**Lesson Topic:** Electromagnetic Waves Vs. Mechanical Waves

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

1. Explain the difference between Electromagnetic and Mechanical Waves.
2. Identify examples of each of the waves.
3. Create their own body waves to simulate the different waves.

**Time Required:** 75 minutes

**Materials Needed:**

- Teacher computer with internet access
- Projector/Smartboard
- 1 computer/laptop/iPad per student with internet access
- Electromagnetic Waves Vs. Mechanical Waves handout (attached)
- Video: Mechanical Waves vs. Electromagnetic Waves
- Slinky (1per group)
- Around 10 dominoes (1 set per group)
- Piece of rope/string/yarn (1 per group)

**Teacher Preparation:**

- Assign a Legends of Learning Instructional Quick Play playlist for the day(s) you will be teaching the lesson.
    - Instructional - Middle School - Electromagnetic Waves Vs. Mechanical Waves
- Assign a Legends of Learning Content Review Quick Play playlist for the day(s) you will be teaching the lesson.
    - Content Review - Middle School - Electromagnetic Waves Vs. Mechanical Waves
- Make copies of Electromagnetic Waves Vs. Mechanical Waves Worksheet (1 per student)

**Engage (20 minutes):**

1. Have your students sign in to Legends of Learning. Instruct students to complete the Instructional playlist.
2. Assist students as needed during game play, pause playlist if you need to address content or questions to the entire class.

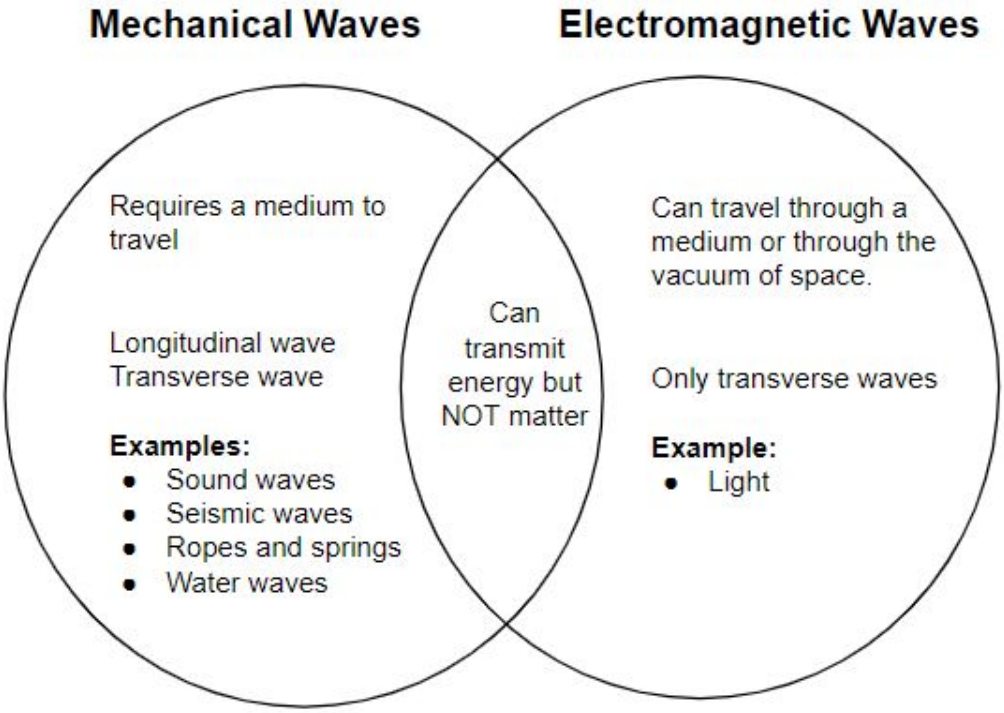
**Explore (10 minutes):**

1. Have students get into small groups or partners.
2. Write on the board:
    a. Transverse waves - particles move perpendicular to the direction the wave travels
    b. Longitudinal waves - particles move in the same direction as the waves travels
3. Pass out the Electromagnetic Waves Vs. Mechanical Waves handout.
4. Tell students “In a moment, I am going to give your group/partnership a slinky, a bunch of dominoes and a small piece of rope (or string/yarn etc). Using what you

know about waves, experiment with these items and see what kind of waves you can make with them. Fill in the chart on your handout as you work."
5. Give students time to explore with the items.
6. When students finish, tell them we will be discussing their outcomes later in class.

**Explain (15 minutes):**

1. Tell students "We are going to watch a video. As you watch, I want you to fill in what you can about the different waves."
2. Play the video
    a. Pause the video as needed to allow students time to fill in the handout with definitions of each type of wave.
3. After the video, go through the answers to the handout.
4. Draw the following Venn Diagram on the board for students to fill in on their handout.




    a.
5. Tell students "Looking back at our activity with the slinkies, dominoes and rope, which items could model electromagnetic waves?" (slinky and rope) mechanical waves? (Slinky and the dominoes)
    a. What about the slinky made it the easiest to work with? (With it being a spring, it can move in many directions).
    b. What was limiting about the rope and the dominoes? (They really only had one way to move and experiment with).

