Physics

Fall 2025

Weeks 13 - 14

Monday / Tuesday (November 3 & 4)

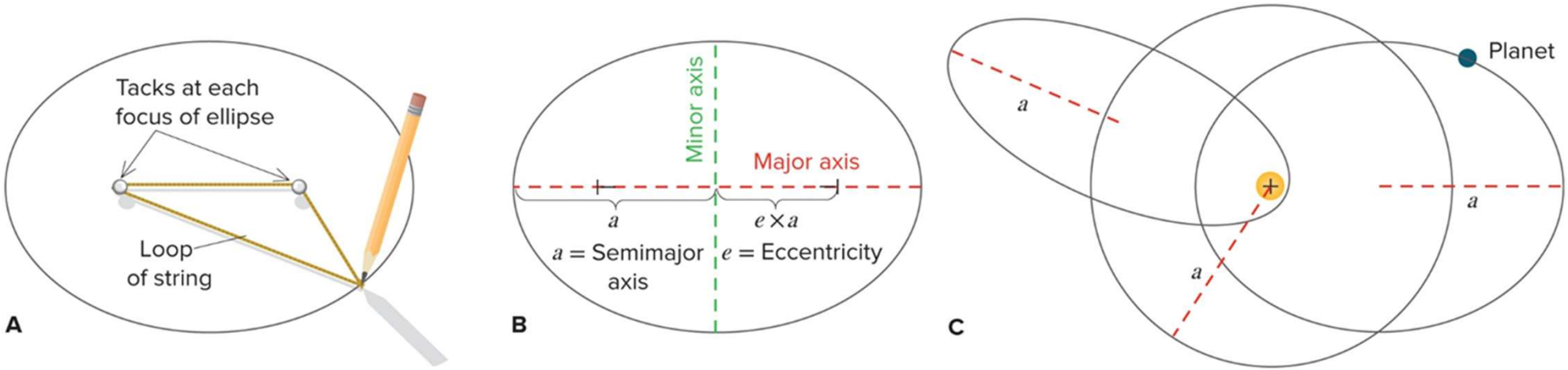
- T: 5H - describe and calculate, using scientific notation, how the magnitude of force between two objects depends on their masses and the distance between their centers, and predict the effects on objects in linear and orbiting systems using Newton's law of universal gravitation
- O: I will explore the idea of orbit
- D: by learning about Kepler's Laws and completing a PhET.
- A: Kepler's Laws, ellipse, orbit
- Y: How does a planet's motion keep it from falling into a star?

Johannes Kepler

- Johannes Kepler (1571 to 1630)
- Using the very precise Mars data, Kepler showed the orbit to be an ***ellipse.***

