

Linear Motion Worksheet (p. 1)

Honors Freshman Physics

Physics problems must be solved completely using the scientific approach K-U-E-S .

1. **Knowns** – write the known values (include units) and its variable symbol.
 2. **Unknowns** – write the variable symbol for what you will be solving for
 3. **Equation** – write the equation you will be using (symbols only!!)
 4. **Substitute & Solve** - Substitute the known values (numbers & units) for the letters in the equation.
 5. The **answer** should be circled/boxed and contain correct significant digits & units and no fractions.
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SPEED

1. Light from the sun reaches the earth in 498 s. If the sun is 1.494×10^{11} m from the earth, how fast (m/s) does light travel in space?
 3.00×10^8 m/s
2. A bullet is fired at 660 m/s and strikes a target 200.0 meters away. What is the duration of the bullet's flight?
0.30 s
3. What is the average speed (km/h and mi/h) of a runner who completes a 5.00 km race in 20.50 min?
14.6 km/h 9.05 mi/h
4. How far would an object move in 20.0 seconds if it were traveling at a constant speed of 63.00 meters per second?
1260 m
5. An amusement park carousel travels at a speed of 8.0 m/s. If the circular track of the carousel has a radius of 10.3 m, how many seconds will it take for the carousel to make one complete revolution?
8.1 s

VELOCITY

6. What is the velocity of a car traveling north on I-75 if it takes 2 hours to reach Chattanooga (120 miles)?
60 mi/h N
7. The controls on a motorboat are marked at the position where it travels at 25.0 km/h in still water. What will be the velocity of the boat, as measured by an observer on shore, if it is directed upstream on a river which flows at the rate of 4.0 km/h?
21.0 km/h

VELOCITY (continued)

8. During a 400 meter run at a track meet the runner in lane 1 will start and finish at the same point. If it takes 58.00 seconds for her to run the race what is her velocity? *No velocity*
9. (a) What is the displacement of a cyclist during a 0.50 hour ride if his average velocity was 1.00 km/h west? (b) Did the cyclist actually travel more, less, or the same total distance as his displacement. Explain your answer *0.50 km W more or same*

ACCELERATION

10. A car starts from rest and reaches a velocity of 22.0 m/s in 20.0 seconds. What is its acceleration? *1.10 m/s²*
11. *How long would the same car, from #10, take to go from 22.0 m/s to 30.0 m/s with the same acceleration?* *7.3 s*
12. *How much time does a car with an acceleration of 2 m/s² take to go from 10 m/s to 30 m/s?* *10 s*
13. What is the acceleration of a racing car if its velocity is decreased uniformly from 66 m/s to 44 m/s during an 11 second period? *-2.0 m/s²*
14. A spacecraft traveling at 1200 m/s is uniformly accelerated at the rate of 150 m/s² by burning its second stage rocket. If the rocket burns for 18 s, what is the final velocity of the craft? *3900 m/s*

MOTION CONCEPTS

15. Can an automobile with a velocity toward the north have an acceleration toward the south? Explain.

16. Can an object reverse its direction of travel while maintaining a constant acceleration? If so, give an example. If not, explain why.

17. You are driving north on a highway. Then without changing speed, you round a curve and drive east.
(a) Does your velocity change? (b) Do you accelerate? Explain.

18. Starting from rest, one car accelerates to a speed of 50 km/h, and another car accelerates to a speed of 60 km/h. Can you say which car underwent the greater acceleration? Why or why not?

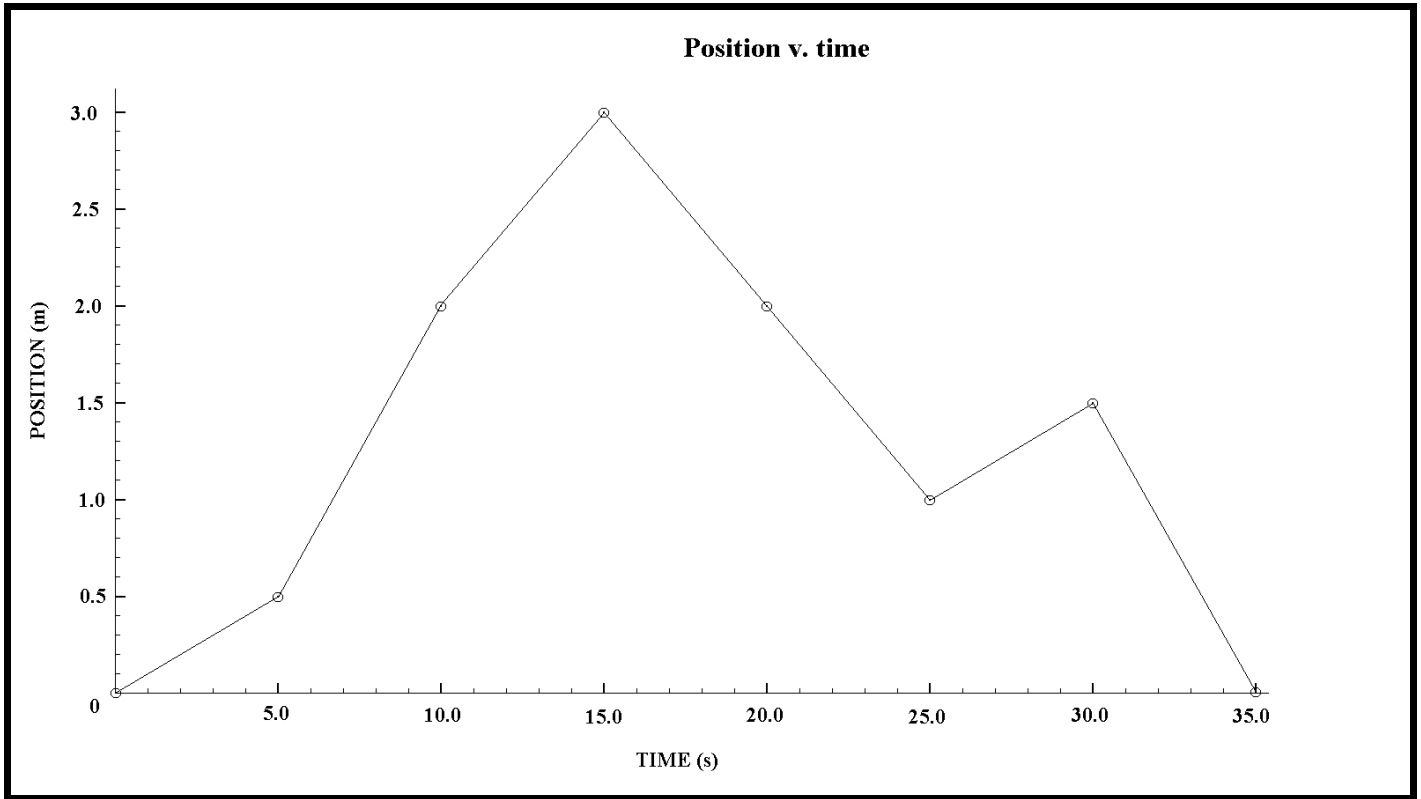
19. Cite an example of something that undergoes acceleration while moving at a constant speed. Can you also give an example of something that accelerates while travelling at constant velocity? Explain

20. (a) Can an object be moving when its acceleration is zero? If so, give an example. (b) Can an object be accelerating when its speed is zero? If so give an example.

21. What is the acceleration of a car that moves at a steady velocity of 100 km/h for 100 seconds? Explain your answer.

FREEFALL CONCEPTS

22. What are the conditions for a freely falling object?
23. What is the gain in velocity per second for a freely falling object? *9.8 m/s*
24. The acceleration of free fall is about 10 m/s^2 . Why does the seconds unit appear twice?
25. What is the velocity acquired by a freely falling object 5.0 seconds after being dropped from a rest position? What is it after 6.0 seconds? *49 m/s* *57.8 m/s*
26. What is the displacement of a freely falling object 5.00 seconds after being dropped from a rest position? What is it after 6.00 seconds? *123 m* *176 m*
27. If a friend claims that in a standing jump he can remain off the ground for 1.0 second then how high can he jump? For 2.0 seconds? Are either of these claims likely to be true? *1.2 m* *4.9 m*
28. Suppose that a freely falling object were somehow equipped with a speedometer. By how much would its speed reading increase with each second of fall? *9.8 m/s*
29. Suppose that the same freely falling object were also equipped with an odometer. Would the readings of distance fallen indicate equal or different falling distances for successive seconds?
30. For a freely falling object dropped from rest, what is the acceleration at the end of the 5th second of fall? The 10th second? Defend your answer.
31. When a ball player throws a ball straight up, by how much does the velocity of the ball decrease each second while ascending? By how much does it increase while descending? How much time is required for rising as compared to falling?
32. Someone standing at the edge of a cliff throws a ball nearly straight up at a certain speed and another ball nearly straight down with the same initial speed. If air resistance is negligible, how will the speed of each ball compare just before striking the ground below?



Graph #2

