

# Unit 2: 1D Motion

## Work Packet

Show all work, including equation and substitution of numbers with units. Make sure to follow the steps to solve physics problems.

### I. Displacement, Distance, Speed, and Velocity:

1. An electron travels 4.82 meters in 0.0036 seconds. What is its average speed?
2. Wayne Mellon slaps a hockey puck into the goal at a speed of 34.8 m/s from a distance of 20.0 meters. How much time did the goalie have to react to the shot?
3. A moving body must undergo a change of...  
a) velocity            b) acceleration            c) position            d) direction
4. A baseball player throws a ball from the outfield to home base. He throws the ball with a speed of 15 m/s and the ball arrives at the plate 3 s later. How far did the ball travel?
5. If a boy runs 125 m north, and then 75 m south, what is his total displacement (magnitude and direction)? What is his total distance? (Hint sketch out the path)
6. A hiker is at the bottom of a canyon facing the canyon wall closest to her. She is 280.5 meters from the wall and the sound of her voice travels at 340 m/s at that location. How long after she shouts will she hear her echo?
7. A girl walks 20 m east then 70 meters north. What is the girl's displacement (mag. And direction)? What is the girl's distance? (Hint sketch out the path)

## II. Constant Acceleration (Part I)

1. A school teacher's sedan can go from 0 to 25 m/s in only 4.0 seconds. What is the acceleration of sedan?
2. A car moving at a speed of 5 m/s, accelerates at a constant rate of  $2.5 \text{ m/s}^2$  for 5 s. What is the car's final speed?
3. A rocket accelerates upward from rest with a uniform acceleration of  $4.2 \text{ m/s}^2$ . How far will the rocket have traveled in 8.0 s?
4. A train starts from rest and accelerates at a rate of  $3 \text{ m/s}^2$ . How long does it take the train to travel 50 m.
5. A motorcycle traveling 30.0 m/s "decelerates" at the rate of  $-2.0 \text{ m/s}^2$ . How much distance does the cycle cover after 3 s?
6. A car traveling 10 m/s accelerates for 3 s and travels 60 m. Find the acceleration of the car.
7. A golf ball comes to rest 1.9 seconds after hitting a net. The force of the net slowed the ball down at a rate of  $56.3 \text{ m/s}^2$ . What was the velocity of the ball when it first hit the net?

### III. Constant Acceleration (Part II)

1. A ball is dropped from rest off a cliff. If the ball accelerates down at  $9.81\text{m/s}^2$ , what is the ball's speed after it falls 40 m?
2. A boy on a motor scooter is traveling at a velocity 14.1 m/s when he applies his brakes in order to stop. How much time will it take him to stop if he slows down at a rate of  $3.2\text{ m/s}^2$ ?
3. A car accelerates from 20 m/s to 28 m/s over a distance of 50 m. What is the car's acceleration?
4. An object initially traveling at 20 m/s south decelerates uniformly at  $6\text{ m/s}^2$  and is displaced 25 m. What is the final velocity of the object? (magnitude and direction)
5. A motorist is driving at a constant velocity of 28 m/s when he decides to pass a car is in front of him. He accelerates at a rate  $2.5\text{ m/s}^2$  for 3.0 seconds while passing the car. What is his velocity at the end of the 3.0 seconds?
6. A train reaches a speed of 35 m/s after accelerating at a rate of  $5\text{ m/s}^2$  over a distance of 40 m. What was the train's initial speed?



4. A man stands on a flat surface and shoots an arrow vertically into the sky at a velocity of 60. m/s.
- a) Calculate the maximum height the arrow reached.

b) What was the velocity of the arrow when it hit the ground?

c) Locate the arrow 10. seconds into its flight.

5. A canon shoots a ball into the air and it reaches a maximum height of 200. m.

A) Determine the speed at which it was launched at.