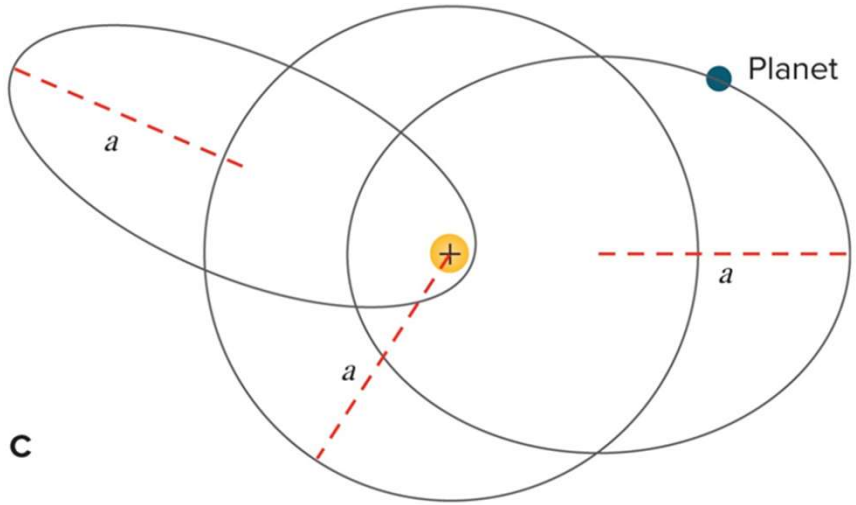
Kepler's Success

- Planets follow ellipses with the Sun located at one of the two foci



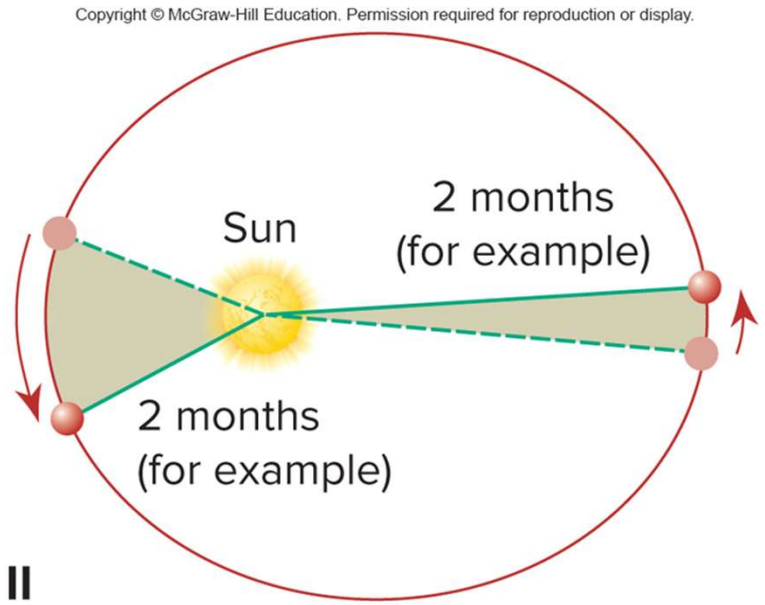
Kepler's 1st Law

- Planets move in elliptical orbits with the Sun at one ***focus*** of the ellipse.



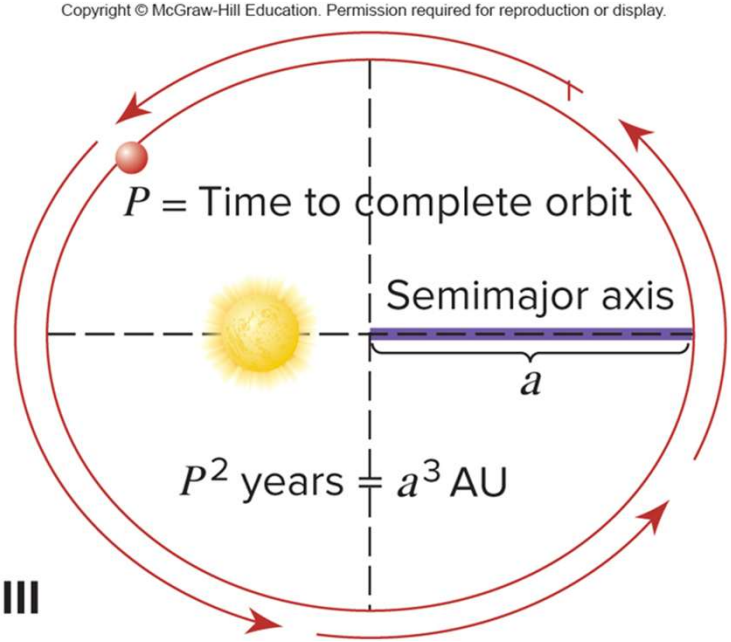
Kepler's 2nd Law

- The orbital speed of a planet varies so that a line joining the Sun and the planet will sweep out equal areas in equal time intervals.
- The closer a planet is to the Sun, the faster it moves.



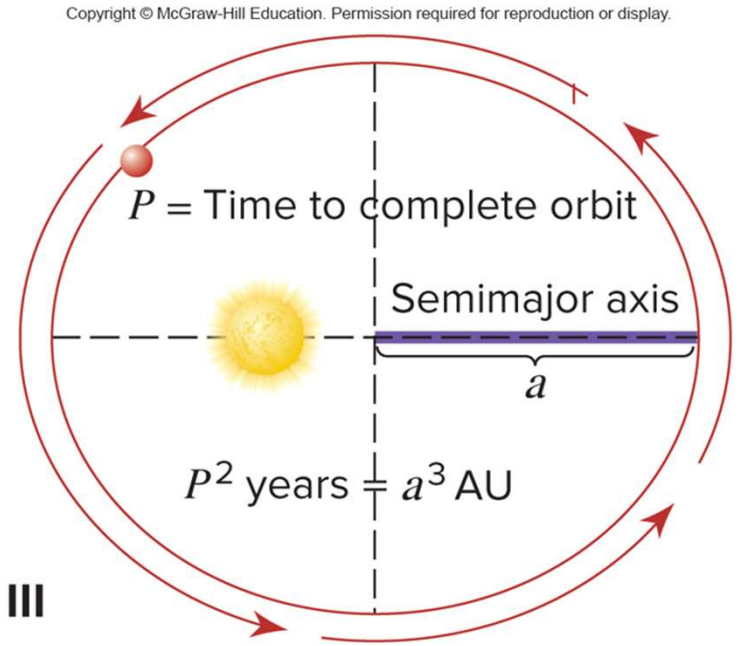
Kepler's 3rd Law

- The amount of time a planet takes to orbit the Sun is related to its orbit's size.
- The square of the period, P, is proportional to the cube of the ***semimajor axis,*** a.



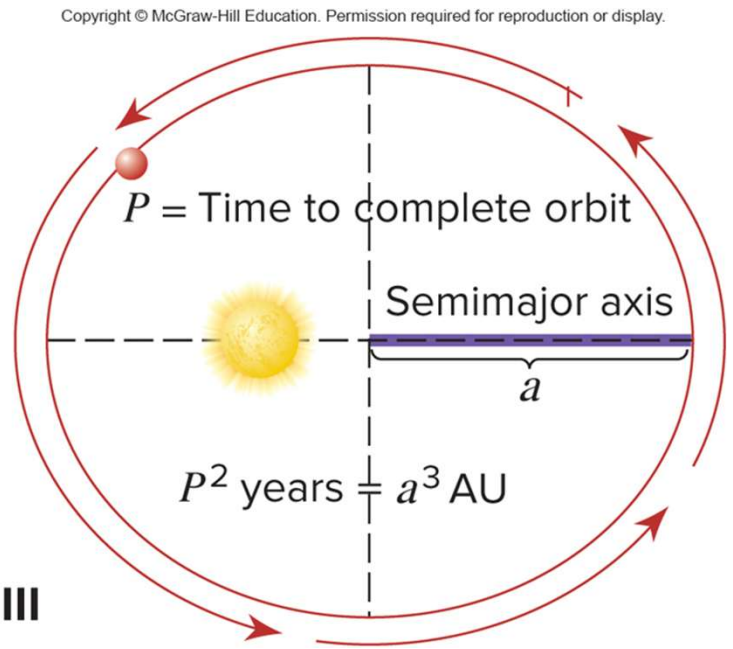
Kepler's 3rd Law: Period and Distance

- This law implies that a planet with a larger average distance from the Sun, which is the semimajor axis distance, will take longer to circle the Sun.
- Third law hints at the nature of the force holding the planets in orbit.



Kepler's 3rd Law: Still in Use Today!

- Third law can be used to determine the semimajor axis, a, if the period, P, is known, a measurement that is not difficult to make.



Wednesday / Thursday (November 5 & 6)

- Test review – gravity practice problems

Journal 3.1

- What is your favorite season and why?

- T: 5E - explain and apply the concepts of equilibrium and inertia as represented by Newton's first law of motion using relevant real-world examples such as rockets, satellites, and automobile safety devices
- 5F - calculate the effect of forces on objects, including tension, friction, normal, gravity, centripetal, and applied forces, using free body diagrams and the relationship between force and acceleration as represented by Newton's second law of motion
- 5H - describe and calculate, using scientific notation, how the magnitude of force between two objects depends on their masses and the distance between their centers, and predict the effects on objects in linear and orbiting systems using Newton's law of universal gravitation
- O: I will solidify my understanding of Universal gravitation
- D: by completing a test review.
- A: Universal gravitational constant, inverse square
- Y: What two factors affect gravity? Which one has more affect?

Friday (November 7)

- C-day

Monday / Thursday (November 10 & 13)

- Test
- Intro reading for next unit

Good Things

- Get ready for the test

- T: 5E - explain and apply the concepts of equilibrium and inertia as represented by Newton's first law of motion using relevant real-world examples such as rockets, satellites, and automobile safety devices
- 5F - calculate the effect of forces on objects, including tension, friction, normal, gravity, centripetal, and applied forces, using free body diagrams and the relationship between force and acceleration as represented by Newton's second law of motion
- 5H - describe and calculate, using scientific notation, how the magnitude of force between two objects depends on their masses and the distance between their centers, and predict the effects on objects in linear and orbiting systems using Newton's law of universal gravitation
- O: I will be able to demonstrate my understanding of gravity
- D: by making a good grade on my Unit 3 district assessment.
- A: gravity
- Y: How will I know that I did well on the test?

