PHYSICS 11 KINEMATICS WORKSHEET 1

Read over your notes on uniform motion, time and displacement, and refer to Chapter 3 of the text to answer the following questions.

1. Explain why a person taking a round-trip flight to Hawaii will have travelled a long distance, yet have a net displacement of 0.

2. Winnie-the-Pooh went searching for honey. He walked due east for 6.0 km and then due west for 4.0 km. Calculate:
   a) the total distance travelled. b) the magnitude of the total displacement.

3. In order to get to the corner store to load up on snacks for Monday Night Football, Bubba Louie had to drive 300 m west along 5th St., and then 400 m north along Cliffe Ave.
   a) Determine the distance travelled.
   b) Determine the magnitude of the total displacement travelled.

4. The world record time for the 100 m dash is 9.69 s. Determine the average speed for this run.

5. Viking I, the first spacecraft to land on Mars, traveled 7.00×10^8 km in 303 days. Calculate its average speed in km/s.

6. Determine the time taken for a girl, riding her bike at 2.50 m/s, to travel 1800 m.

7. How far (in metres) will Phreddie Physics travel in 15.0 minutes, driving his Harley at 24.0 m/s?

8. The speed limit on the Coquihalla highway from Hope to Kamloops is 110 km/h.
   a) Convert this speed to m/s.
   b) If you see a deer on the road ahead of you as you are driving along, it usually takes 1.00 s for the brakes to be applied. How far will the car travel in that time?

9. A delivery van, parked 200 m (E) of a police car, moves to a position 600 m (E) of the police car in 18 s. Calculate the average velocity of the delivery van.

10. A hiker travels 5.00 km due north for 3/4 of an hour, then 12.0 km due east for another 2.00 hours. Determine the following for this trip, in km/h:
    a) average speed b) average velocity (magnitude only).

11. A circus van moves 50 km (E) in the first hour, 40 km (W) in the second hour, and 30 km (W) in the next half-hour. Calculate, in km/h:
    a) average speed b) average velocity.

12. According to the Theory of Continental Drift, South America and Africa once formed part of a single larger continent called Pangaea that eventually broke apart. Today, the average distance between matching shorelines of South America and Africa is about 8000 km. Measurements indicate that the continents are drifting apart at a speed of about 4.0 cm/year.
a) According to these measurements, about how long ago did these continents separate?
b) What assumptions did you make in order to answer (a)?

13. A tourist wishes to travel from Courtenay to Nanaimo in 1.2 hours to catch a Horseshoe Bay - bound ferry, which is 115 km away.
a) What should her average speed be in order to just make it to the ferry terminal on time?
b) If she spends the first half-hour going 90 km/h, how fast will she need to go to reach the terminal on time?
c) If she instead decides to go 85 km/h for the first 60 km, how fast will she need to go for the remaining distance in order to make the ferry on time?

*14. In an Olympic race, two runners complete the 200 m dash in the following times: 21.81 s and 22.03 s. What distance separated the runners at the finish line?

1. no displacement because of no net difference between starting and finishing positions 2. a) 10.0 km b) 2.0 km
3. a) 700 m b) 500 m 4. 10.3 m/s 5. 26.7 m/s 6. 7.20×10^2 s 7. 2.16×10^4 m 8. 30.6 m 9. 22.2 m/s (E)
10. a) 6.2 km/h b) 4.7 km/h 11. a) 48 km/h b) 8 km/h (W) 12. a) 200 My ago b) assumed a <u>constant</u> spreading rate
13. a) 96 km/h b) 100 km/h c) 110 km/h *14. 2.00 m

PHYSICS 11 KINEMATICS WORKSHEET 2

Read over your notes kinematics formulas, and refer to pp 54-56, 63-68 of the text to answer the following questions. In terms of direction, forward is positive.

1. A motorcycle travelling north at 22 m/s accelerates at 1.2 m/s^2 for 5.0 s. Calculate the motorcycle's new speed.

2. An object moves from 30.0 m/s to 120.0 m/s, accelerating at a constant rate of 6.0 m/s^2. How far did the object travel in this time?

3. A car slows down from a speed of 22.0 m/s to 3.0 m/s with a constant acceleration of -2.1 m/s^2. How long does this take?

4. A corvette starts from rest and travels 69 m in 5.0 s. What is its acceleration?

5. A sprinter on a school track team is running *north* at a velocity of 6.0 m/s. Five seconds later she is running *south* at 4.0 m/s. Calculate the average acceleration for this interval.

6. A sports car travels on a straight road at 22.0 km/h and increases its speed to 57.0 km/h in 5.0 s. Find the car's acceleration in m/s^2.

7. A spacecraft accelerates at a rate of 20.0 m/s^2.
   a) How much time is required for its speed to increase from 7.0×10^3 m/s to 8.0×10^3 m/s?
   b) How far does the craft travel during this time?

8. A cyclist reaches the top of a hill at 5.0 m/s and travels downhill with a constant acceleration, reaching the bottom in 8.3 s with a speed of 11.4 m/s. How long was the hill (total length down)?

9. In a television tube, the electron travels from an electron gun to the screen 0.45 m away in 6.0×10^{-9} s. If the electron starts from rest, what is its final speed when it hits the screen?

1. 1.2 m/s 2. 1.13×10^3 m 3. 9.0 s 4. 5.5 m/s^2 5. -2 m/s or 2 m/s (S) 6. 1.9 m/s^2 7. a) 50 s b) 3.8×10^5 m
8. 68 m 9. 1.5×10^8 m/s

PHYSICS 11 KINEMATICS WORKSHEET 3

Read over your notes kinematics formulas, and refer to pp 54-56, 63-68 of the text to answer the following questions. Assume g = 9.8 m/s^2.

1. A flower pot falls from a third storey window, 17.0 m above a sidewalk.
   a) With what speed does the pot hit the path?
   b) How long does it take for the pot to hit the path?

2. A penknife drops out of a sailor's hand while she is at the top of a mast. She times the knife's drop to the deck and measures 1.3 s.
   a) How high was she up the mast?
   b) With what speed did the knife hit the deck?
   c) What was the knife's average speed?

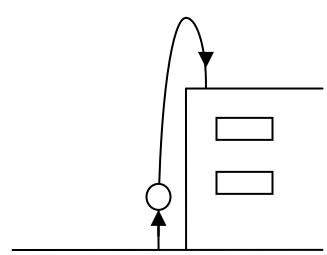
3. Our hero, Phreddie Physics, visits Vancouver so he can drop a small iron bolt from Lion's Gate bridge to the water 65 m below.
   a) With what speed will the bolt hit the water?
   b) What should be the bolt's average velocity while dropping?
   c) How long will the drop take?

4. Dirk Doofus belly-flops straight down from a 3.0-metre diving board into the water.
   a) How long is he airborne?
   b) With what speed does Dirk hit the ground?
   c) Will this landing be painful?

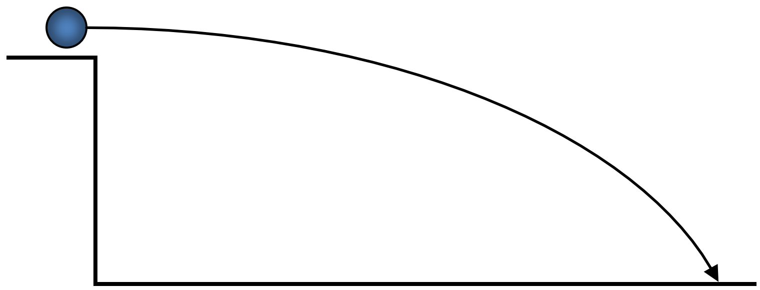
5. A cowboy fires a bullet straight up from ground level at a speed of 182 m/s.
   a) How high does the bullet go?
   b) How long does it take for the bullet to stop?
   c) When is the bullet's acceleration equal to zero?
   d) What is the bullet's total time in the air?

6. A car moving at 30 m/s makes a head-on collision with a stone wall. From what height would the car have to fall in order to make an equally hard collision with the ground (i.e., hit at the same speed)?

7. A baseball is tossed from street level by a student straight up at a speed of 25.3 m/s. After reaching maximum height, it is caught by another student on the roof of a building, 17.4 m above the street (see side picture). How long does this take?



8. An object is fired horizontally from the top of a cliff, and lands on the ground at some distance away from the base of the cliff.



a) List all the horizontal information that is known about the object.
b) List all vertical information known about this object.

9. Homer Simpson attempts to cross a 27 m-deep canyon on Bart's skateboard. He takes off horizontally from one side at 12.3 m/s but ends up falling to the canyon floor.
a) How long is he airborne?
b) How far from the cliff does he land?

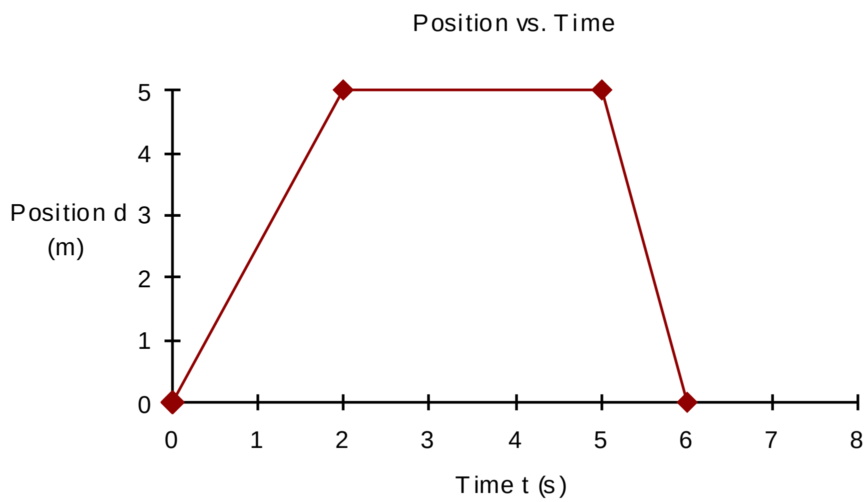
10. A student throws a baseball horizontally from the balcony of the school. If the balcony is 5.6 m above the ground, and the ball lands on the ground 25 m from the base of the school, with what initial speed did the student throw the baseball?

1. a) 19 m/s b) 1.9 s 2. a) 8.3 m b) 12 m/s c) 6.0 m/s 3. a) 35 m/s b) 18 m/s c) 3.6 s
4. a) 0.78 s b) 7.6 m/s c) u-betcha 5. a) 1.69×10^3 m b) 18.6 s c) never! (explain) d) 37.2 s 6. 47 m 7. 4.34 s
8. a) $a = 0$, $v_i = v_f = v_{av} =$ constant b) $v_i = 0$, $a = 9.8\ m/s^2$ down 9. a) 2.4 s b) 29 m 10. 23 m/s

PHYSICS 11 KINEMATICS WORKSHEET 4

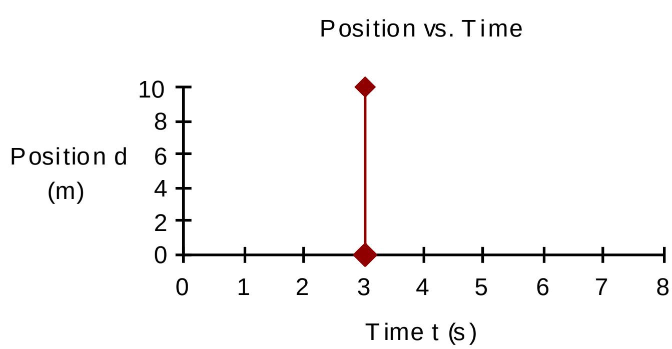
Read over your notes on uniform motion, time and distance, and refer to Chapter 3 of the text to answer the following questions.

1. The motion of an object is shown in the following position-time graph.

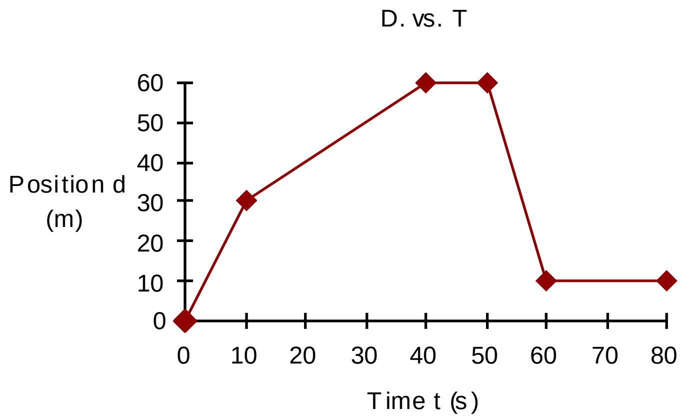


a) Describe the motion of the object for the three distinct intervals shown.
b) Determine the distance of the object from the starting point (i.e. displacement) after
  i) 2.00 s   ii) 5.00 s   iii) 6.00 s
c) When is the object at 3.00 meters?
d) What is the velocity of the object for each of the intervals?
e) Calculate the average velocity for the time interval of 0-5.00 s.
f) Determine the overall:
  i) displacement   ii) distance traveled

2. Is the motion shown in the following graph possible? Explain your answer.



3. The motion of an object is described by the following position-time graph.



a) Determine the position of the object after

i) 20.0 s ii) 45.0 s iii) 55.0 s

b) When is the object at the following positions:

i) 40.0 m ii) 10.0 m

c) Determine the velocity for each of the five intervals shown.

d) Calculate the average velocity for each of the following time intervals:

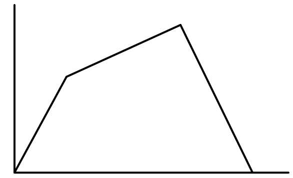
i) 0-40.0 s ii) 10.0-60.0 s iii) 40.0-80.0 s

e) Determine the overall:

i) displacement ii) distance traveled

4. Draw a position-time graph for a runner who goes at 5.00 m/s for 10.0 s, then at 2.00 m/s for 20.0 s, then at -9.00 m/s for 10.0 s. Hint: remember that the slope of a d-t graph represents speed.

1. a) v = 2.5 m/s forward for 2 s; v = 0 m/s for 3 s; v = -5 m/s (5 m/s backwards) for 1 s b) 5m; 5m; 0m
c) 1.2 s and 5.4 s d) see #2a e) 1.0 m/s f) 0 m; 10 m 2. no; cannot move without any change in time
3. a) 40 m; 60 m; 35 m b) 20.0 s; 3.0 s c) 3 m/s; 1 m/s; 0 m/s; -5 m/s; 0 m/s (all in the same direction)
d) 1.5 m/s; -0.4 m/s; -1.25 m/s e) 10 m; 110 m 4. speeds represent slopes for intervals of 50 m, 40 m and -90 m



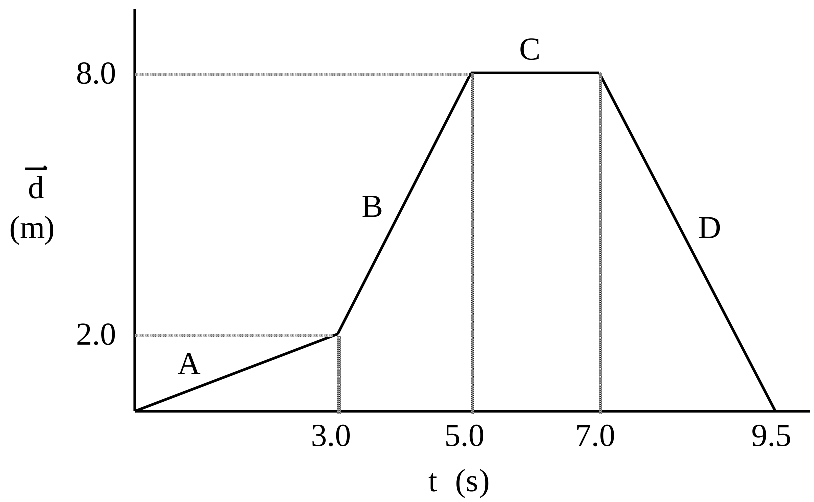
PHYSICS 11 KINEMATICS WORKSHEET 5

Read over your notes on v-t graphs and acceleration, and refer to pp 54-56, 63-68 and Chapter 4 of the text to answer the following questions. In terms of direction, forward is positive.

1. Explain why acceleration is a vector quantity.

2. Sketch and label a velocity-time graph positive acceleration for 5 s, zero acceleration for 2 s, then negative acceleration for 3 s until the velocity becomes 0.

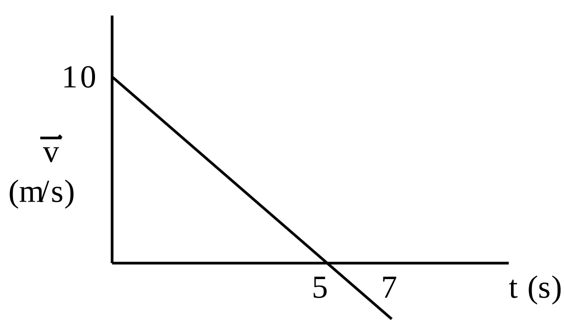
3. Examine the following Position - Time graph:



a) Determine the velocity for each of the intervals shown.
b) Draw a labelled velocity-time graph for the motion shown.

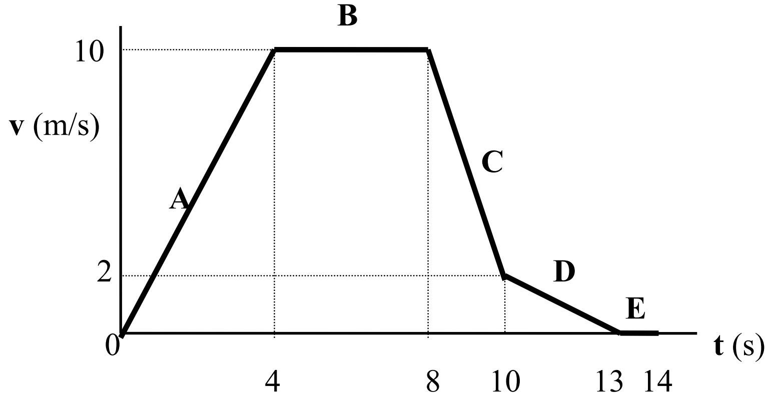
4. Explain the physical meaning of a negative slope for a velocity-time graph.

5. For the following v - t graph:



a) Describe what is happening to the object between 0 - 5 s.
b) What happens to the object <u>at</u> t = 5 s?
c) What happens to the object <u>after</u> t = 5 s?

6. For the following v - t graph, determine:



a) the acceleration during each interval **A-E**
b) the displacement during each interval **A-E**
c) the final position.

*7. The following table shows position-time data for a minivan accelerating from rest at a constant rate.

Time t (s)	Position **d** (m N of start)
0	0
1.0	1.3
2.0	5.2
3.0	11.7
4.0	20.8
5.0	32.5
6.0	46.8

a) Perform the necessary calculations to determine the instantaneous velocity at 1.0 s, 2.0 s, 3.0 s, 4.0 s and 5.0 s.
b) Plot a velocity vs. time graph (on graph paper) for the first five seconds of motion.
c) Determine the acceleration of the minivan.
d) Predict the velocity at t = 6.0 s.

1. Derived from velocity, which involves direction. 2. +, 0, then - slope 3. a) A: 0.67 m/s B: 3.0 m/s C: 0 D: -3.2 m/s b) see below 4. deceleration (slowing down) 5. a) decelerating (slowing down) b) stopped (v = 0) c) begins to accelerate in opposite direction 6. a) A: 2.5 m/s^2 B: 0 C: -4 m/s^2 D: -0.67 m/s^2 E: 0 b) A: 20 m, B: 40 m, C: 12 m, D: 3 m, E: 0 c) 75 m 7. a) 2.6 m/s, 5.2 m/s, 7.8 m/s, 10.4 m/s, 13 m/s c) 2.6 m/s^2 d) 15.6 s

for 3 b):