/Posters	Teacher Return:
		A	Teacher's Manual	
		B	Book: The Mystery of Magnets	
		C	Book: Magnetism and Electricity	
		D	Book: Experiments with Magnets	
		E	Book: Science with Magnets	
		F	Book: Magnet Science	

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MAGNETS & MAGNETISM:
Suitcase Program [3-5]

SUITCASE EXHIBIT INVENTORY CHECKLIST

MoSH Check In:	Teacher Check In:	Item	Materials	Teacher Return:
		1	8 Horseshoe Magnets	
		2	14 6” Steel Bar Magnets	
		3	4 - Magnet on a Blue Post Magnets	
		4	12 Wand Magnets	
		5	30 Ceramic Ring Magnets	
		6	10 Cow Magnets	
		7	45 Magnetic Balls	
		8	13 Magnetic Pole Cards (6 Green “North” Cards, 6 Red “South” Cards & 1 “Earth”)	
		9	Clear container for water with lid	
		10	5 (Magnetite) Loadstone Boxes	
		11	20 Poker Chips	
		12	8 Steel Screws	
		13	8 Brass Washers	
		14	8 Large Aluminum Nails	
		15	15 Large Galvanized Nails	
		16	8 Large Rubber Bands	
		17	12 Small Compasses	
		18	Bag of Paper Clips	
		19	80 Large Steel Washers	
		20	8 White Stone and 8 Hematite Samples	
		21	2 Spools of String	
		22	6 Rectangular Iron Filings Boxes	
		23	8 Pieces of Gold Colored Aluminum Foil	
		24	8 Pieces of Cloth	
		25	8 Pressed Wood Squares	
		26	8 Plastic Squares	
		27	5 3-D Magnetic Field Visualizers	
		28	15 Dowel Stands with 4 Magnets each	
		29	5 Ceramic Bar Magnets	
		30	4 Sets of Balance and Fulcrum Base	
		31	22 Plastic Cups	