Setting Up the WSPR Board and Antenna

Lesson Overview	The purpose of this lesson will be to introduce the WSPR project and to set up the WSPR and board and antenna so that signals can be received.
Lesson Objectives	Students will: • understand the concept of invisible radio waves. • understand that radio signal strength is determined by the power that is used to generate the signal. • understand the unique nature of the low power signals used by the WSPR project. • understand the need for an antenna to receive the WSPR signals. • be able to calculate the optimal length of antenna and ground wires as related to the WSPR band that they will be receiving. • be able to connect the antenna and ground wires to the WSPR board. • be able to adjust the position of the antenna for optimum reception of WSPR signals. • be able to check the WSPR web site to determine if they are "catching" any WSPR signals.
National Content Standards Addressed (From the National Academy of Sciences)	Content Standard A: Science as Inquiry • Use technology and mathematics to improve investigations and communications. • Formulate and revise scientific explanations and models using logic and evidence. • Recognize and analyze alternative explanations and models. Content Standard B: Physical Science-Interactions of Energy and Matter • Waves, including sound and seismic waves, waves on water, and light waves, have energy and can transfer energy when they interact with matter.

	• Electromagnetic waves result when a charged object is accelerated or decelerated. Electromagnetic waves include radio waves (the longest wavelength), microwaves, infrared radiation (radiant heat), visible light, ultraviolet radiation, x-rays, and gamma rays. The energy of electromagnetic waves is carried in packets whose magnitude is inversely proportional to the wavelength. Content Standard E: Science and Technology • Creativity, imagination, and a good knowledge base are all required in the work of science and engineering.
Suggested Grade Level(s)	High School or Middle School depending on the level of complexity presented.
Suggested Time Frame	1-2 class sessions
Prerequisite Skills and Knowledge	An understanding of the WSPR project; the concept of invisible radio waves; the difference between audible and inaudible signals; an understanding of power levels used to generate signals and how that affects the distance that radio waves travel; an understanding of how the earth's atmosphere and sun activity affects radio waves.
Materials and Equipment	• Computer with Internet connection (WSPR software should be downloaded and installed on the computer before beginning this lesson). A means to display the computer screen to the entire class would be very helpful. • WSPR board (20 meter or 30 meter band) • Antenna and ground wires (the wires can be cut to the preferred length before the lesson or can be cut during the lesson when the optimal length has been calculated as part of the lesson)
Introduction	• Remind students of the previous lesson(s) where the WSPR project was introduced and the prerequisite knowledge of radio waves and signal strength. • Discuss the various parts of the WSPR receiver (the

	use of a picture of the WSPR board that can be displayed to the entire class is helpful here as the parts are small. Alternatively, students can be given a worksheet with the picture of the board.) • Discuss the frequency band (20 or 30 meter) that is being used by your particular WSPR receiver • Discuss the reasons for using different bands
Set up the WSPR Board, Antenna and Ground Wire	• Connect the WSPR board to the computer's sound card and to the power source (either the USB port or electrical outlet). Check to see that the green LED is lit to show that the board is receiving power • Calculate the optimal length of the antenna and ground wires • Cut the two wires, or use those purchased with the board • Attach the antenna and ground wires to the WSPR board • Discuss the need for an antenna to receive radio signals and why it is best to have a ground wire. • Determine where the best placement of the antenna should be. • Go to WSPRnet.org and create a user name and password. Provide a name so that your school/classroom can be recognized on the site. (You do not have to be a licensed HAM radio operator to use the site as you are not transmitting. Choose a name that makes sense to you and that is not too long or complicated.) • Look at the WSPR website and check to see if you have had any "catches" where your school/classroom name appears and determine where those WSPR signals are being generated.
Conclusion	• Review the concepts of radio waves, audible and inaudible signals, power used to generate signals and signal strength, frequency bands, the need for antenna and ground wires • Review the steps that were taken to set up the WSPR receiver, antenna and ground wires. • Review the WSPR website and the "catches" that you have received. Determine the power used to

	generate the WSPR signal of each of the sites.
Possible Homework	• Have the students calculate the distances between your location and the WSPR transmitters.
Teacher Resources	• http://wsprnet.org/drupal/ • http://stellarwspr.com/