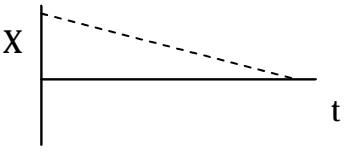

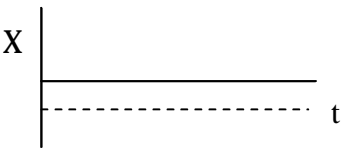

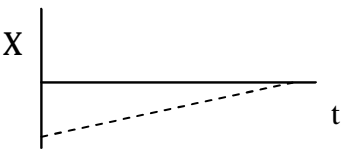
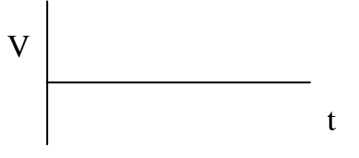
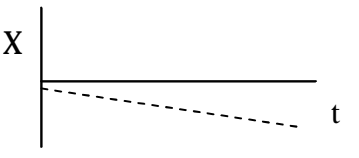
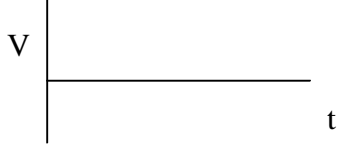
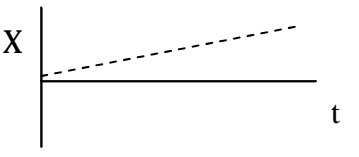
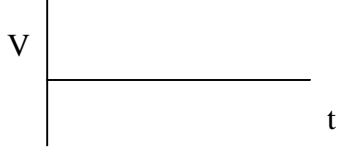

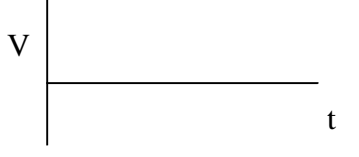
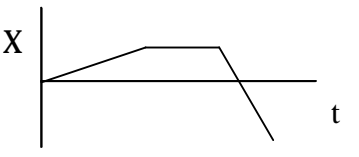

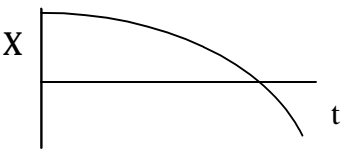

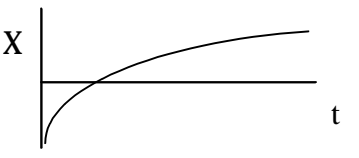

B) Determine the total flight time.

6. A window washer slips off the scaffolding on the Daily Planet building and falls for 7.00 seconds.

A. Calculate the final speed of the man after he falls for 7.00 seconds.

B. Superman saves the clumsy man by catching him and stopping him over 10. m. What acceleration did the window washer experience during the catch?

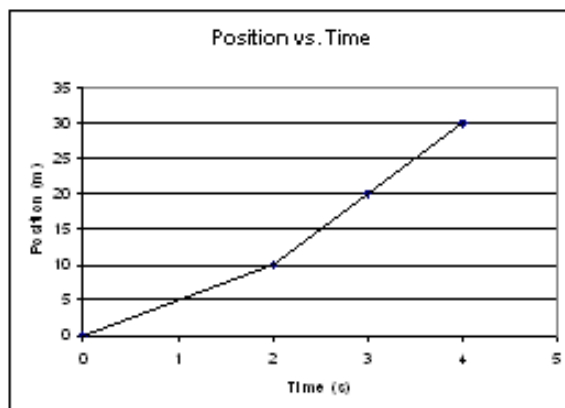
V. Graphing Motion Part 1:

XT Graph	Is the XT Graph showing: (a) +, -, or 0 velocity? (b) +, -, or 0 positions? (c) toward or away from ref?	VT Graphs
	(a)  (b) (c)	
	(a)  (b) (c)	
	(a)  (b) (c)	
	(a)  (b) (c)	
	(a)  (b) (c)	
	(a)  (b) (c)	
	(a)  (b) (c)	
	(a)  (b) (c)	
	(a)  (b) (c)	

## VI. Graphing Motion Part 2

Answer questions 1-2 based on the graph to the right.

1. What is the object's velocity from  $t = 2$  s to  $t = 4$  s?



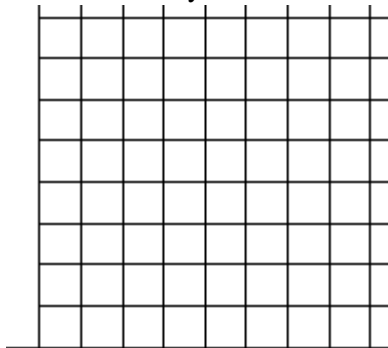
Answer the following questions based on the graph to the right.

2. What is the object's acceleration from time interval  $t = 3$  s to  $t = 5$  s?
3. What is the object's acceleration from time interval  $t = 6$  s to  $t = 8$  s?
4. What is the total distance the object traveled for the first 3 seconds?



5. An object goes from 0 to 15 m/s in 4 seconds. The object remains at 15 m/s for 2 seconds. Then accelerates to a speed of 20 m/s in 2 s.

