Grade 06 - Unit 04 - Types of Interactions (njdoe Gr 6 Unit 5)

Content Area: **Science**
Course(s):
Time Period: **Generic Time Period**
Length: **20 days - Feb- March**
Status: **Published**

Stage 1: Desired Results

Unit Overview/ Rationale

Students use *cause and effect*; *system and system models*; and *stability and change* to understand ideas that explain why some materials are attracted to each other while others are not. Students apply ideas about gravitational, electrical, and magnetic forces to explain a variety of phenomena including beginning ideas about why some materials attract each other while others repel. In particular, students develop understandings that gravitational interactions are always attractive but that electrical and magnetic forces can be both attractive and negative. Students also develop ideas that objects can exert forces on each other even though the objects are not in contact, through fields. Students are expected to consider the influence of science, engineering, and technology on society and the natural world. Students are expected to demonstrate proficiency in *asking questions*, *planning and carrying out investigations*, *designing solutions*, and *engaging in argument*. Students are also expected to use these practices to demonstrate understanding of the core ideas.

Standards & Indicators

Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exertin even though the objects are not in contact. *[Clarification Statement: Examples of this phenomenon could include the interactio electrically-charged strips of tape, and electrically-charged pith balls. Examples of investigations could include first-hand experie [Assessment Boundary: Assessment is limited to electric and magnetic fields, and is limited to qualitative evidence for the existe*
Ask questions about data to determine the factors that affect the strength of electric and magnetic forces. [*Clarification State devices that use electric and magnetic forces could include electromagnets, electric motors, or generators. Examples of data cou the number of turns of wire on the strength of an electromagnet, or the effect of increasing the number or strength of magnets electric motor.] [Assessment Boundary: Assessment about questions that require quantitative answers is limited to proportional thinking.]* **(MS-PS2-3)**
Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depe interacting objects. *[Clarification Statement: Examples of evidence for arguments could include data generated from simulation charts displaying mass, strength of interaction, distance from the Sun, and orbital periods of objects within the solar system.] [A Assessment does not include Newton's Law of Gravitation or Kepler's Laws.]* **(MS-PS2-4)**

	magnetic forces.
MS-PS2-4	Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects.
MS-PS2-5	Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact.

Big Ideas - Students will understand that...

Students will conduct investigations of fields that exist between objects exerting forces on each other, even though the objects are not in contact. Through first-hand experiences or simulations, students will observe and evaluate the behavior of objects and record evidence of fields that exist and are responsible for the observed behavior of the objects. Students can investigate the interactions between magnets, electrically charged strips of tape, and/or electrically charged pith balls. Through hands-on investigations or simulations, students will be able to observe how the motion or behavior of objects change when they are exposed to electric or magnetic fields. For example, a pith ball could be suspended from a lightweight string and students can apply a charge to a balloon, comb, or plastic rod and make observations about the motion of the pith ball when these objects are placed in close proximity to the ball. The same type of investigation could be conducted with magnets or strips of electric tape. If instruction starts with students making these observations, students could then generate questions that they could use to ask questions about the cause-and-effect relationships that could explain their observations. A short research project could be conducted to provide data that students would use to help them answer their self-generated questions.

Students will investigate magnetic and electric forces to determine the nature of the force (repulsive, attractive, or both), and factors that affect the strength of the forces. Before beginning the investigations, students will generate questions that will be used to guide their investigations. Depending on the nature of their questions, students may need to cite specific textual evidence to support the generation of a hypothesis. During the investigation, students will identify cause-and-effect relationships and use their understanding of these relationships to make predictions about what would happen if a variable in the investigation were changed. They will also determine the impact of distance on the strength of a force. Investigations may include the use of electromagnets, electric motors, or generators. During these investigations, students will collect data that they will use to answer their self-generated questions.

