Learning Objective: Gravity and The Birth of Our Solar System

NGSS Standard: (MS-ESS1.B-3)The solar system appears to have formed from a disk of dust and gas, drawn together by gravity.

Objective:
Students will be able to:

1. Understand how they 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.

Time Required: 90 minutes

Materials Needed:

- Teacher computer with internet access
- Projector/Smartboard
- 1 computer/laptop/iPad per student with internet access
- Structure of Our Solar System handout (attached)

Teacher Preparation:

- Create Playlist 1, a 40 minute playlist in Legends of Learning with the following games found in the Gravity and the Birth of Our Solar System learning objective (in order):
  - *Explore: My Space Ride*
  - *Gravity and the Birth of our Solar System*
- Create Playlist 2, a 10 minute playlist in Legends of Learning with 5 assessment questions from the Gravity and the Birth of Our Solar System learning objective
- Have the legends of learning game *Solar Nebula*, found in the Gravity and the Birth of Our Solar System learning objective, ready to show on the projector/Smartboard

Engage (10 minutes):

1. On the projector/Smartboard show the legends of learning game *Solar Nebula*.
2. Demonstrate the game for the class. As the game progresses have the students think about the following questions with a partner.
   a. How does this game show gravity at work?
      i. *The particles are attracted to one another.*
   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?
      i. *Gravity is very weak at the start of the game.*
   c. As the particles are moved closer to one another what happens to the force of gravity?
      i. *The force of gravity increases as the particles move closer to one another.*
   d. As the game progresses the force of gravity continually increases. Why do you think this is happening?
      i. *The mass of the objects keeps increasing which increases the force of gravity.*
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 (40 minutes):

1. Have your students sign in to Legends of Learning and enter your teacher code.
2. Launch Playlist 1 to your students.
3. As students complete *Explore: My Space Ride*, students should fill out the Structure of Our Solar System worksheet. Students will be completing the first side of this worksheet with this game.
4. Assist students as needed during game play, pause playlist if you need to address content or questions to entire class.
5. Students will then move onto the second game *Gravity and the Birth of our Solar System*. As students play the game they should complete the Nebular Theory & Gravity: Forming a Solar System worksheet.
6. Assist students as needed during game play, pause playlist if you need to address content or questions to entire class.

Explain (20 minutes):

1. Review answers to the Structure of Our Solar System handout by drawing diagrams on board or using Smartboard.
    a. Point out that Pluto is no longer a planet because of its orbit and size.
    b. Also show students that the planets are split up into two categories: rocky planets and gas giants. Draw a line between them on your diagram and have students do the same on theirs.
2. Next, 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 their was less mess 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):

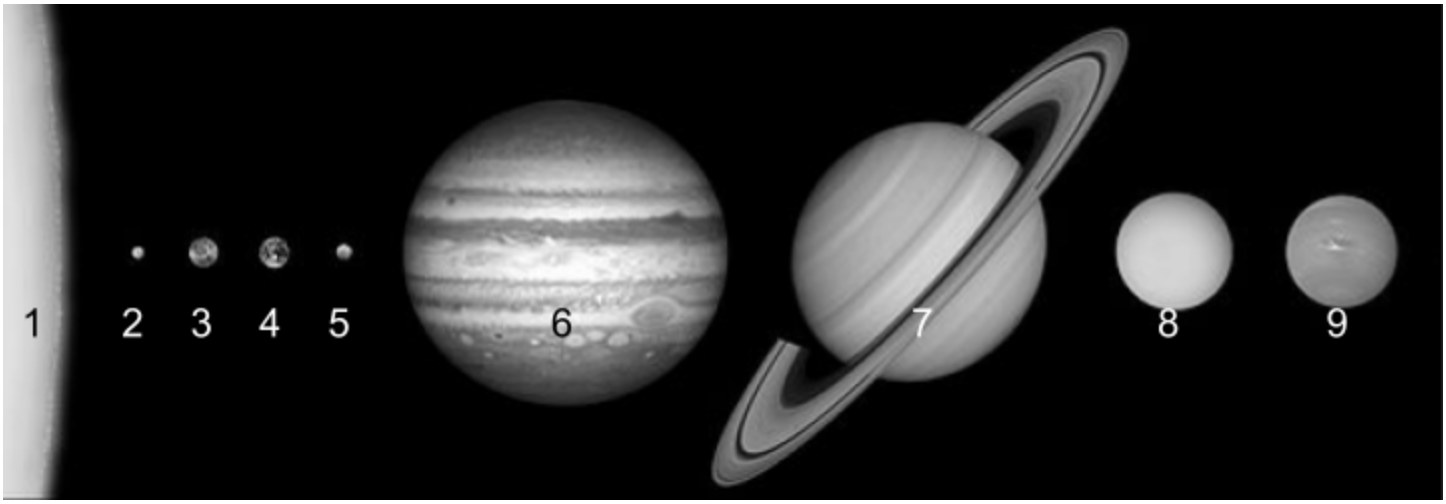
1. Much of what we know about the universe and solar system is from data that was collected by astronomers; who have the job of studying celestial bodies.
2. Today, most of these jobs are run by universities, governments, and some private industries. However, in the past it was much more complicated 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. Launch Playlist 2 to your students. When they finish the assessment questions, any time left is freeplay.
2. Analyze student results to determine what concepts need to be a focus for reteaching.

