**Lesson Topic:** The Milky Way Galaxy and Other Galaxies

**Objective:**
Students will be able to:

1. Explain how galaxies are held together through gravity
2. Explain how scientists use telescopes to understand galaxies
3. Identify different types of galaxies

**Time Required:** 60 minutes

**Materials Needed:**

- 1 computer/laptop/iPad per student with internet access
- 1 teacher computer and projector with internet access
- 1 set of galaxy images per 2-3 students
- Galaxy handout (attached)

**Teacher Preparation:**

- Assign a Legends of Learning Instructional Quick Play playlist for the day(s) you will be teaching the lesson.
    - Instructional - Middle School - The Milky Way Galaxy and Other Galaxies
- Assign a Legends of Learning Content Review Quick Play playlist for the day(s) you will be teaching the lesson.
    - Content Review - Middle School - The Milky Way Galaxy and Other Galaxies
- Copy Galaxies handout (attached)
- Collect colored images of various galaxies from NASA website and print for each group (2-3 students) trying to represent major types of galaxies.

**Engage (5 mins):**

1. Group students into small groups of 2-3 individuals.
2. Give them a set of images from NASA of different galaxies.
3. Have student groups use inductive reasoning skills to group galaxies based on what they see. Move around to each group and ask them to justify why certain images were grouped together. Students can also ‘name’ their groups according to their own observations.
4. Once students have determined their groupings, explain that scientists do group galaxies and that they will be learning about each type of group. Ask students probing questions to determine what they already know such as: “Do you know any galaxies?”, “What galaxy do we live in?”, “How can scientists study objects so far away?”, “How far away from Earth have humans actually been?”, “How far from the Earth have we been able to send a spacecraft to take images?”

**Explore (25 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 Galaxies Handout.

3. Assist students as needed during game play, pause playlist if you need to address content or questions to the entire class.

**Explain (10 minutes):**

1. Review answers to the Galaxies Handout by going over them aloud to make sure all students have correct information.
2. Go back to the original images. Have students re-group images according to correct labels. Discuss which galaxy we live in and what type it is. Probe students to think about how we know about the Milky Way when we can't directly photograph it. This would be a great time to reiterate that we have never sent a spacecraft further out than our own solar system to take pictures and images (which is a misconception for many students).

**Elaborate (5 minutes):**

1. Show the following SciShow video to explain how we know what the Milky Way looks like: **How Do We Know What the Milky Way Looks Like?**

**Evaluate (15 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.

Name: _____ Date: _____

The Milky Way and Other Galaxies

**Directions:** While playing the first game in Legends of Learning, use what you learn to complete the diagrams and answer the questions below.

1. Where is the Hubble telescope located? Why is its location so important?

_____

_____

2. What two factors cause the Earth to orbit around the Sun instead of crashing into it or moving away from it?

_____

3. Using that information what can you infer about the rotation of our own galaxy, the Milky Way, around its central point?

_____

_____

4. What wavelengths of electromagnetic radiation do telescopes use to obtain images of other galaxies?

_____

5. How can scientists use the color of a star to understand its lifespan?

_____

_____

_____

6. Draw the three primary types of galaxies

| Spiral Galaxy | Elliptical Galaxy | Irregular Galaxy |
|---|---|---|
| | | |

7. A _____ is a structure that consists of anywhere from hundreds to thousands of galaxies that are bound together by gravity.

8. Clusters of galaxies are grouped together to form _____. They contain dozens of individual clusters throughout an area of space about 150 million light-years across.

9. The _____ is a spherical region of the universe comprised of all matter that can be observed from Earth at the present time. There are at least two trillion _____ within it.

10. Which type of galaxy is the most common in the universe? _____

11. Which type of galaxy containers older, lower mass stars? _____

12. What type of galaxy will likely be formed when Andromeda and the Milky Way Collide?_____

13. What is responsible for holding together each galaxy? _____

14. How large is the Milky Way in terms of light years? _____

15. If you could travel at the speed of light, how many years would it take you to cross the Milky Way? _____

16. What type of materials make up a galaxy? _____
_____