## Acceleration Study Guide

## Definitions and Concepts

1) Define acceleration.
2) What is the difference between a positive acceleration and a negative acceleration?
3) Write a summary of the equations that relate displacement, time, velocity and acceleration.
4) Give an example of each of the following:
a) An object that is slowing down but has a positive acceleration.
b) An object that is speeding up but has a negative acceleration.
c) An object that is moving at a constant speed but has an acceleration.
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.
6) Give examples of falling objects where air resistance can and cannot be ignored.

## Graphing

7) Four cars start from rest. Car $A$ accelerates at $6.0 \mathrm{~m} / \mathrm{s}^{2} ; \operatorname{car} B$ at $5.4 \mathrm{~m} / \mathrm{s}^{2} ; \operatorname{car} C$ at $8.0 \mathrm{~m} / \mathrm{s}^{2}$; and car D at $12.0 \mathrm{~m} / \mathrm{s}^{2}$.
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 .
8) Draw a velocity vs. time graph showing the motion of an object with the following acceleration vs. time graph.

9) Using the graph to the right, find the magnitude of displacement during the time intervals.
a) $t=5.0 \mathrm{~min}$ and $t=10.0 \mathrm{~min}$
b) $t=10.0 \mathrm{~min}$ and $t=15.0 \mathrm{~min}$
c) $t=25.0 \mathrm{~min}$ and $t=30.0 \mathrm{~min}$
d) $\dagger=0.0 \mathrm{~min}$ and $\dagger=25.0 \mathrm{~min}$

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

## Problems

11) Marco wants to buy a used sports car with the greatest acceleration. Car A can go from $0 \mathrm{~m} / \mathrm{s}$ to 17.9 $\mathrm{m} / \mathrm{s}$ in 4.0 s . Car B can accelerate from $0 \mathrm{~m} / \mathrm{s}$ to $22.4 \mathrm{~m} / \mathrm{s}$ in 3.5 s . Car $C$ can go from $0 \mathrm{~m} / \mathrm{s}$ to $26.8 \mathrm{~m} / \mathrm{s}$ in 6.0 s . Rank the three cars from greatest acceleration to least.
12) A rocket traveling at $155 \mathrm{~m} / \mathrm{s}$ is accelerated at a rate of $-31.0 \mathrm{~m} / \mathrm{s}^{2}$ ?
a) How long will it take before the instantaneous speed is $0.0 \mathrm{~m} / \mathrm{s}$ ?
b) How far will it travel during this time?
c) What will its velocity be after 8.0 s ?
13) Determine the displacement of a plane that experiences uniform acceleration from $66 \mathrm{~m} / \mathrm{s}$ north to $88 \mathrm{~m} / \mathrm{s}$ north in 12 s .
14) If a bullet leaves the muzzle of a rifle with a speed of $600 \mathrm{~m} / \mathrm{s}$, and the barrel of the rifle is 0.90 m long, what is the acceleration of the bullet in the barrel?
15) A baseball pitcher throws a fastball at a speed of $44 \mathrm{~m} / \mathrm{s}$. 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.
16) Highway safety engineers build guardrails so that cars hitting them will slow down at a safe rate. Suppose a car going $110 \mathrm{~km} / \mathrm{hr}$ hits the guardrail and the guardrail decreases the car's velocity at a rate of $32 \mathrm{~m} / \mathrm{s}^{2}$. What distance would the car travel along the guardrail before coming to a stop?
17) A student drops a rock from a bridge to the water 45 m below. With what speed does the rock strike the water?
18) You throw a ball downward from a window at a speed of $2.0 \mathrm{~m} / \mathrm{s}$. How fast will the ball be moving when it hits the sidewalk 13.5 m below?
