AP Physics 1 Summer Assignment

Dear Future AP Physics 1 Student,

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

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 the 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** Geometry. Of course, you can still be successful if you have not completed these courses but be prepared to work hard!

NOTE: (You cannot take AP Physics 1 and Geometry at the same time!)

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.** In order 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.

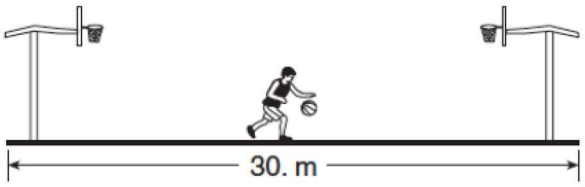
Kinematics Practice Worksheet 1

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:**

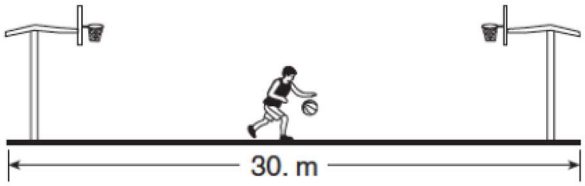
  - **Average Speed [$\overline{v}$]:** Scalar quantity. Describes how "fast" an object is moving on average. It is the total distance divided by the total time.

  - **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?

4) A drone travels 90.0 meters due north in 15 seconds. It hovers in place for 5.0 seconds, and then flies 40.0 meters south in 5.0 seconds. Calculate the drone's average velocity for the entire flight.

5) One car travels 40 meters due east in 5 seconds, and a second car travels 64 meters due west in 8 seconds. Did the cars have the same **average speed** or **average velocity** during their periods of travel? Explain your answer.

6) A person observes fireworks from a safe distance of 0.750 kilometer. If sound travels at 340 meters per second in air, how much time elapses between the person seeing and hearing the firework explosion?

- **Instantaneous Speed and Velocity:**

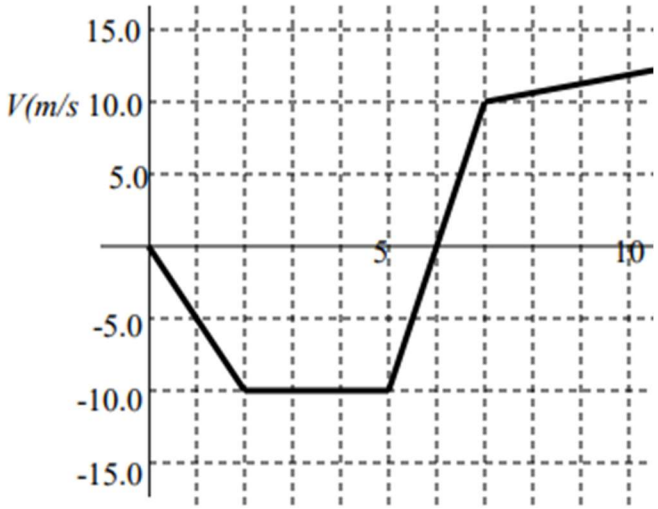
  - **Instantaneous Speed / Velocity:** Is the speed or velocity at a specific point (instant) in time.

    - **Initial Speed or Initial Velocity [v_i]:** The speed or velocity at the beginning of a time interval.

    - **Final Speed or Final Velocity [v_f]:** The speed or velocity at the end of a time interval.

    - **Change in speed or velocity [Δv]:** $\Delta v = v_f - v_i$

  - **Below is a graph of Velocity vs. Time.** Assume east is the positive direction.



    - What is the velocity of the object at 3.0 seconds?

    - What is the velocity of the object at 6.0 seconds?

    - What is the change in velocity from 5.0 seconds to 7.0 seconds?

  - **GFESA – Problem Solving Method**

- **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?

Answer Key
Physics 1 Summer Assignment

1. C
2. D
3. A
4. A
5. B
6. B
7. A
8. C
9. A
10. A
11. D
12. D
13. A
14. D
15. C
16. D
17. C
18. A
19. C
20. D
21. A
22. A
23. A
24. D
25. A
26. B
27. A
28. D
29. B
30. C

Instructions: Answer questions 1-30 and check your answers!