**Elaborate (20 minutes):**

1. Briefly review the types of waves.
2. Write the following on the board:
    a. Transverse Wave - particles move in the perpendicular direction that the wave travels.

b. Longitudinal Wave - particles move in the same direction as the wave travels.

3. Ask students “What are the different types of waves?” (longitudinal and transverse, mention electromagnetic and mechanical).
4. Break the class into two or three groups
5. Have all groups stand in a circle with their right shoulders facing the middle of the circle.
6. Tell students “Your goal is to work together to create a transverse wave and then come up with a longitudinal wave. Be prepared to explain why each of your waves qualifies as a transverse and longitudinal wave.”
7. Give students time (5-10 mins) to discuss and choreograph their wave.
8. After enough time, have each group perform their waves.
    a. The waves can be simple:
        i. Transverse = each student waving their arms up and down one at a time in the circle.
        ii. Longitudinal = gently pushing/nudging the person next to them in the circle.
9. As each group finishes one of their waves ask, “How is this a transverse/longitudinal wave?”

**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.

Name:_____

# Electromagnetic Waves Vs. Mechanical Waves

In the chart below, place an X in the box if you were able to create the wave using each material.

| | **Transverse Waves** | **Longitudinal Waves** |
|---|---|---|
| **Slinky** | | |
| **Rope** | | |
| **Dominoes** | | |

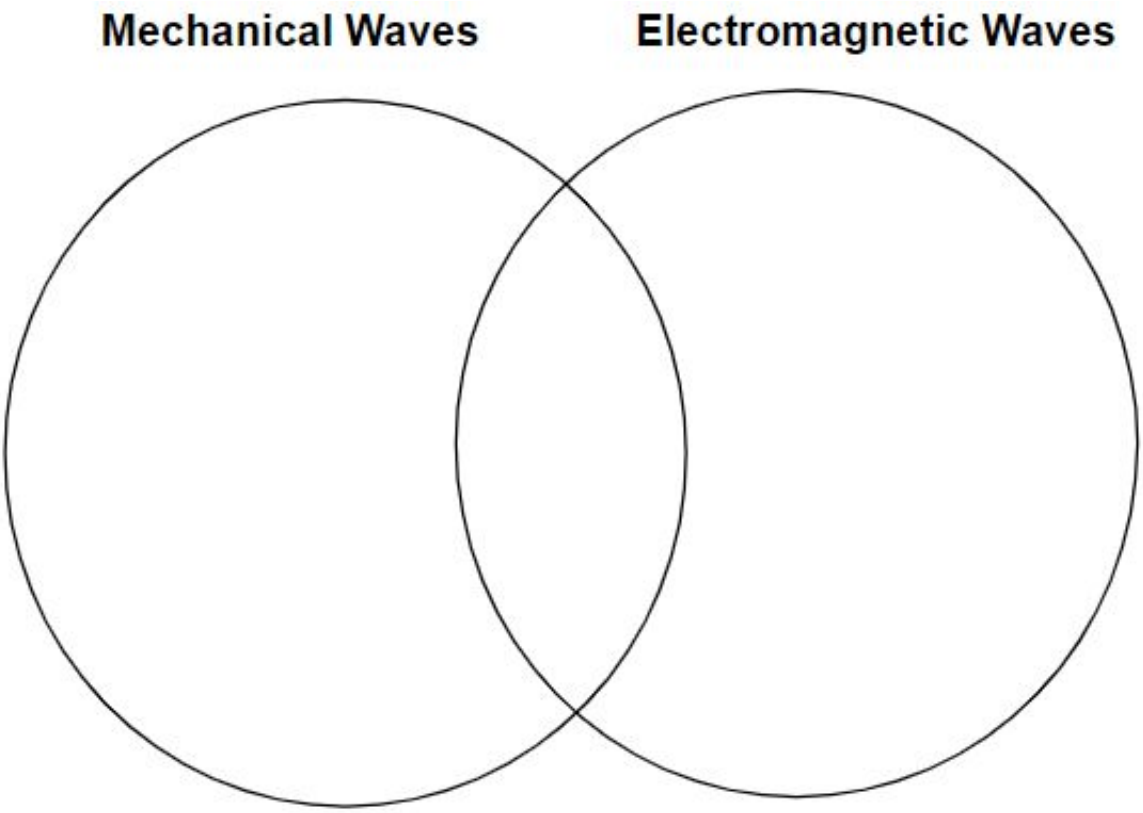
Electromagnetic Wave -

Mechanical Wave -

Transverse Wave -

Longitudinal Wave -

Complete the Venn Diagram.



Name:_____

# Electromagnetic Waves Vs. Mechanical Waves

In the chart below, place an X in the box if you were able to create the wave using each material.

| | **Transverse Waves** | **Longitudinal Waves** |
|---|---|---|
| **Slinky** | X | X |
| **Rope** | X | |
| **Dominoes** | | X |

Electromagnetic Wave - can travel through a medium or through the vacuum of space, can only be transverse

Mechanical Wave - Requires a medium to travel, can be transverse or longitudinal

Transverse Wave - particles move in the perpendicular direction that the wave travels.

Longitudinal Wave - particles move in the same direction as the wave travels

Complete the Venn Diagram.