Student handout

In this unit, you will explore the classical mechanics of central forces, especially gravitational orbits like the earth going around the sun.

Motivating Questions

- What shapes can the orbits have?
- What are Kepler's laws and why are they true?
- What is an effective potential diagram and how can it be used to predict the shape of an orbit?

Key Activities/Problems

- Problem: Undo Formulas for Center of Mass (Geometry)
- Activity: Acting Out Effective Potentials (In class, only)
- Activity: Effective Potentials
- Problem: Hockey
- Problem: Scattering

Unit Learning Outcomes

At the end of this unit, you should be able to:

- List the properties that define a central force system.
- Calculate a reduced mass for a two-body system and describe why it is important.
- Use the solution (algebraic or geometric) to a reduced mass system to describe the motion of the original system.
- Describe the role that conservation of energy and angular momentum play in a central force system. In particular, where do these properties appear in the solutions of the equations of motion?
- Use an effective potential diagram to predict the possible orbits in a central force system: which orbits are bound or unbound? which are closed or open? where will the turning points be?

Equation Sheet for This Unit

- Classical Orbits Equation Sheet