

# *GEODESY AND NAVIGATION*



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**MIT**  
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# Introduction

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In this unit on geodesy, students will explore the problem of defining a universal time system and a stationary reference frame within the universe, followed by a study of data gathering and processing methods. The next layer in the unit is a set of discussions, labs, and activities centered on three geodetic techniques: very long baseline interferometry, global positioning system, and satellite laser ranging. Students will study and experiment with these techniques by using simplified methods and instruments like a simple acoustic interferometer to apply their knowledge of fundamental physics concepts to geodesy. Lastly, students will investigate the applications of geodetic techniques as it relates to tectonic plate movement, post-glacial rebound, and interstellar travel.

The primary goal of these lessons is to function as interjection lessons for a physics class but they can be taught as a unit for astronomy or earth science classes. Physics teachers may choose which labs, activities, and discussions are most useful for the instruction and enrichment of standard physical principles and employ them without disrupting their overall curriculum or objectives. Therefore, these lessons are organized by physical principles with the aim of enriching a physics curriculum. The following is the breakdown of these lessons:

1. Intro to Science
  - Measurement - Powers of 10
  - Reckoning of Time
  - Measuring and Determining Spatial Reference Frames
  - Gathering/Processing Data
2. Kinematics
  - VLBI - Acoustic Interferometer
  - GPS - Relative Motion of Cities
  - SLR - Measuring Earth
3. Forces
  - Tectonic Plate Movement
  - Post-Glacial Rebound
4. Energy
  - Interstellar Travel

These can be used throughout the year as a continuous enrichment of your curriculum. Alternatively, you can use parts or all of these since each can function as a standalone lesson. Each of the lessons has notes and background information, but depending on the lesson, you might have to refer to a previous lesson for more information on the topic.

Frequently, physics teachers will be asked “why is this important?” or “when is this really used?” Therefore, this unit will allow teachers to not only teach physics principles, but have them also relate to current research. Sometimes students learn about science as a history lesson, but the reality is that science is a changing and dynamic field where our understanding of ourselves and the world around us changes as we collect more data. Through this unit, the students can learn about current research being done and endeavors for future research that could further changes in science.

We hope you find these lessons informative and enriching to your curriculum. Please let us know your thoughts or suggestions if you use them.

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