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They will also determine the impact of distance on the strength of a force. Investigations may include the use of electromagnets, electric motors, or generators. During these investigations, students will collect data that they will use to answer their self-generated questions. Investigations can take place in the classroom, outdoor environment, or museums and other public facilities with available resources and when appropriate. Students will frame a hypothesis based on observations and scientific principles about the behavior of electromagnetic forces and carry out investigations to collect data about the factors that affect the strength of electric and magnetic forces. Examples of investigations could include the effect of the number of turns of wire on the strength of an electromagnet or the effect of increasing the number or strength of magnets on the speed of an electric motor. Students will analyze both numerical and symbolic data and use these data to determine the factors that affect the strength of electric and

magnetic fields. Students will conclude this portion of the unit by citing specific textual evidence to support the analysis of information they access while reading science and technical texts or online sources about electric and magnetic forces, attending to the precise details of explanations or descriptions.

The next portion of this unit will focus on gravitational forces. Students will construct and present oral and written arguments using evidence to support the claim that gravitational interactions are always attractive and depend on the masses of interacting objects. Students will also understand that there is gravitational force between any two masses, but it is very small except when one or both of the objects have large mass. Because of this, gravitational fields will only be observed through the observation of simulations, the use of models, or the analysis of data. These could include simulations or digital tools and charts displaying mass, strength of interactions, distance from the sun, and orbital periods of objects within the solar system. Models used need to represent gravitational interactions between two masses within and between systems.

Essential Questions - What provocative questions will foster inquiry and transfer of learning

Is it possible to exert on an object without touching it?

Can you apply a force on something without touching it?

If I were able to eliminate air resistance and dropped a feather and a hammer at the same time, which would land first?

Content - Students will know...

- Fields exist between objects that exert forces on each other even though the objects are not in contact.
- The interactions of magnets, electrically charged strips of tape, and electrically charged pith balls are examples of fields that exist between objects exerting forces on each other, even though the objects are not in contact.
- Forces that act at a distance (electric, magnetic, and gravitational) can be explained by fields that extend through space and can be mapped by their effect on a test object (a charged object or a ball, respectively).
- Cause-and-effect relationships may be used to predict phenomena in natural or designed systems.
- Factors affect the strength of electric and magnetic forces.

- Devices that use electric and magnetic forces could include electromagnets, electric motors, and generators.
- Electric and magnetic (electromagnetic) forces can be attractive or repulsive.
- The size of an electric or magnetic (electromagnetic) force depends on the magnitudes of the charges, currents, or magnetic strengths involved and on the distances between the interacting objects.
- Cause-and-effect relationships may be used to predict the factors that affect the strength of electrical and magnetic forces in natural or designed systems
- Gravitational interactions are always attractive and depend on the masses of interacting objects.
- There is a gravitational force between any two masses, but it is very small except when one or both of the objects have large mass.
- Evidence supporting the claim that gravitational interactions are attractive and depend on the masses of interacting objects could include data generated from simulations or digital tools and charts displaying mass, strength of interaction, distance from the sun, and orbital periods of objects within the solar system.

Skills - Students will be able to...

- Students will conduct an investigation and evaluate an experimental design to produce data that can serve as the basis for evidence that fields exist between objects exerting forces on each other even though the objects are not in contact.
- Students will identify the cause-and-effect relationships between fields that exist between objects and the behavior of the objects.
- Students will ask questions about data to determine the effect of the strength of electric and magnetic forces that can be investigated within the scope of the classroom, outdoor environment, and museums and other public facilities with available resources and, when appropriate, frame a hypothesis based on observations and scientific principles.
- Students will perform investigations using devices that use electromagnetic forces.
- Students will collect and analyze data that could include the effect of the number of turns of wire on the strength of an electromagnet or the effect of increasing the number or strength of magnets on the speed of an electric motor.
- Students construct and present oral and written arguments supported by empirical evidence and scientific reasoning to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects.
- Students use models to represent the gravitational interactions between two masses.

Stage 2: Assessment Evidence

Assessment

Glencoe Chapter quizzes and assessments including the following:

Chapter 15

Chapter 17

Chapter 19

Chapter 20

End of Unit assessments (multiple choice and constructed responses)

Mini Lab Performance based assessments (rubrics)

Essential Question Responses

Page Keeley Science Probes (formative assessments)

Performance Assessment: Can you identify the mass of a soda can on each planet?

Stage 3: Learning Plan

Learning Activities

Academic vocabulary activities: journals, e-flash cards, puzzles, origins, word parts, e-games

Mini-labs (student engagement)

Launch labs (teacher demo)

Inquiry labs (use of inquiry skills)

Interactive technology: classroom presentations, science videos, transparencies, visual literacy models, whiteboard

Reading Strategies: make tables, guiding questions, organize ideas, illustrate ideas, quick answers, make lists, make outlines, infer meaning, compare and contrast

Electromagnetic Power! Students investigate the characteristics of electromagnetism and then use what they learn to plan and conduct an experiment on electromagnets.

Inspector Detector Challenge: Students use the engineering design process to design and build magnetic-field detectors, and use them to find hidden magnets. Parallels are drawn to real-world NASA missions and how NASA scientists use magnetic field data from planets and moons. The website has video clips, teaching suggestions, a student handout, and a link to the pdf of the Teacher's Guide for Mission: Solar System. The Inspector Detector challenge is a series of activities that form a unit in the Mission: Solar System collection. * NOTE: The Teacher's Guide does not contain the lesson plan. You will need to click on the Student Handout heading of the website to download the "Inspector Detector Challenge Leader's Notes". Or you can go to the Design Squad webpage

Modifications for all students:

- Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community.
- Provide students with multiple choices for how they can represent their understandings (e.g. multisensory techniques-auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling).
- Provide opportunities for students to connect with people of similar backgrounds (e.g. conversations via digital tool such as SKYPE, experts from the community helping with a project, journal articles, and biographies).
- Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences).
- Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings.
- Use project-based science learning to connect science with observable phenomena.
- Structure the learning around explaining or solving a social or community-based issue.
- Provide ELL students with multiple literacy strategies.
- Collaborate with after-school programs or clubs to extend learning opportunities.

Accommodations for students with IEPs and learning difficulties:

-visual sentence frames using academic vocabulary for discussion

-graphic organizers and sentence starters

-graphic organizers for comparing and contrasting 3 types of rocks

-Model using examples of rocks to classify according to characteristics

-Model the structure and layers of the Earth by using a diagram

-Use visuals to show important vocabulary for students to make connections

-Draw pictures for vocabulary words for visual learners

-Have students share their text to text, text to world, and text to self connections

-One on one teacher support for comprehension and fluency

- Modeling and scaffolding to highlight specific vocabulary and key concepts

-close reading chapters/chunks

-rereading key sections for fluency and comprehension

-colored overylays and reading windows to reduce visual distractions

-Sentence starters for writing assignments

-Vocabulary word banks and strategies (Say it, Define it, Act it)

-Think alouds and Think-Pair-Share

-Modified tests/quizzes

-Use of technology to allow students to be read the text, allow for highlighter use, and stop students to think about key ideas/concepts

-Closed notes packet

For ELL students:

-visuals for vocabulary

-word wall

-additional word work such as illustrating vocabulary and playing vocabulary games

-partner reading

-choral reading

-Think-aloud while modeling writing

-analyze sample summaries before writing

-color-coded sticky notes for close reading to identify which sticky notes pertain to vocabulary

-questions about text, etc.

-When students make an error in speaking, answer or restate what they said using the correct form without drawing attention to the mistake.

For gifted students:

-Have students complete extended research projects on a related issue of their choice as it pertains to a content area

-Students perform a written/oral presentation to describe in detail the layers of the Earth and present to classmates.

-Students classify rocks according to classification, do extensive research and explain how we use those rocks in our everyday life.

Resources

Glencoe Earth and Space iScience, McGraw Hill, 2012

Chapter 15

Chapter 17

Chapter 19

Chapter 20

Paige Keeley Science Probes

Brain POP shorts

Various literature selections connected to science topis

Various video clips connected to science topics

ConnectEd.Mcgraw-hill.com resources

NJDOE Model Curriculum

Quizlet.com

Padlet.com

ebackpack.com

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Unit Reflections & Teacher Notes