

Educational Resources from *Phenomenon Science Education*
Student Proficiency Goals for **NGSS MS-PS2-4**



Information about MS-PS2-4

NGSS Performance Expectation 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.**

Clarification Statement.

Examples of evidence for arguments 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.

Assessment Limits.

Assessment does not include Newton's Law of Gravitation or Kepler's Laws.

Science and Engineering Practice (Engaging in Argument from Evidence)

- Construct and present oral and written arguments supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem.

Disciplinary Core Idea (PS2.B: Types of Interactions)

- Gravitational forces are always attractive. 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—e.g., Earth and the sun.

Crosscutting Concept (Systems and System Models)

- Models can be used to represent systems and their interactions—such as inputs, processes and outputs—and energy and matter flows within systems.

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Student Proficiency Goals

SEP (Engaging in Argument from Evidence):

- Students identify and describe a claim related to a phenomenon, or a model of the phenomenon, that is an example of the idea that gravitational forces are always attractive.
- Students identify and describe a claim related to a phenomenon, or a model of the phenomenon, that is an example of the idea that gravitational forces depend on the masses of the objects.
- Students identify and describe evidence that can support or refute the claims.
- Students collect evidence that supports or refutes the claims.
- Students identify scientific reasoning that supports or refutes the claims.
- Students identify strengths and weaknesses in the collected evidence including the type of source the evidence came from, the validity and reliability of the evidence, and the ability of the evidence to support each identified claim.
- Students use reasoning to link the collected evidence to their claims.
- Students construct and present written arguments that support or refute explanations for a phenomenon or a model of a phenomenon.
- Students construct and present oral arguments to support or refute explanations for a phenomenon or a model of a phenomenon.

DCI (PS2.B Types of Interactions):

- Students know that gravitational forces are always attractive.
- Students know that there is a gravitational force between any two objects that have mass.
- Students know that the gravitational force between two objects depends on the masses of those objects.
- Students know that the gravitational force between two objects is very small unless one or both of the objects have a large mass.

CCC (Systems and System Models):

- Students consider the system of two objects involved in a gravitational force.
- Students use models to represent and describe systems of two objects involved in a gravitational force.
- Students consider the masses of objects and use models to represent the gravitational forces between them.