Tuesday / Wednesday (November 11 & 12)

- Substitute (Veterans' Day)
- PhET Skate Park

- T: **7A** - calculate and explain work and power in one dimension and identify when work is and is not being done by or on a system

7B - investigate and calculate mechanical, kinetic, and potential energy of a system

- O: I will be able to explore energy transfers
- D: by completing a PhET simulation
- A: thermal energy, potential energy, kinetic energy
- Y: What does the addition of friction to a system cause?

Friday (November 14)

- C-day

Monday / Tuesday (November 17 & 18)

- Work lecture and worksheet

- T:7A - calculate and explain work and power in one dimension and identify when work is and is not being done by or on a system

7B - investigate and calculate mechanical, kinetic, and potential energy of a system

- O: I will be able to understand work, gpe, and KE
- D: by taking notes and completing a worksheet about these topics.
- A: work, energy, gpe, KE
- Y: How can one determine if work is being done?

Work

- The product of distance and the force in the direction an object moves.

- Work = Force x Distance

Definition of Energy…

The ability or capacity to do work.

Measured by the capability of doing work:
potential energy
or
the conversion of this capability to motion:
kinetic energy.

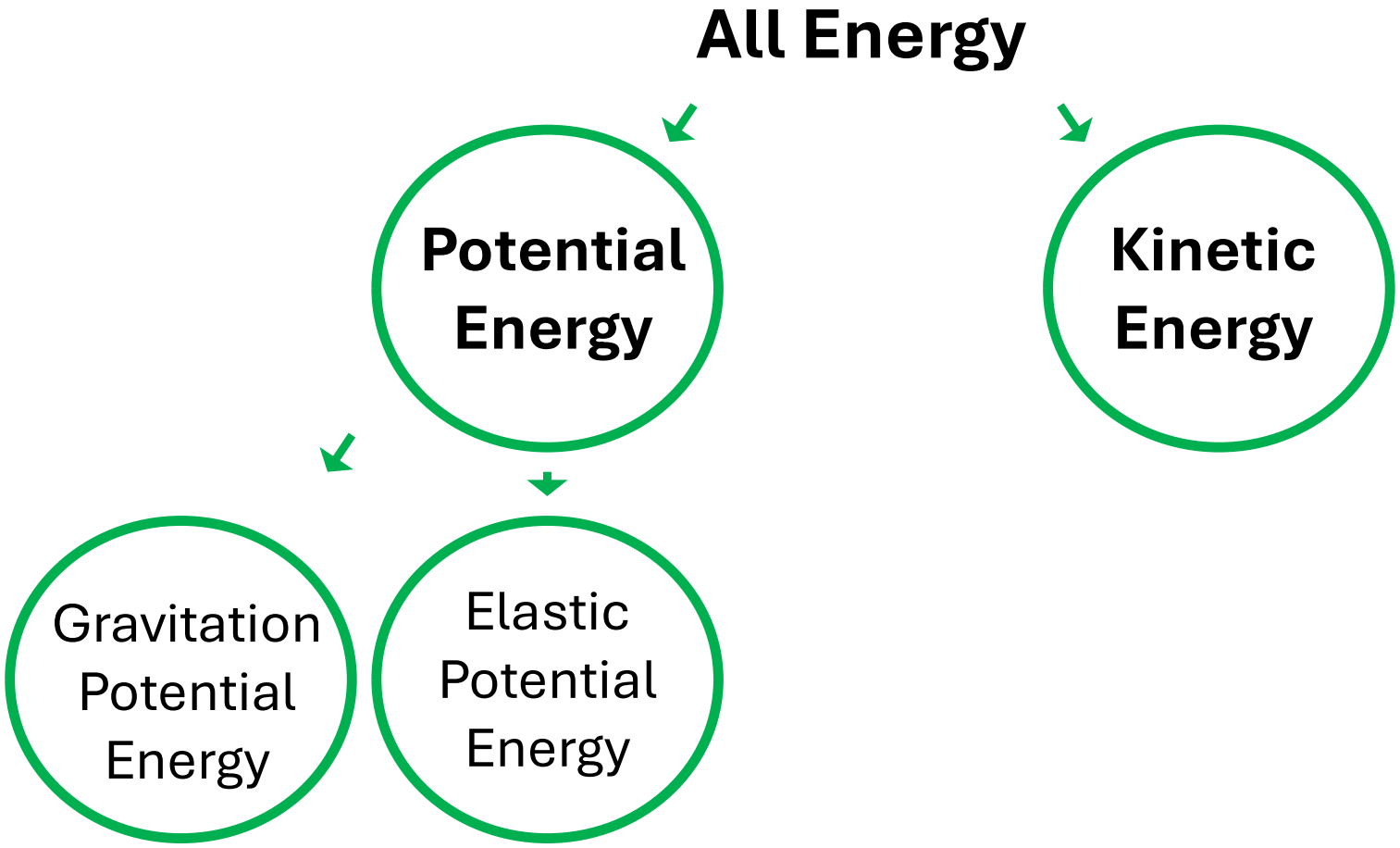
WHAT IS ENERGY?

- The ability to cause change
  - Think about things that have energy “in them”…
  - All those things can make something DO something!
- It’s what causes change in everything!
  - Nothing changes without some energy causing it.

2 types of energy

Kinetic and Potential Energy

How is all energy divided?



Potential Energy

- Energy that is stored due to position or shape. It is *stored energy*.

<u>There are 2 types of Potential Energy</u>

- 1) Gravitational Potential Energy (GPE)
- 2) Elastic Potential Energy

Gravitational Potential Energy (GPE)

- Potential Energy that depends upon an objects height above a reference point

Formula:

PE = mgh

Potential energy is calculated by:

The object's mass (m), multiplied by the earth's gravitational pull (g) (9.8 m/sec/sec), multiplied by the height (h) the object can fall.

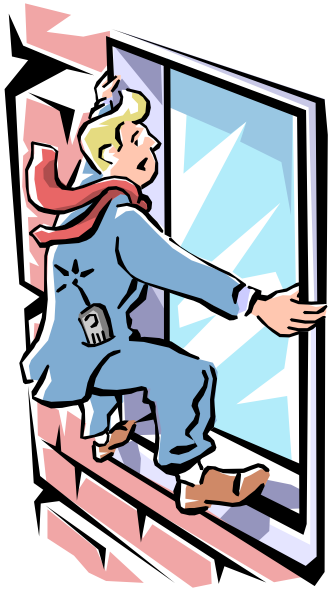
Formula Representation

Formula	Represents	Units
PE = mgh	m = mass	Kilogram (kg)
	g = acceleration due to gravity	m/s/s
	h = height	Meter (m)

Gravitational Potential Energy

- Books on a shelf have Gravitational Potential Energy.
- Which books have the most Gravitational Potential Energy? Why?

Gravitational Potential Energy



- A man and his cell phone are on a ledge outside a very tall building.
- Which object (the man or his cell phone) has the most Gravitational Potential Energy? Why?

What does Potential Energy depend on and how does it affect potential energy?

- Height – The higher the object, the more potential energy.
- Mass – The greater the mass of the object, the more potential energy it has.
- Potential energy depends on both mass and height.

Potential Energy Converted to Kinetic Energy…

When stored energy begins to move, the object now transfers from potential energy into kinetic energy.

Standing still

Running

Kinetic Energy Preview

- Kinetic Energy is the energy of motion or energy in use
- Any matter in motion has Kinetic Energy
- There are many forms of Kinetic Energy
- Some forms include: electromagnetic (light - radiant), thermal (heat), electrical, and mechanical (sound – acoustic)

Kinetic Energy Definition and Formula

- The energy an object has due to its motion

Formula:

$$KE = \frac{1}{2}mv^2$$

Kinetic energy is calculated by:
Squaring the velocity (v), multiply by the object's mass (m), than divided by 2.

Formula Representation

Formula	Represents	Units
$KE = \frac{1}{2}mv^2$	KE = Kinetic Energy	Joules (J)
	m = mass	kilogram (kg)
	v = velocity	Meter/second (m/s)

Work into Power

$$\text{Power} = \frac{\text{Work}}{\text{Time}} = \frac{\text{Force} \cdot \text{Displacement}}{\text{Time}}$$

$$\text{Power} = \text{Force} \cdot \frac{\text{Displacement}}{\text{Time}}$$

$$\boxed{\text{Power} = \text{Force} \cdot \text{Velocity}}$$

Wednesday / Thursday (November 19 & 20)

- Substitute on 20

- T: 7A - calculate and explain work and power in one dimension and identify when work is and is not being done by or on a system

7B - investigate and calculate mechanical, kinetic, and potential energy of a system

- O: I will better understand energy and how it is stored, transferred, and transformed
- D: by completing a worksheet and a PhET simulation.
- A: heat, kinetic energy, potential energy, conservation of energy
- Y: How can we show that energy is conserved?

Friday (November 21)

- C-day
- Substitute