1. A moving object must undergo a change of

   A) velocity
   B) acceleration
   C) position
   D) direction

2. One car travels 40. meters due east in 5.0 seconds, and a second car travels 64 meters due west in 8.0 seconds. During their periods of travel, the cars definitely had the same

   A) average velocity
   B) total displacement
   C) change in momentum
   D) average speed

3. A car travels 90. meters due north in 15 seconds. Then the car turns around and travels 40. meters due south in 5.0 seconds. What is the magnitude of the average velocity of the car during this 20.-second interval?

   A) 2.5 m/s
   B) 5.0 m/s
   C) 6.5 m/s
   D) 7.0 m/s

4. How long will it take an object to move 100 meters if the object is traveling with an average speed of 0.5 meter per second?

   A) 200 s
   B) 2 s
   C) 5 s
   D) 50 s

5. The average velocity of an object during 6.0 seconds is 2 meters per second. What is the total distance traveled by the object?

   A) 1/3 m
   B) 12 m
   C) 3 m
   D) 4 m

6. Acceleration is a vector quantity that represents the change in:

   A) displacement
   B) velocity
   C) distance

7. A car traveling west in a straight line on a highway decreases its speed from 30.0 meters per second to 23.0 meters per second in 2.00 seconds. The car's average acceleration during this time interval is

   A) 3.5 m/s^2 east
   B) 3.5 m/s^2 west
   C) 13 m/s^2 east
   D) 13 m/s^2 west

8. A child riding a bicycle at 15 meters per second accelerates at -3.0 meters per second^2 for 4.0 seconds. What is the child's speed at the end of this 4.0-second interval?

   A) 12 m/s
   B) 27 m/s
   C) 3.0 m/s
   D) 7.0 m/s

9. As a car is driven south in a straight line with *decreasing* speed, the acceleration of the car must be

   A) directed northward
   B) directed southward
   C) zero
   D) constant, but not zero

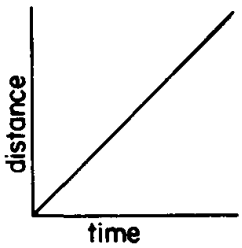
10. A car increases its speed from 9.6 meters per second to 11.2 meters per second in 4.0 seconds. The average acceleration of the car during this 4.0-second interval is

    A) 0.40 m/s^2
    B) 2.4 m/s^2
    C) 2.8 m/s^2
    D) 5.2 m/s^2

11. A car, starting from rest, accelerates at 4.0 m/s^2. What is its velocity at the end of 8.0 seconds?

    A) 0.50 m/s
    B) 2.0 m/s
    C) 16 m/s
    D) 32 m/s

12. The graph below represents the motion of an object. The object must be moving with:

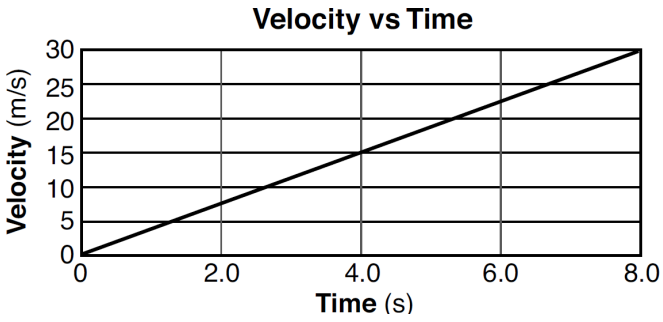


    A) increasing acceleration
    B) decreasing acceleration
    C) increasing speed
    D) constant speed

13. A car with an initial velocity of 16.0 meters per second east slows uniformly to 6.0 meters per second east in 4.0 seconds. What is the acceleration of the car during this 4.0 second interval?

    A) 2.5 m/s^2 west
    B) 2.5 m/s^2 east
    C) 4.0 m/s^2 west
    D) 4.0 m/s^2 east

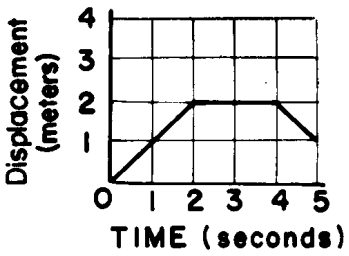
14. The graph below represents the motion of an airplane that starts from rest and takes off from a straight runway.



Which quantity is represented by the slope of the graph?

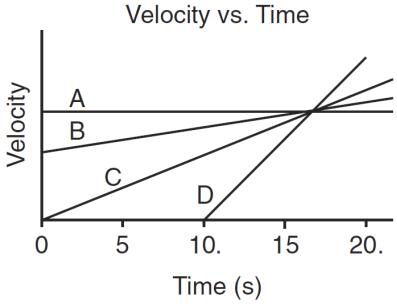
A) total distance traveled
B) displacement
C) average speed
D) acceleration

15. The graph below represents the motion of an object traveling in a straight line as a function of time. What is the average speed of the object during the first four seconds?



A) 1 m/s
B) 2 m/s
C) 0.5 m/s
D) 0 m/s

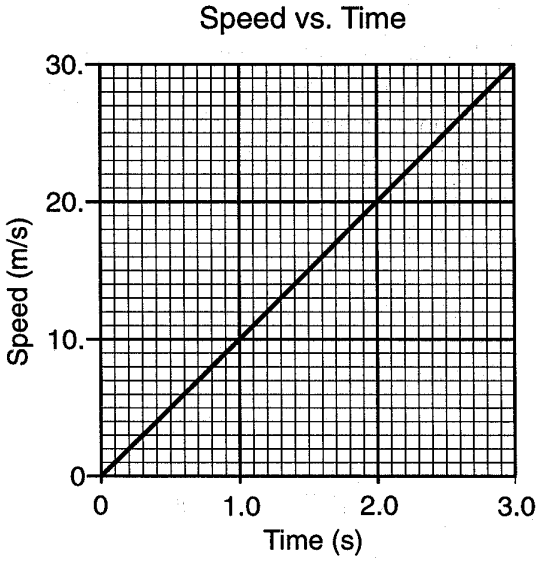
16. The diagram below represents the relationship between velocity and time of travel for four cars, *A*, *B*, *C*, and *D*, in straight-line motion.



Which car has the greatest acceleration during the time interval 10. seconds to 15 seconds?

A) *A*
B) *B*
C) *C*
D) *D*

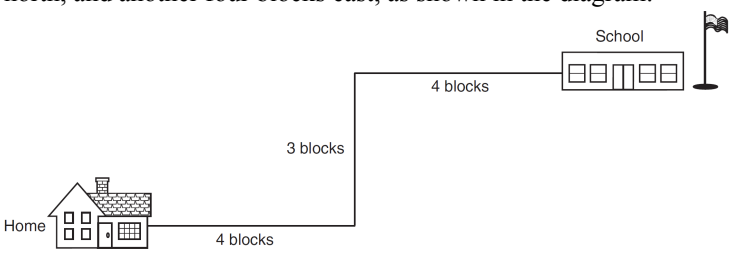
17. The graph below represents the relationship between speed and time for a car moving in a straight line.



The magnitude of the car's acceleration is

A) 1.0 m/s^2
B) 0.10 m/s^2
C) 10 m/s^2
D) 0.0 m/s^2

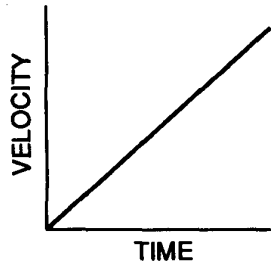
18. A student on her way to school walks four blocks east, three blocks north, and another four blocks east, as shown in the diagram.



Compared to the distance she walks, her displacement from home to school is

A) less
B) greater
C) the same

19. The graph below represents the motion of a body moving along a straight line.



According to the graph, which quantity related to the motion of the body is constant?

A) speed
B) velocity
C) acceleration
D) displacement

20. Which is a vector quantity?

A) speed
B) time
C) distance
D) displacement

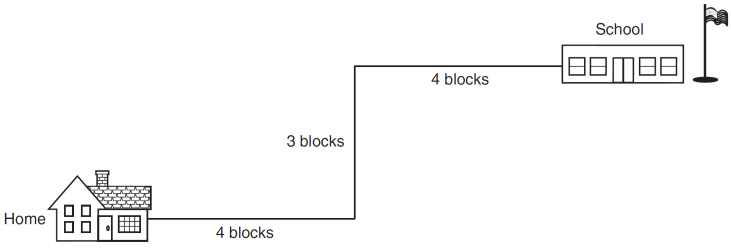
21. Scalar is to vector as

A) speed is to velocity
B) displacement is to distance
C) displacement is to velocity
D) speed is to distance

22. The speedometer in a car does not measure the car's velocity because velocity is a

A) vector quantity and has a direction associated with it
B) vector quantity and does not have a direction associated with it
C) scalar quantity and has a direction associated with it
D) scalar quantity and does not have a direction associated with it

23. A student on her way to school walks four blocks east, three blocks north, and another four blocks east, as shown in the diagram.



Compared to the distance she walks, the magnitude of her displacement from home to school is

A) less
B) greater
C) the same

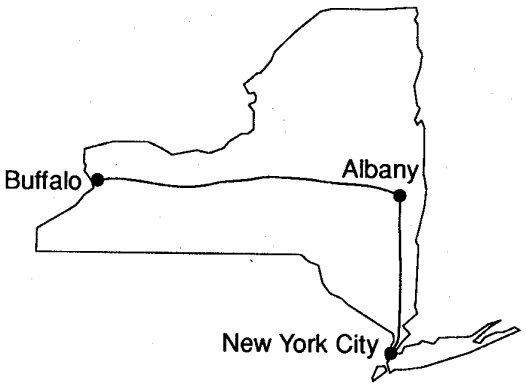
24. Which quantity includes both magnitude and direction?

A) mass
B) time
C) distance
D) velocity

25. A ship changes direction several times and finishes 20 miles north of its starting point. This displacement is a vector quantity because it has

A) both magnitude and direction
B) magnitude but no direction
C) direction but no magnitude
D) neither magnitude nor direction

26. A car is driven from Buffalo to Albany and on to New York City, as shown in the diagram below.



Compared to the magnitude of the car's total displacement, the distance driven is

A) shorter
B) longer
C) the same

27. If a woman runs 100 meters north and then 70 meters south, her displacement vector will be

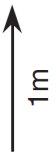
A) 30 m north
B) 30 m south
C) 170 m north
D) 170 m south

28. A student walks 3 blocks south, 4 blocks west, and 3 blocks north. What is the resultant displacement vector of the student?

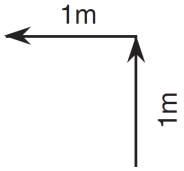
A) 10 blocks east
B) 10 blocks west
C) 4 blocks east
D) 4 blocks west

29. Which vector diagram represents the greatest magnitude of displacement for an object?

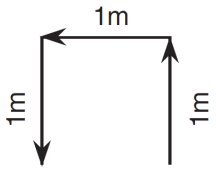
A)



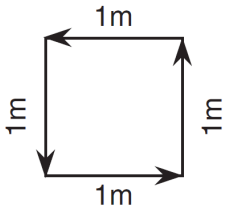
B)



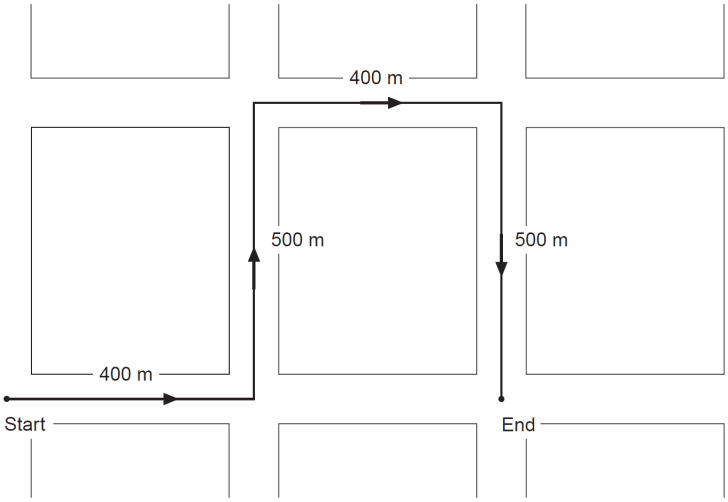
C)



D)



30. The map below shows the route traveled by a school bus.



What is the magnitude of the total displacement of the school bus from the start to the end of its trip?

A) 400 m
B) 500 m
C) 800 m
D) 1,800 m