

Acceleration Study Guide

Definitions and Concepts

1) Define acceleration.

Acceleration is the change in velocity over a period of time. This can be speeding up, slowing down, or changing directions at a constant speed.

2) What is the difference between a positive acceleration and a negative acceleration?

A positive acceleration is increasing speed in a positive direction. A negative acceleration is increasing speed in a negative direction. A negative acceleration could also be the slowing of an object that is moving in a positive direction.

3) Write a summary of the equations that relate displacement, time, velocity and acceleration.

$$a = \frac{v}{t}; d = \frac{1}{2}(V_f + V_i)t; V_f = V_i + at; d = V_i t + \frac{1}{2}at^2; V_f^2 = V_i^2 + 2ad$$

4) Give an example of each of the following:

a) An object that is slowing down but has a positive acceleration.

A car backing up that is coming to a stop.

b) An object that is speeding up but has a negative acceleration.

A bicycle that is coming to a stop.

c) An object that is moving at a constant speed but has an acceleration.

A merry go round at full speed.

5) Explain why an aluminum ball and a steel ball of similar size and shape, dropped from the same height, reach the ground at the same time.

The two objects have similar masses and shapes, therefore they experience the same amount of air resistance as they fall. As a result, they will hit the ground at the same time due to the same acceleration and similar air resistance.

6) Give examples of falling objects where air resistance can and cannot be ignored.

A leaf and a piece of paper.

Graphing

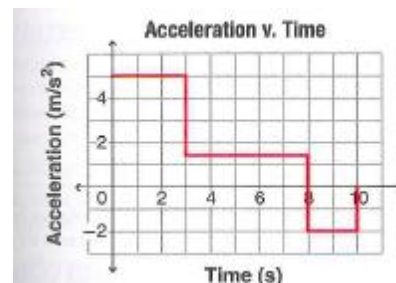
7) Four cars start from rest. Car A accelerates at 6.0 m/s^2 ; car B at 5.4 m/s^2 ; car C at 8.0 m/s^2 ; and car D at 12.0 m/s^2 .

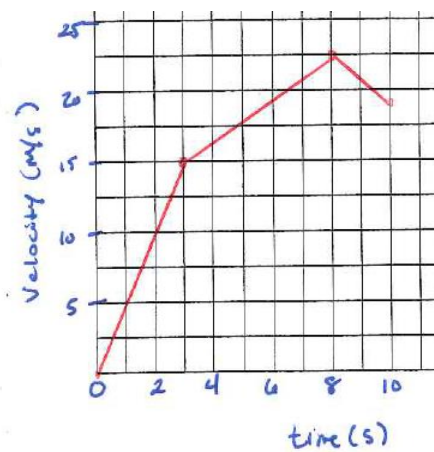
a) In the first column of a table, show the velocity of each car at the end of 2.0 sec.

b) In the second column, show the displacement of each car during the same 2.0 sec.

Car A	12.0 m/s	12.0 m
Car B	10.8 m/s	10.8 m
Car C	16.0 m/s	16.0 m
Car D	24.0 m/s	24.0 m

8) Draw a velocity vs. time graph showing the motion of an object with the following acceleration vs. time graph.





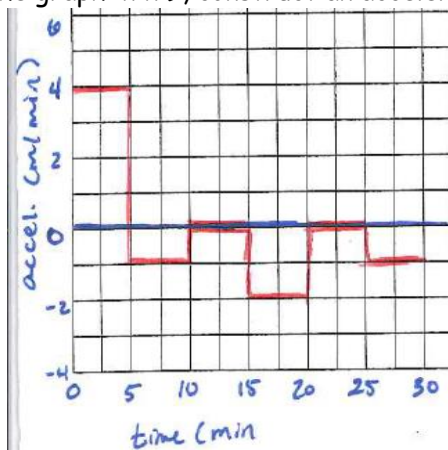
Answer:

9) Using the graph to the right, find the magnitude of displacement during the time intervals.

- a) $t = 5.0 \text{ min}$ and $t = 10.0 \text{ min}$ 87.5 m
- b) $t = 10.0 \text{ min}$ and $t = 15.0 \text{ min}$ 75 m
- c) $t = 25.0 \text{ min}$ and $t = 30.0 \text{ min}$ 12.5 m
- d) $t = 0.0 \text{ min}$ and $t = 25.0 \text{ min}$ 287.5 m



10) For the graph in #9, construct an acceleration vs. time graph for the same time intervals.



Answer:

Problems

11) Marco wants to buy a used sports car with the greatest acceleration. Car A can go from 0 m/s to 17.9 m/s in 4.0 s. Car B can accelerate from 0 m/s to 22.4 m/s in 3.5 s. Car C can go from 0 m/s to 26.8 m/s in 6.0 s. Rank the three cars from greatest acceleration to least.

Car B (6.4 m/s^2), Car A & C (4.5 m/s^2)

12) A rocket traveling at 155 m/s is accelerated at a rate of -31.0 m/s^2

- a) How long will it take before the instantaneous speed is 0.0 m/s? 5 s
- b) How far will it travel during this time? 387.5 m
- c) What will its velocity be after 8.0 s? -93 m/s

13) Determine the displacement of a plane that experiences uniform acceleration from 66 m/s north to 88 m/s north in 12 s. 1.8 m/s^2

14) If a bullet leaves the muzzle of a rifle with a speed of 600 m/s, and the barrel of the rifle is 0.90 m long, what is the acceleration of the bullet in the barrel? $200,000 \text{ m/s}^2$

15) A baseball pitcher throws a fastball at a speed of 44 m/s. The ball has constant acceleration as the pitcher holds it in his hand and moves it through an almost straight line distance of 3.5 m. Calculate the acceleration of the ball. 277 m/s^2

16) Highway safety engineers build guardrails so that cars hitting them will slow down at a safe rate. Suppose a car going 110 km/hr hits the guardrail and the guardrail decreases the car's velocity at a rate of 32 m/s^2 . What distance would the car travel along the guardrail before coming to a stop? 14.6 m

17) A student drops a rock from a bridge to the water 45 m below. With what speed does the rock strike the water? $30. \text{ m/s}$

18) You throw a ball downward from a window at a speed of 2.0 m/s. How fast will the ball be moving when it hits the sidewalk 13.5 m below? 6.1 m/s