Velocity vs. Time



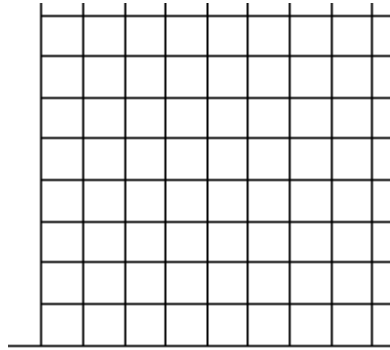
- A) Create a velocity vs. time graph based on the information above.
- B) Calculate the acceleration from 2-4 s.
- C) Calculate the total distance covered during the first 6 s.



## Graphing Motion Practice Problems

1. A student walks 5 m in 2 s at a constant velocity. He stops for 3 s then walks an additional 15 m in 3 s at a constant velocity.

A) Sketch a **Position vs. Time** graph for his motion:



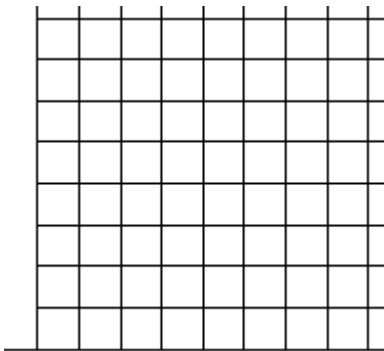
B) What is the distance he walks? \_\_\_\_\_

C) What is his displacement? \_\_\_\_\_

D) Calculate his speed(s):

2. A student starts from rest and accelerates for a distance of 10 m in 2 s. She then walks an *additional* 20 m at a constant velocity for 4 s. Finally, she walks *back* 15 m toward her starting point in 2 s at a constant velocity.

A) Sketch a **Position vs. Time** graph for his motion:



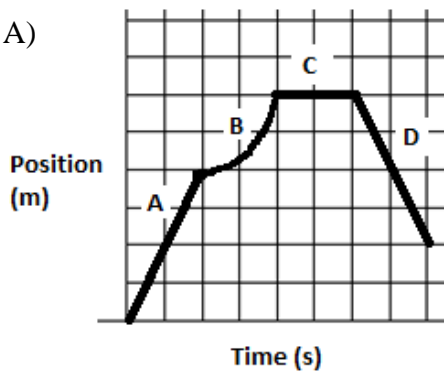
B) What is the distance she walks? \_\_\_\_\_

C) What is her displacement? \_\_\_\_\_

D) Calculate her speed(s) (when constant only):

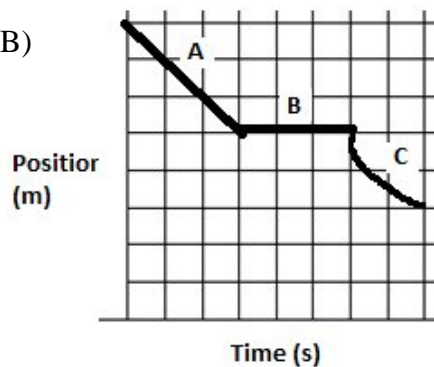
3. Given the Position vs. Time graphs, explain the motion of the object at each interval:

A)



- A - \_\_\_\_\_  
 B - \_\_\_\_\_  
 C - \_\_\_\_\_  
 D - \_\_\_\_\_

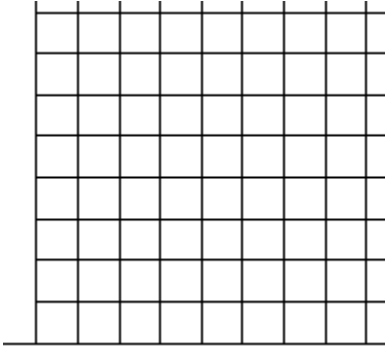
B)



- A - \_\_\_\_\_  
 B - \_\_\_\_\_  
 C - \_\_\_\_\_

B) A student starts from rest at accelerates to a speed of 10 m/s in 3 s. She then maintains that speed for 3 s.

A) Sketch a **Velocity vs. Time** graph for her motion:

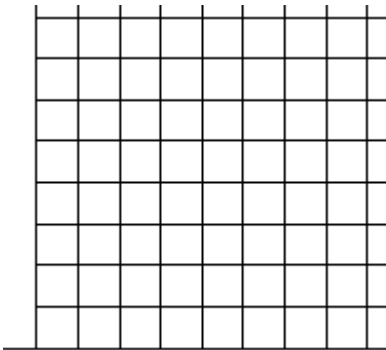


B) Calculate her acceleration(s):

C) Calculate the total distance she traveled:

C) A car starts from rest and accelerates to a speed of 20 m/s in 3 s. Then it remains at the same speed for 2 s until slowing down to 10 m/s in 3 s.

a. Sketch a **Velocity vs. Time** graph for the car's motion:



B. Calculate car's acceleration(s):

C. Calculate the total distance the car traveled: