**Lesson Plan for Inertial Reference Frame PhET-Like Simulation**

**Learning Goals:**

1. Identify whether or not a reference frame is an inertial reference frame.
2. Determine whether the physics depicted in two different reference frames are the same or not.

**Background:**

This lesson should be taught after students have learned about the basic kinematic equations of motion. Students should have a firm understanding of basic algebra and be able to calculate the difference between quantities such as velocity, distance, and time. Students do not need to understand drag/air resistance and related calculations.

**Introduction:**

A user’s manual for the simulation can be found at https://nerdydandaman.github.io/. Teachers should introduce their students to the concept of reference frames and teach them the difference between inertial and non-inertial reference frames.

**Lesson Notes and Ideas:**

Teachers should instruct students as to where to find the simulation, and hand out the worksheet, which contains instructions on how to use the simulation and questions to guide the student’s learning.

Once a majority of the class have completed the first section, stop them for a brief intermission. Introduce some basic situations that can be viewed through two different reference frames and have a short vote by raise of hands asking whether the physics displayed is the same in each frame. Provide examples of scenarios that are the same between two frames to help develop student’s instincts on what constitutes an inertial reference frame.

**Post-Lesson**

1. Task students with creating a situation that can be viewed from two different inertial-reference frames. Ask them to provide a basic kinematic calculation proving the same event is happening in the frames. Ask them to think of an example of how the frame could become a non-inertial reference frame.
2. Hold a brief discussion about the uses of reference frames throughout physics and how students may utilize the concept in their later studies, potentially discussing their utility in classical mechanics, or their importance in relativity. Ask students for examples of topics in physics that might rely on reference frames.