# AP Physics 1 Summer Assignment


Dear Future AP Physics 1 Student,

Here is the much-anticipated summer assignment. The purpose of this assignment is to get a jump start on the first physics topic, which is called Kinematics. Before you begin this assignment there are a few important points to address.

First, I am committed to helping you learn physics; however, it is important to point out that this course is called AP Physics. It is a true college level course, **not** an Honors Course. You must be able to handle material at a fast pace and learn on your own from resources provided. The key to success in a college physics course is the desire to challenge oneself and the ability to persevere in a stressful, fast-paced academic environment.

Second, this course is intended for students who have completed both **Honors** Chemistry and **Honors** Algebra II / Trig. Of course, you can still be successful if you have not completed these courses but be prepared to work hard!

**NOTE: (If you are in Geometry you absolutely cannot take AP Physics 1!)**

Third, this summer assignment is an introduction to basic Kinematics concepts. It is important that this information is fresh in your brain for class, so please do not complete this assignment until the last week in August. To complete the summer assignment, please do the following:

**1)** Print this packet.

**2)** Watch the linked videos (1-9) and work on the problems. **Follow all directions as indicated!**

You should find this assignment to be relatively straightforward. It is intended to introduce basic concepts and help prepare you for class. If you have any questions, please contact me at msneider@csh.k12.ny.us

I look forward to working with you this fall. Physics is a fun, interesting course, and I have a great year planned for us. Have a relaxing summer! **Please Note: The summer assignment is due in class on the first day of school.**

Sincerely, Mr. Sneider

**Video Links:**

Video 1: https://drive.google.com/file/d/1AVgMNIkkMcNRTXiEXzIDDAVoS1FWSpBV/view?usp=sharing
Video 2: https://drive.google.com/file/d/19JyJx9kjpZ4rVgnDzzSTdh5haDmCvOOL/view?usp=sharing
Video 3: https://drive.google.com/file/d/15KXrKRt05RgJWs3KlHn7JS8haOXAjxrk/view?usp=sharing
Video 4: https://drive.google.com/file/d/14Sg9cC82SvuK3MphRioVBA3-pR3KYxXq/view?usp=sharing
Video 5: https://drive.google.com/file/d/1sO247oNh5opWLgMfdhSxfpAldpDCF4zX/view?usp=sharing
Video 6: https://drive.google.com/file/d/1LMJIvROWqn3kDW-njta9cGFx1SZN9_qb/view?usp=sharing
Video 7: https://drive.google.com/file/d/1-o6R8fm7EMkP9EKu7Ef3T_fR-FV8qC0b/view?usp=sharing
Video 8: https://drive.google.com/file/d/1llVqcsq3Fam4o7mA17fYde93iPbldur5/view?usp=sharing
Video 9: https://drive.google.com/file/d/1yDO1YaE1Vf40EksWc7vd431U5WBb51S-/view?usp=sharing

# Topic 1: Kinematics

**Kinematics:** Study of motion using mathematics. The concepts discussed in kinematics include position, velocity, acceleration, free fall, and graphing motion.

- **Units:** Physicists use the International System of Units. This system is based on the kilogram (kg), meter (m), and second (s). We will always use kilograms, meters, and seconds as our base units. We will also use derived units such as Newtons and Joules, but these units are made up of kilograms, meters, and seconds.

- **Scalars & Vectors:** Every quantity in physics is either a scalar quantity or a vector quantity.

  - **Scalar Quantity:** a quantity that has magnitude only.

  - **Vector Quantity:** a quantity that has both magnitude and direction. The direction of a vector quantity is represented using an arrow!

- **Vector Addition:** Combining or adding vector quantities is very different from combining scalar quantities.

  - When adding vector quantities, you must account for the magnitude of the quantity as well as its direction.

  - Vector directions are typically based on the cartesian coordinate plane.

- **Position:** The change in position of an object can be quantified in two ways: distance & displacement.

  - **Distance [d]:** A scalar quantity that measures the total path length traveled by an object. The fundamental unit of distance is the meter (m).

  - **Displacement [Δd]:** A vector quantity that measures an object's change in position. It is represented by an arrow pointing from the initial position [$d_i$] to the final position [$d_f$]. The fundamental unit of displacement is the meter (m).

    - **Example:** A student walks 20 meters west from a history classroom. Compare the distance traveled by the student to their displacement.

    - **Example:** A student walks 35 meters to the east and then 50 meters to the west. Compare the student's distance traveled to their displacement.

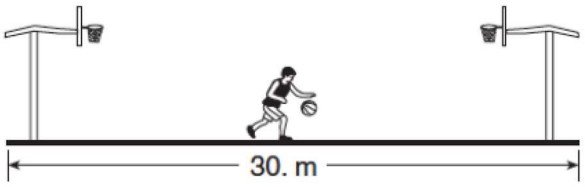
**Kinematics Practice Worksheet 1**

1) A girl leaves a history classroom and walks 10 meters north to a drinking fountain. Then she turns and walks 30 meters south to an art classroom. What is the girl's total displacement from the history classroom to the art classroom?

2) A baseball player runs 27.4 meters from the batter's box to first base, overruns first base by 3.0 meters, and then returns to first base. Compared to the total distance traveled by the player, the magnitude of the player's total displacement from the batter's box is

A) 3.0 m shorter
B) 6.0 m shorter
C) 3.0 m longer
D) 6.0 m longer

3) In a drill during basketball practice, a player runs the length of the 30-meter court and back. The player does this three times in 60 seconds.




a) The magnitude of the player's total displacement after running the drill is
1. 0.0 m
2. 30 m
3. 60 m
4. 180 m

b) What distance is traveled by the player? _____meters.

- **Speed and Velocity:** Both speed and velocity quantify how fast or quickly an object moves. Although they are different quantities, they share the same symbol. **BE CAREFUL!**

  - **Speed [v]:** a scalar quantity that describes the rate at which an object's position changes. It is sometimes called the magnitude of the velocity. The S.I. unit for speed is the meter per second (m/s).

  - **Velocity [v]:** a vector quantity that describes the rate at which an object's position changes. The S.I. unit for velocity is the meter per second (m/s).

- **Average Speed and Velocity:**

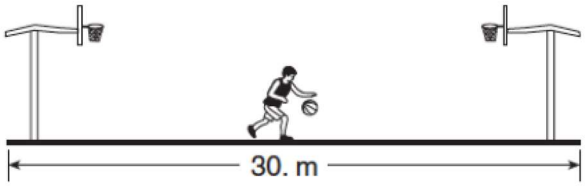
  - **Average Speed [ $\overline{v}$ ]:** Scalar quantity. Describes how "fast" an object is moving on average. It is the total distance divided by the total time.

  - **Average Velocity [ $\overline{v}$ ]:** Vector quantity. Describes how "fast" an object is moving on average in a certain direction. It is the total displacement divided by the total time.

  - **Example:** A student jogs 200 meters due west in 25 seconds. They turn and run 120 meters east in 10 seconds. Calculate the student's average speed and average velocity.

**Kinematics Worksheet 2**

1) In a practice drill on a basketball court a player runs the length of the 30-meter court and back three times in 60 seconds. Calculate and compare the player's average speed to their average velocity.




2) In a 4-kilometer race, a runner completes the first kilometer in 5.9 minutes, the second kilometer in 6.2 minutes, the third kilometer in 6.3 minutes, and the final kilometer in 6 minutes. Calculate the runner's average speed for the entire race in meters / second.

3) A high-speed train travels 300 kilometers in one hour. What is the average speed of the train in meters per second?

- **Acceleration [ a ]:** Vector quantity defined as the rate at which velocity changes.
    - **ANY** time an object's speed or velocity ***CHANGES,*** the object is accelerating!
    - An object at rest or moving with a constant velocity has an acceleration of 0!

- **Example:** A car enters the highway moving at 36.0 meters per second and increases its speed to 125 meters per second to merge with traffic. It takes the car exactly 5.00 seconds to change its velocity. Calculate the average acceleration of the car in meters per second squared.

- **Example:** A car is cruising along at 45.0 meters per second due west when the driver steps on the brakes and slows the car to 18 meters per second west in 3.61 seconds. Determine the magnitude and direction of the car's acceleration.

- **Acceleration is a VECTOR!!**

| Direction of $V_i$ | Direction of Acceleration | Magnitude of the Velocity (SPEED) |
|---|---|---|
| **East** | | |
| **East** | | |
| **East** | | |
| **West** | | |
| **West** | | |
| **West** | | |

**1)** A car enters the highway moving at 12.1 meters per second east accelerates up to 35.7 meters per second east to merge with traffic. It takes the car 5.30 seconds to reach highway velocity. Calculate the magnitude and direction of the car's acceleration.

**2)** A car cruising along at 45.5 meters per second due west decreases its speed over a period of 3.61 seconds. If the rate at which the car's velocity changes is 5.98 meters per second squared east, calculate the velocity of the car after 3.61 seconds have elapsed.

**3)** A car is initially at rest at a traffic light. When the light turns green the car accelerates south for 6.00 seconds at a rate of 3.00 meters per second each second. What is the final speed **and** final velocity of the car?