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| <p>Lesson Topic: Gravity and The Birth of Our Solar System</p> |
| <p>Objective: Students will be able to:</p> <ol style="list-style-type: none"> 1. Understand how the solar system was formed. 2. Describe how the force of gravity acts between objects. 3. Describe the basic structure of the solar system. 4. Relate the Nebular theory to the formation of the solar system. |
| <p>Time Required: 80 minutes</p> |
| <p>Materials Needed:</p> <ul style="list-style-type: none"> ● Teacher computer with internet access ● Projector/Smartboard ● 1 computer/laptop/iPad per student with internet access ● Nebular Theory handout (attached) |
| <p>Teacher Preparation:</p> <ul style="list-style-type: none"> ● Assign a Legends of Learning Instructional Quick Play playlist for the day(s) you will be teaching the lesson. <ul style="list-style-type: none"> ○ Instructional - Middle School - Gravity and The Birth of Our Solar System ● Assign a Legends of Learning Content Review Quick Play playlist for the day(s) you will be teaching the lesson. <ul style="list-style-type: none"> ○ Content Review - Middle School - Gravity and The Birth of Our Solar System ● Have the legends of learning game <i>Solar Nebula</i>, found in the Gravity and the Birth of Our Solar System learning objective, ready to show on the projector/Smartboard |
| <p>Engage (10 minutes):</p> <ol style="list-style-type: none"> 1. On the projector/Smartboard show the legends of learning game Solar Nebula. 2. Demonstrate the game for the class. As the game progresses, the students think about the following questions with a partner. <ol style="list-style-type: none"> a. How does this game show gravity at work? <ol style="list-style-type: none"> i. <i>The particles are attracted to one another.</i> b. At the start of the game the particles must be moved closer to one another in order for gravity to work. What does this tell you about gravity early on in the game? <ol style="list-style-type: none"> i. <i>Gravity is very weak at the start of the game.</i> c. As the particles are moved closer to one another what happens to the force of gravity? <ol style="list-style-type: none"> i. <i>The force of gravity increases as the particles move closer to one another.</i> d. As the game progresses the force of gravity continually increases. Why do you think this is happening? <ol style="list-style-type: none"> i. <i>The mass of the objects keeps increasing which increases the force of gravity.</i> 3. Throughout the game questions will pop up. Have the class participate to see if they can answer the questions as a group. 4. Explain to the class that in this lesson they will learn about the role gravity played in the formation of the solar system. |

Explore (30 minutes):

1. Have your students [sign in to Legends of Learning](#). Instruct students to complete the Instructional playlist.
2. As students complete the assigned game, students should fill out the Nebular Theory worksheet.
3. Assist students as needed during game play, pause playlist if you need to address content or questions to the entire class.

Explain (20 minutes):

1. Review the Nebular Theory & Gravity: Forming a Solar System worksheet by drawing the diagrams on the board/Smartboard.
 - a. Focus on the effect that gravity played on each stage.
 - b. Ask students to predict what would happen to the formation of a galaxy if there was less mass available or the matter was further apart.
 - i. Have the students discuss this question with small groups and then discuss it as a class.

Elaborate (10 minutes):

1. Much of what we know about the universe and solar system is from data that was collected by astronomers; who have the job of studying celestial bodies.
2. Today, most of these jobs are run by universities, governments, and some private industries. However, in the past it was much more complicated to be an astronomer.
3. Show the studies the TED Ed video [Tycho Brahe, the scandalous astronomer](#).
4. Ask students to name the complications that an astronomer from this time period could have had that was independent of the technology that they were using.

Evaluate (10 minutes):

1. Have your students [sign in to Legends of Learning](#). Instruct students to complete the Content Review playlist.
2. [Analyze student results](#) to determine what concepts need to be a focus for reteaching.

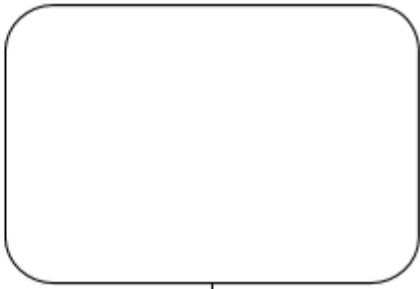
Additional Lesson Strategies:

- To use Legends for additional instruction, create a [custom playlist](#) with an [instructional game](#) and pre and post [assessment](#).
- To use Legends for a quick formative assessment, create a 5-question [assessment](#) in a [playlist](#).
- To use Legends for a student-directed experience, create a [targeted freeplay](#) playlist.
- Encourage students to play on their own at home in [Legends of Learning: Awakening](#) for a student-driven experience including avatars, battling, and quests all centered around topics they are covering in class.

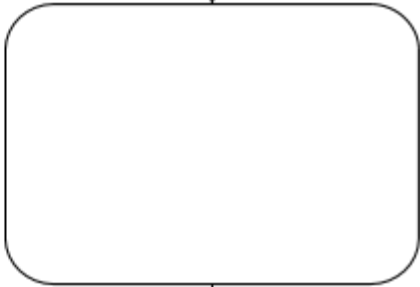
Nebular Theory & Gravity: Forming a Solar System

Name / Pd: _____

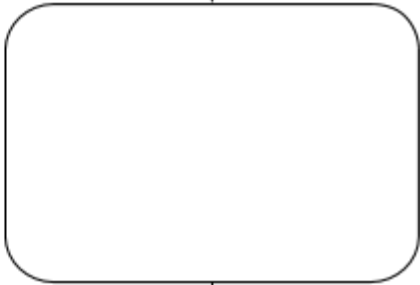
Directions: While playing the game in Legends of Learning, use what you learn to complete the diagram. For each stage, draw a diagram of how the matter is arranged and what part gravity played in creating the next stage.

**Nebular
Theory****Solar Nebular**

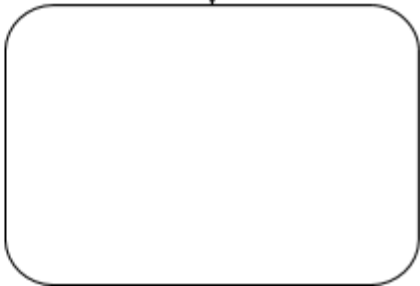
What took place / gravity's roles:

**Formation of the Sun**

What took place / gravity's roles:

**Accretion of Planets**

What took place / gravity's roles:

**Death of a Star/Sun**

What took place / gravity's roles: