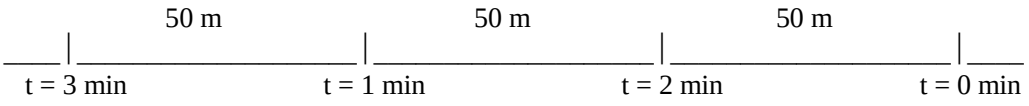
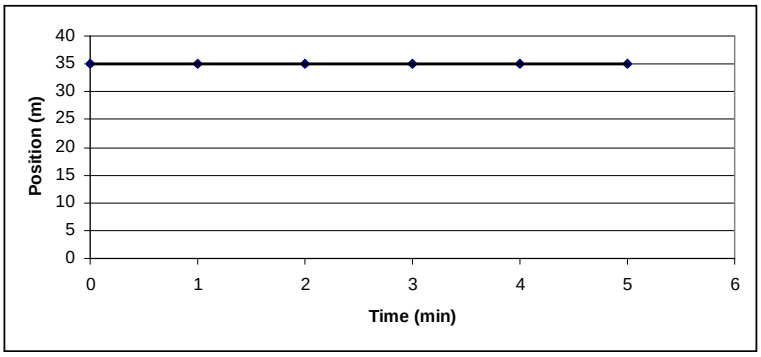
Kinematics Study Guide

1. Two students measure the speed of light. One obtains $(3.001 \pm 0.001)\times10^8$ m/s; the other obtains $(2.999 \pm 0.006)\times10^8$ m/s. The true value of the speed of light is 2.998×10^8 m/s.
   a. Which is more precise? $(3.001 \pm 0.001)\times10^8$ m/s b. Which is more accurate? $(2.999 \pm 0.006)\times10^8$ m/s
2. According to #59 on p. 25 of your textbook, how long is the leaf? (Remember, you should only estimate one digit!)
   8.3 cm (note: I estimated the 3; you might have estimated something else. What matters is that you got 8 point something and ended up with only 2 sig figs).
3. The masses of two metal blocks are measured. Block A has a mass of 8.45 g and block B has a mass of 45.87 g. How many significant figures are expressed in these measurements? A has 3; B has 4
4. Convert each of the following measurements to meters.
   a. 42.3 cm 0.423 m b. 21 km 21,000 m c. 214 μm 0.000214 m or 2.14×10^{-4} m or 214×10^{-6} m
5. Convert 67.3 in to meters. 1.71 m
6. Solve the following problem: 15.5 cm x 12.17 cm 189 cm^2 (3 sig figs)
7. What is the difference between a scalar and a vector? Scalar has magnitude only; vector has magnitude and direction
8. Below is a representation of a person pacing back and forth. Calculate the following:
   a. Distance traveled 250 m b. Displacement -150 m c. Velocity -50m/min



9. A car travels 50 km, North with constant velocity of 85 km/hr. He stops for 15 minutes and then continues driving North with an average velocity of 80 km/hr for 50 minutes. Calculate the total displacement, total time of entire trip, and average velocity for entire trip. Show your work!! (Be sure to convert minutes to hours before beginning.)
   116 km, North; 1.67 hr; 69.5 km/hr
10. What does the slope of a d-t graph measure? Velocity (half credit for speed)
11. A position-time graph for a bicycle is shown in the figure below.
    a. What is the position of the bicycle at 1.00 min? 35.0 m
    b. What is the position of the bicycle at 3.50 min? 35.0 m
    c. What is the displacement of the bicycle between the times 1.00 min and 5.00 min? 0.00 m
    d. Describe the motion of the bicycle. The bicycle is not moving



12. Two cars head out in the same direction. Car A starts 1.0 min before car B. The position-time graphs for both cars are shown in a graph.
    a. How far apart are the two cars when car B starts out at t = 1.0 min? 0.75 km
    b. At what time do the cars meet? 2.0 min
    a. How far apart are the cars at time t = 3.0 min? 0.75 km
13. The position of an airplane as a function of time is shown in the figure.
    a. What is the average velocity of the airplane? -200 km/hr (actually, -2.0×10^2 km/hr to account for sig figs. It must be put into scientific notation so that you can input the decimal point.)
    b. What is the average speed? 200 km/hr (or 2.0×10^2 km/hr to account for sig figs)
14. What does the slope of the tangent to the curve on a velocity-time graph measure? Instantaneous acceleration
15. Can a car traveling on an interstate highway have a negative velocity and a positive acceleration at the same time? Explain.
    Yes; he can be slowing down in the negative direction.
16. If an object's velocity-time graph is a straight line parallel to the t-axis, what can you conclude about the object's acceleration? It is not accelerating.
17. p. 861 from text #9. a. 80 m (or 8.0×10^1 m to account for sig figs) b. 240 m c. 40 m (or 4.0×10^1 m)

18. Give some examples of falling objects for which air resistance cannot be ignored. Flat pieces of paper; parachutes, birds, etc.
19. p. 862 #20. a. 3.24 m/s b. 0.536 m
20. Draw the corresponding d-t, v-t, and a-t graphs for the following situation which involves 5 motions:
    (1) constant speed in the positive direction (2) slowing down in the positive direction
    (3) stopping for a moment in time (4) speeding up in the negative direction
    (5) constant speed in the negative direction
    Your d-t graph should include the following segments:
    Straight line with a positive slope; positive slope but getting less steep (starts to flatten out); flat for a tiny segment; negative slope but gets steeper and steeper; straight line with a negative slope
    Your v-t graph should include the following segments:
    Flat line above t-axis; straight line above t-axis going toward t-axis; crosses over t-axis; straight line under t-axis going away from t-axis; flat line below t-axis
    Your a-t graph should include the following segments:
    Flat line on t-axis; flat line below t-axis; small flat line on t-axis; flat line below t-axis; flat line on t-axis
21. The value of g on the Moon is one-sixth of its value on Earth.
    a. Would a ball that is dropped by an astronaut hit the surface of the Mon with a greater, equal, or lesser speed than that of a ball dropped from the same height to Earth? Lesser speed
    b. Would it take the ball more, less, or equal time to fall? More time
22. A dragster starting from rest accelerates at 49 m/s^2. How fast is it going when it has traveled 325 m? Show your work!! 180 m/s
23. A stone that starts are rest is in free fall for 8.0 s. Shown your work when solving the following:
    a. Calculate the stone's velocity after 8.0 s. -80 m/s
    b. What is the stone's displacement during this time? -320 m
24. The velocity of a car changes over an 8.0-s time period, as shown in the Table below.
    a. Plot the v-t graph of the motion. (Oops; I only gave data up to 7 s in the table, so just go to 7 s. It should have two segments: straight line with a positive slope and flat line.)
    b. Determine the displacement of the car during the first 2.0 s. 8 m
    c. What displacement does the car have during the first 4.0 s? 32 m
    d. What is the displacement of the car during the entire 8.0 s? 90 m (if you stop the graph at 7 s)
    e. Find the slope of the line between t = 0.0 s and t = 4.0 s. What does this slope represent? 4 m/s^2 ; object is accelerating at a constant 4 m/s^2
    f. Find the slope of the line between t = 5.0 s and t = 7.0 s. What does this slope indicate? 0 m/s^2 ; object is not accelerating (or is is traveling with a constant velocity or speed)

Time (s)	Velocity (m/s)
0.0	0.0
1.0	4.0
2.0	8.0
3.0	12.0
4.0	16.0
5.0	20.0
6.0	20.0
7.0	20.0

25. The total distance a steel ball rolls down an incline at various times is given in the Table below.
    a. Draw a d-t graph of the motion of the ball. It should have a straight line with a positive slope
    b. Calculate the slope of the line. Include units! 2.0 m/s
    c. Write the equation of the line in terms of d and t. d = (2 m/s)t or d = 2.0t
    d. Calculate the distance the ball has rolled at end of 2.2 s. 4.4 m

Time (s)	Distance (m)
0.0	0.0
1.0	2.0
2.0	4.0
3.0	6.0
4.0	8.0
5.0	10.0

26. p. 861 from text #1. a. 0.40 m/s^2 b. 0.20 m/s^2 c. 20 s (or $2.0x10^1$ s)
27. p. 862 from text #12. 0.823 m/s^2
28. p. 862 from text #18. Solve this problem two ways:
    (1) Draw a v-t graph The graph starts at the origin and gains speed in the negative direction (a straight line going away from the t-axis).
    The base of the triangle is 4.78 s. The height of triangle is 46.8 m/s (since the slope of the line is the acceleration, -9.8 m/s^2 , and rise over run is the slope, the rise is found to be 46.8 m/s, which is the height of the triangle). Calculating the area of the triangle → **-112 m**
    (2) Use an equation -112 m
29. p. 861 from text #4. -1.10 m/s^2
30. p. 862 from text #11. -30.0 m