Structure of Our Solar System Name / Pd: _____

Directions: While playing the first game in Legends of Learning called *Explore: My Space Ride*, use what you learn to complete the diagram. For each planet, also list one interesting fact.



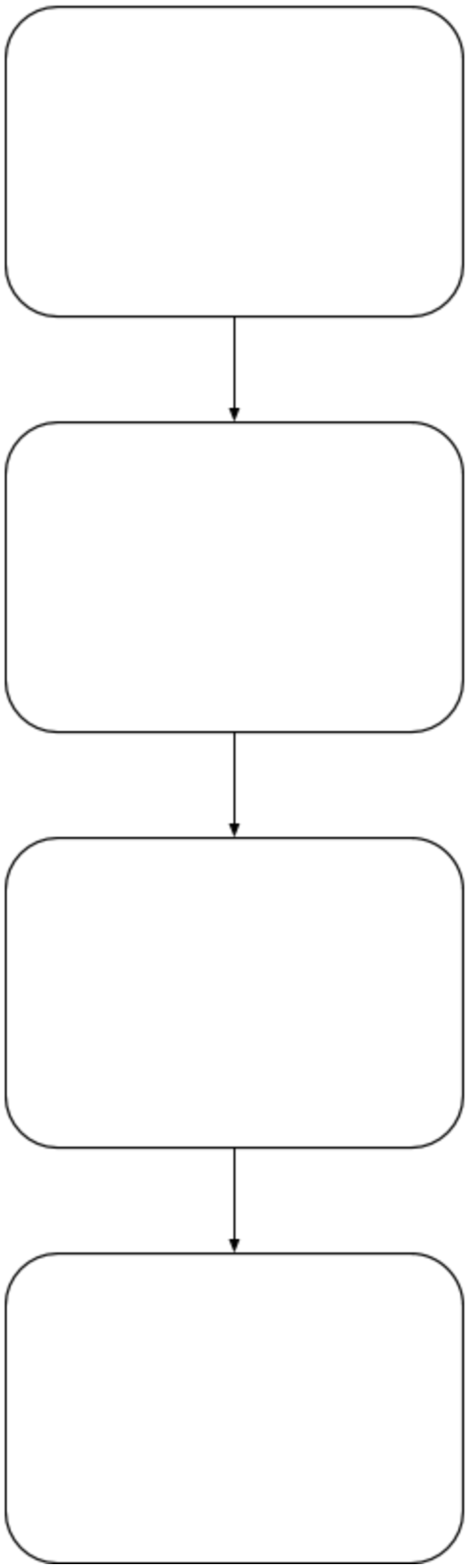
Planet/Celestial Body	Interesting Fact
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	

10. Think about it: Why do you think Pluto was not included on the tour?

Nebular Theory & Gravity: Forming a Solar System Name / Pd: _____

Directions: While playing the second game in Legends of Learning called *Gravity and the Birth of our Solar System*, 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: