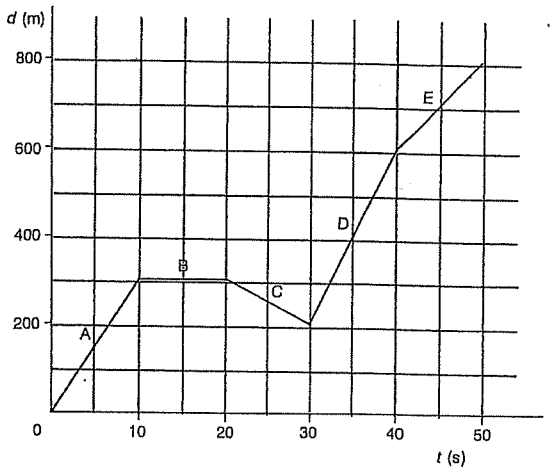
0 HONOURS Velocity



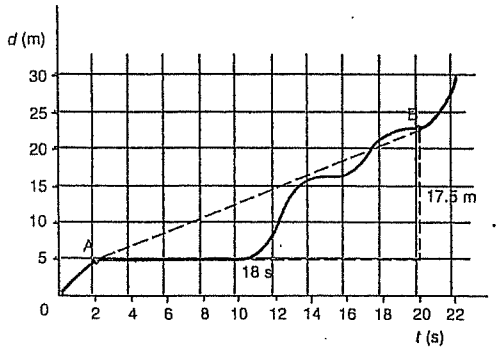
ance-time graph shows the motion of a delivery truck e driver is trying to find a certain house on a long dark reet.

1. How far is the truck from its starting point after:
a. 10 s b. 15 s c. 30 s

d. 43 s e. 50 s

2. What is the truck's speed in each of the lettered intervals?

A = B = C = D = E =



In the real world, an object's speed or velocity changes several times during a trip. The graph represents the motion of an object that is moving very irregularly. Only where the line is straight is the speed constant.

The average speed between two points is equal to the slope of the line joining the two points on a distance-time graph. To calculate average speed between two points, use the equation $v = \Delta d/\Delta t$

3. Calculate the average speed between A and B

4. From the graph, calculate the average speed for the entire trip.

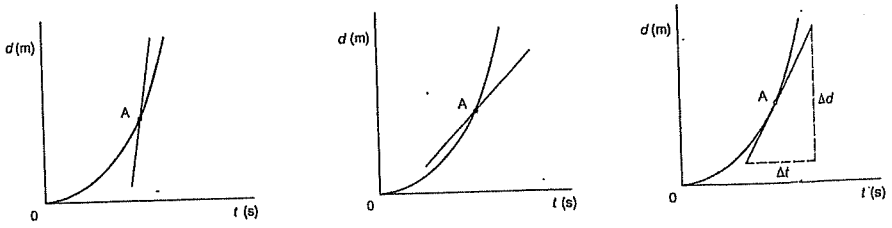
5. Find the average speed for each of the following intervals
   a. from 0 s to 2 s

   b. from 6 s to 10 s

   c. from 15 s to 18 s

   d. from 6 s to 15 s

When an object's speed changes it is accelerating. When a car accelerates its speed changes and its distance-time graph will be curved. To determine the speed of the car at point A on the graph, you must draw a line that just touches point A. Such a line is called tangent. The slope of the tangent line is the speed of the car at that point.

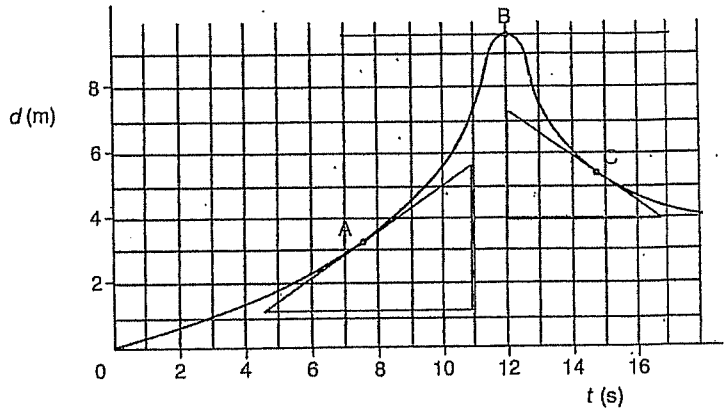


6. On the following distance-time graph, find the speed at points A, B, and C by finding the slope of the tangent to the graph at each of the points.

For point A:

For point B:

For point C:



7. Plot a graph of the data on the graph paper on the next page.

d (m)	t (s)
10.0	0.0
13.1	0.5
15.9	1.0
18.1	1.5
19.5	2.0
20.0	2.5
19.5	3.0
18.1	3.5
15.9	4.0
13.1	4.5
10.0	5.0
6.9	5.5
4.1	6.0
1.9	6.5
0.5	7.0
0.0	7.5
0.5	8.0
1.9	8.5
4.1	9.0
6.9	9.5
10.0	10.0

Using your graph, answer the following:

a. What is the average speed for the first 2.5 s?

b. What is the average speed from the 2.5 s mark to the 7.5 s mark?

c. What is the speed at the 2.5 s mark?

d. At what other time is the speed zero?

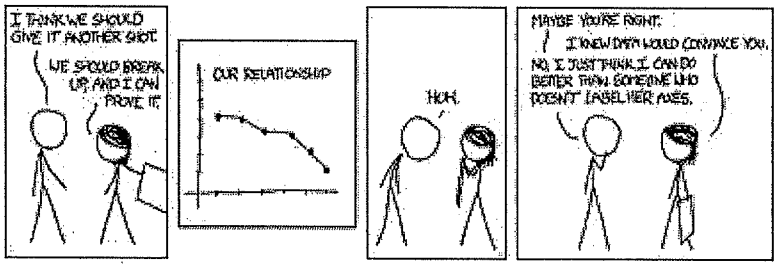
e. What are the speeds at each of the following times?

1) 1.0 s

2) 3.0 s

3) 5.0 s

4) 1.7 s



Review For Everything in Physics So Far! Do #1-9, 12-14 on a separate piece of paper!
(Answers are on the bottom of the last page of this booklet)

1. A spinning top makes one revolution every 0.080 s. What is its frequency?

2. A record-player turntable makes 33.3 revolutions/min. What is its period in seconds?

3. An electric clock motor rotates 1200 times in 240 s.
   a. What is its frequency? b. What is its period?

4. What is the period of the minute hand of a clock?

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

6. How long does it take Kulak, riding her Harley at 2.50 m/s, to travel 1800 m? She is riding slowly to show off her cool ride!

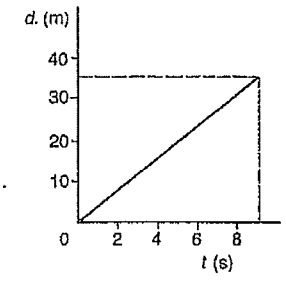
7. How far will a woman travel in 15 min. driving her car down the highway at 24 m/s?

8. The speed limit on the expressways is 100 km/h. If you see something on the road ahead of you, as you are driving along, it usually takes about 1.0 s for the brakes to be fully applied. How far will the car travel in that time, in meters?

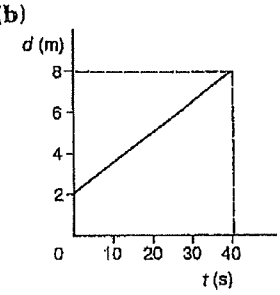
9. The speed limit on suburban streets is 50 km/h. You are traveling the limit when a boy jumps out from behind a parked car 5 m in front of you. How long will it be before you hit him?

10. Calculate the speed of the object in each of these distance-time graphs.

(a)



(b)



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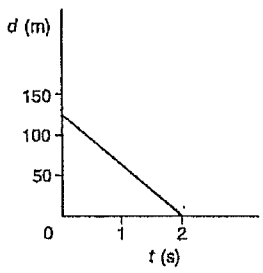
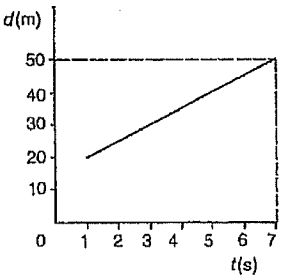
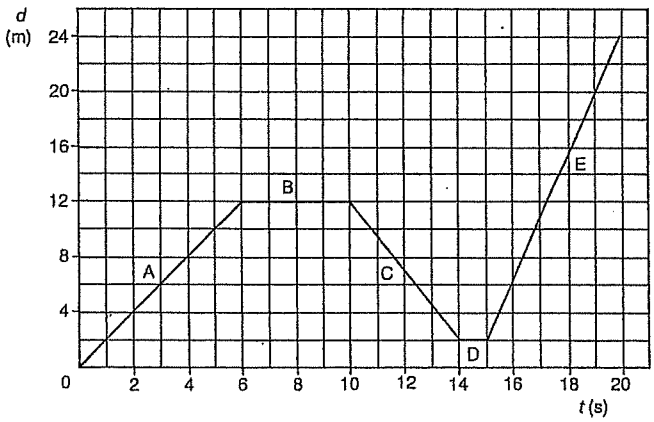


(d)



11. Calculate the speed of this automobile in each part of its trip.



12. Toronto is about 50 km from Hamilton. A freight train starts out from Hamilton for Toronto at 50 km/h. At the same time, a passenger train leaves Toronto for Hamilton at 75 km/h. How much time passes before they meet one another, in minutes?

13. Two trains, each 1.0 km long, are heading towards each other at 50 km/h. At a certain moment, their locomotives are right beside one another (they are on parallel tracks). How much time passes before their cabooses are beside one another, in minutes?

14. A boy runs out the door and starts down the road for school at 10 km/h (he is in Kulak's class and is in a hurry to get there on time). Six minutes later, his mother discovers that he has forgotten Kulak's birthday present, and she runs after him at 14 km/h.
    a. How far does he get in 6.0 min?
    b. How long does it take her to catch him, in minutes?
    c. How far from home is he when she catches him?

Acceleration: the rate at which the speed increases or decreases

If the speed of an object changes by the same amount each second, it has a constant acceleration.

$$\text{acceleration} = \frac{\text{change in velocity}}{\text{time for the change}}$$

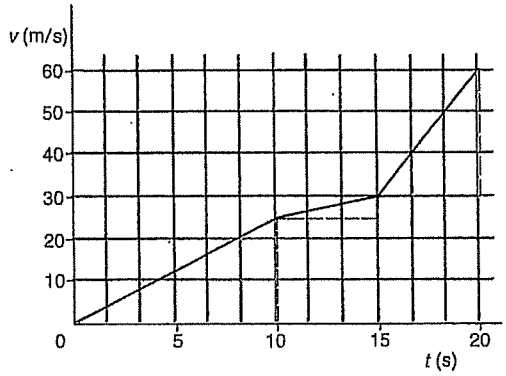
What is the acceleration of a car whose speed increased steadily from 25 m/s to 65 m/s in 8.0 s?

1. A bicycle rider accelerates from 5 m/s to 15 m/s in 4.0 s. What is his acceleration?

2. A jet plane accelerates from rest to 750 km/h in 1.20 h. What is its acceleration?

3. A runner accelerates from 0.52 m/s to 0.78 m/s in 0.050 s. What is her acceleration?

The following is an example of a velocity- time graph.



What is the slope of a velocity time graph equal to?

The equation for acceleration is

Determine the acceleration of this object for the first 10 s of its motion.

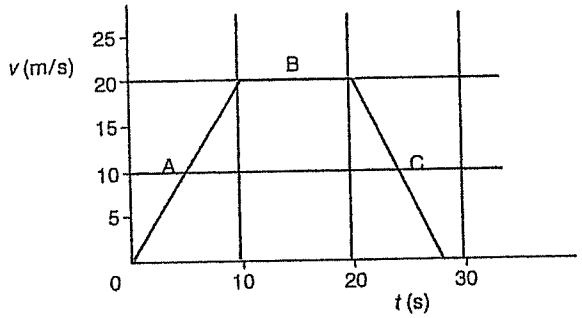
4. Calculate the acceleration of the object in the previous graph for each of the time intervals:
   a. from 10 s to 15 s

   b. from 15 s to 20 s

5. A car accelerates from rest at 50.0 cm/s^2 for 12.5 s. How fast is it moving then?

6. A turtle wants to accelerate from 2 mm/s to 8 mm/s. How long will it take it if its maximum acceleration is 3 mm/s^2?

Describe the motion of the object shown on the following velocity-time graph:



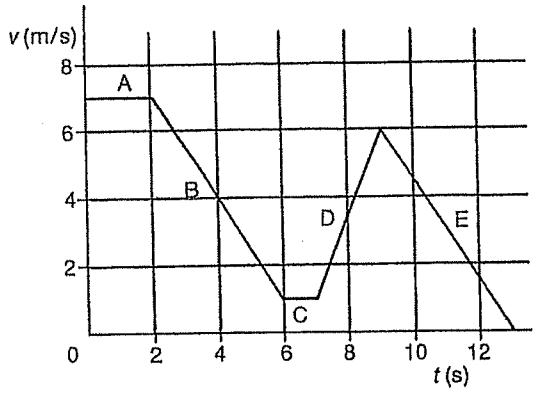
Calculate the acceleration for each section:

7. How long will it take a truck traveling at 35 m/s to stop if it accelerates at –5.0 m/s^2?

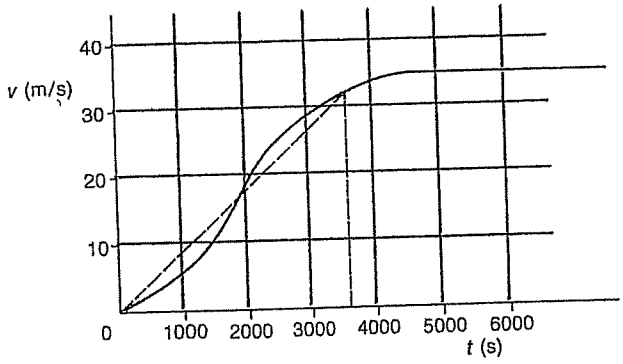
8. A plane landing accelerates at –1.5 m/s^2 for 1.0 min until it stops. How fast was it going as it started to slow down?

9. A car hitting a tree loses 40.0 m/s in 0.100 s. What is its acceleration?

10. Calculate the acceleration of the object in each of the lettered sections on the graph.



Like speed and velocity, acceleration is not always constant. Using a velocity-time graph, how do you find the average acceleration of an object if the acceleration is not constant? Calculate the average acceleration for the first hour.



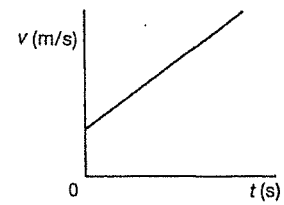
Using the previous graph, find the average acceleration for the following time intervals:

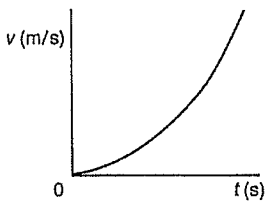
a. 0 s to 5000 s

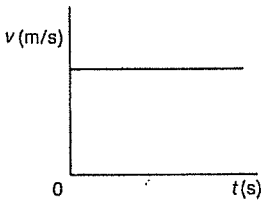
b. 2000 s to 6000 s

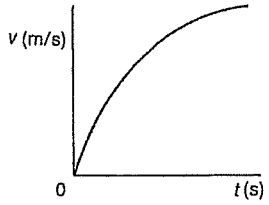
c. 20 min to 90 min

Label the following as constant, increasing, or decreasing acceleration.



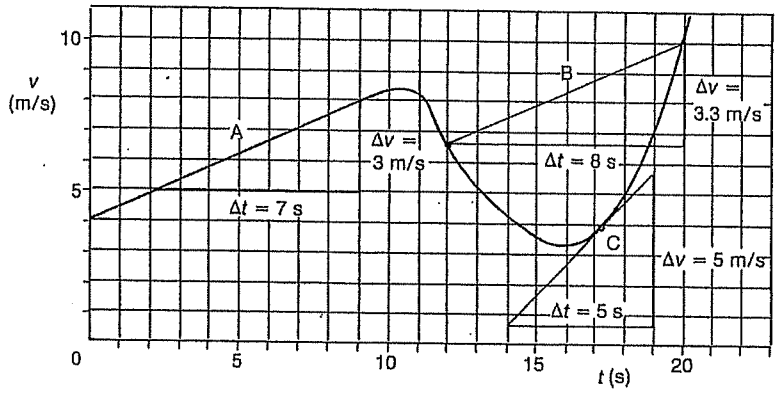




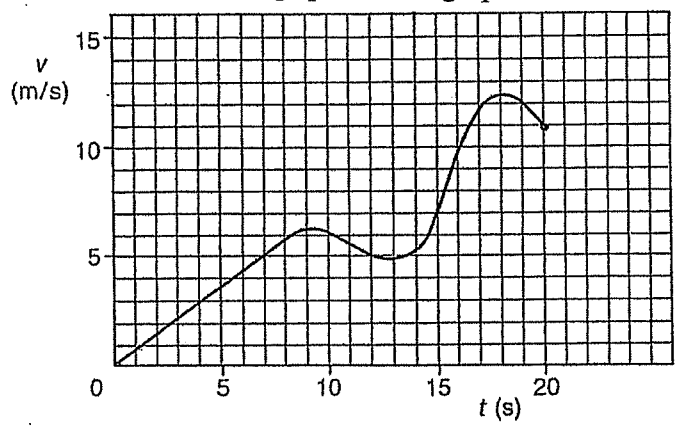


When the velocity-time graph is a curve, it is possible to find the acceleration at a point. How?

On this velocity-time graph, find the acceleration at A, B, and C. Name each type of acceleration.



Examine the following speed-time graph:



11. At what times is the acceleration zero?

12. What is the acceleration for the first 7.0 s?

13. What is the average acceleration for each of the following time intervals?
    a. 5.0 s to 15.0 s

    b. 9.0 s to 13.0 s

    c. 15.0 s to 20.0 s

14. What is the acceleration at each of the following times?
    a. 15.0 s

    b. 11.0 s

    c. 17.0 s

Answers for Review for Everything in Physics So Far!

1. *13 Hz* 2. *1.80 s* 3a. *5.0 Hz* b. *0.20 s* 4. *3600 s* 5. *26.7 km/s* 6. *720 s* 7. *$2.2x10^4$ m* 8. *30 m* 9. *0.4 s* 10a. *4 m/s* b. *0.2 m/s* c. *-63 m/s* d. *5 m/s* 11 A = *2* B = *0* C = *-2.5* D = *0* E = *4.4* 12. *24 min* 13. *1.2 min* 14a. *1.0 km* b. *15 min* c. *3.5 km*