

AP Physics 1: Summer Work

Congratulations on signing up for AP Physics 1! The course builds directly on your prior work in either Honors or CP Physics, but you need to be ready for a rigorous, challenging year.

Course outline: (units 1-4 will be familiar to you, but units 5-8 are completely new)

1. Kinematics
2. Forces and Translational Dynamics
3. Work, Energy, and Power
4. Linear Momentum
5. Torque and Rotational Dynamics
6. Energy and Momentum of Rotating Systems
7. Oscillations
8. Fluids

We will use the [OpenStax College Physics for AP](#) textbook. All chapter references in this document are to this.

This assignment is not an assessment. Use the tasks to help you identify what you need to work on ahead of the start of the course, so you're ready to hit the ground running in the Fall.

The first assignment of the year will be the completion of, and engagement with, this work.

Ongoing assignments throughout the course will include completion of [this workbook](#). Please attempt the first unit, before the course starts.

Feel free to reach out by email with questions. Enjoy the summer!

Mr. B

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Unit Conversion and Scientific Notation

1. Convert 15 kilometers to meters.
2. Convert 2 hours to seconds.
3. Express 0.000045 meters in scientific notation.
4. Express 6.022×10^{23} particles in standard notation

- **Additional Reading/Practice:** OpenStax College Physics, Chapter 1.

Trigonometry for Vector Resolution

1. A vector has a magnitude of 10 units and an angle of 30 degrees above the horizontal. Find the horizontal and vertical components of the vector.
2. A force vector has x and y components of 5 N and 8.7 N, respectively. What is the magnitude and direction of the force vector?
3. Explain why vector resolution is important when analyzing projectile motion.

- **Additional Reading/Practice:** OpenStax College Physics, Chapter 3 and Chapter 5.

Creating and Interpreting Graphs

1. Describe the relationships shown in these data sets. (i.e. positive or negative, linear or non-linear)

a.

x	y
1.1	110
1.2	120
1.3	130
1.4	140
1.5	150

b.

x	y
1	19
3	7
4	1
9	-29

10	-35
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c.

x	y
0	-5
2	-2.17
4	3
6	9.7
8	17.6

2. What does the slope of a position-time graph represent?
3. What does the area under a velocity-time graph represent?

- **Additional Reading/Practice:** OpenStax College Physics, Chapter 2.

Linearizing Data

1. If a graph of y vs. x^2 results in a straight line, what is the general relationship between y and x ?
2. In an investigation into Hooke's Law ($F = -kx$), you vary the extension of a spring (x) and measure the force it applied (F). What graph would you plot to find the spring constant (k), and how does your graph show it?
3. Another experiment involves varying the velocity of an object and relating it to its kinetic energy. What graph would you plot to be able to evaluate the mass of the object, and how does the graph show it?
4. The equation $P = P_0 + \rho gh$ relates the pressure, P , at different depths, h , below the surface of a static fluid. Using these as your dependent and independent variables respectively, identify the slope and y-intercept. (P_0 is the atmospheric pressure, ρ is the fluid density, and g is gravitational field.)
5. Explain why linearizing data is a useful technique in physics.

- **Additional Reading/Practice:** OpenStax College Physics, Chapter 1 (for data analysis). Also try [this link](#).

Precision, Accuracy, Uncertainty, and Significant Figures

1. What is the difference between precision and accuracy?
2. How do you determine the number of significant figures in a measurement?
3. Calculate the perimeter and area of a rectangle with sides 12.5 cm and 3.4 cm. Report your answers with the correct number of significant figures.

- **Additional Reading/Practice:** OpenStax College Physics, Chapter 1.

1D and 2D Motion

1. An object moves at a constant velocity of 10 m/s for 5 seconds. How far does it travel?
2. An object accelerates from rest at 2 m/s^2 . What is its velocity after 3 seconds?
3. A ball is thrown horizontally from a cliff. Describe its vertical and horizontal motion.
4. The ball in Q3 has an initial velocity of 10 m/s and the cliff is 120 m tall. How far from the base of the cliff does it strike the ground?

- **Additional Reading/Practice:** OpenStax College Physics, Chapter 2 and Chapter 5.

Displacement, Velocity, Acceleration, and Time

1. A car accelerates from 15 m/s to 25 m/s in 5 seconds. What is its acceleration?
2. An object is thrown upwards with an initial velocity of 20 m/s. How long does it take to reach its highest point?
3. A projectile is launched from ground level at 12 m/s at an angle of 50° above the horizontal. Calculate its time of flight and range.

- **Additional Reading/Practice:** OpenStax College Physics, Chapter 2 and Chapter 5.

Graphical Analysis of Motion

1. What does the slope of a velocity-time graph represent?
 2. How can you determine the displacement of an object from a velocity-time graph?
 3. Sketch a velocity-time graph for an object that is moving forward but slowing down at a constant rate.
- **Additional Reading/Practice:** OpenStax College Physics, Chapter 2.

Newton's Laws of Motion

1. State Newton's First Law.
 2. State Newton's Second Law.
 3. State Newton's Third Law.
 4. Explain how Newton's Laws apply to a rocket launch.
- **Additional Reading/Practice:** OpenStax College Physics, Chapter 4.

Free-Body Diagrams and Forces

1. Draw a free-body diagram for a book resting on a table.
 2. Draw a free-body diagram for a mass hanging motionless from a pulley.
 3. Draw a free-body diagram for an object in freefall.
 4. Draw a free-body diagram for a toy car sliding down an incline.
 5. Describe, in general terms, how to evaluate the net force acting on an object.
- **Additional Reading/Practice:** OpenStax College Physics, Chapter 4.

Vector Components and Net Forces

1. A force of 20 N acts at an angle of 60 degrees to the horizontal. Find the horizontal and vertical components of the force.
2. Two forces, 10 N east and 15 N north, act on an object. What is the net force acting on the object?
3. Describe, in general terms, how to find the net force when multiple forces act on an object at different angles.

- **Additional Reading/Practice:** OpenStax College Physics, Chapter 4.

Work, Energy, and Power

1. Define work and give its unit.
2. List types of energy and give brief descriptions.
3. Define power and give its unit.

- **Additional Reading/Practice:** OpenStax College Physics, Chapter 9.

Work-Energy Theorem and Conservation of Energy

1. State the work-energy theorem.
2. State the principle of conservation of energy.
3. A ball is dropped from a height. How do its potential and kinetic energies change as it falls?

- **Additional Reading/Practice:** OpenStax College Physics, Chapter 9.

Momentum, Impulse, and Collisions

1. Define momentum and impulse.
2. State the impulse-momentum theorem.
3. State the law of conservation of momentum.
4. Calculate the momentum of a 3,000 kg elephant walking North at 2.5 m/s.
5. Two cars collide and stick together. The first (2,500 kg) was moving East at 12.0 m/s. The second (4,000 kg) was moving West at 4.25 m/s. Calculate their combined velocity after the collision.
6. State one similarity and one difference between an elastic and an inelastic collision.

- **Additional Reading/Practice:** OpenStax College Physics, Chapter 8.

Now the real work begins: complete the first unit
in this workbook.