NAME _____   PERIOD ____

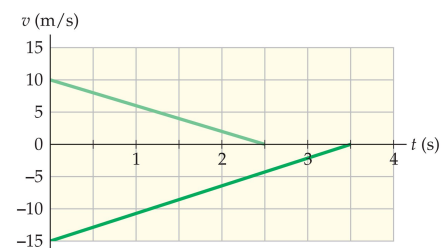UNIT 3 PRACTICE PROBLEMS   AP PHYSICS

3.1 ACCELERATION

1. A 747 airliner reaches its takeoff speed of 173 mi/h in 35.2 s. What is the magnitude of its average acceleration?
2. At the starting gun, a runner accelerates at 1.9 m/s^2 for 5.2 s. The runner's acceleration is zero for the rest of the race. What is the speed of the runner **(a)** at t = 2.0 s, and **(b)** at the end of the race?
3. Running with an initial velocity of +11 m/s, a horse has an average acceleration of -1.81 m/s^2. How long does it take for the horse to decrease its velocity to +6.5 m/s?
4. Assume the brakes of your car create a constant deceleration of 4.2 m/s^2 regardless of how fast you are driving. If you double your driving speed from 16 m/s to 32 m/s, does the time required to come to a stop increase by a factor of two or a factor or 4? Verify and explain your answer.

3.2 MOTION WITH CONSTANT ACCELERATION

5. Landing with a speed of of 81.9 m/s, and traveling due south, a jet comes to rest in 949 m. Assuming the jet slows with constant acceleration, find the magnitude and direction of its acceleration.
6. A child slides down a hill on a sled with an acceleration of 1.8 m/s^2. If she starts at rest, how far has she traveled in **(a)** 1.0 s, **(b)** 2.0 s, and **(c)** 3.0 s?
7. On a ride called the Detonator at Worlds of Fun in Kansas City, passengers accelerate straight downward from rest to 45 mi/h in 2.2 seconds. What is the average acceleration of the passengers on this ride?
8. A rocket blasts off and moves straight upward from launch pad with constant acceleration. After 3.0 s the rocket is at a height of 77 m. **(a)** What are the magnitude and direction of the rocket's acceleration? **(b)** What is its speed at this time?
9. A car and a truck are heading directly toward one another on a straight and narrow street, but they avoid a head-on collision by simultaneously applying their brakes at The resulting velocity versus time graphs are shown in the graph to the right. What is the separation between the car and the truck when they have come to rest, given that at t = 0 the car is at x = 15 m and the truck is at x = -35 m (Note that this information determines which line in the graph corresponds to which vehicle.)

UNIT 3 PRACTICE PROBLEMS   **AP PHYSICS**

3.3 FREELY FALLING OBJECTS

10. Michael Jordan's vertical leap is reported to be 48 inches. What is his takeoff speed? Give your answer in meters per second.
11. The first active volcano observed outside of Earth was discovered in 1979 on Io, one of the moons of Jupiter. The volcano was observed to be ejecting material to a height of about 2.00×10^5 m. Given that the acceleration of gravity on Io is 1.80 m/s^2, find the initial velocity of the ejected material.
12. On a hot summer day in the state of Washington while kayaking, I saw several swimmers jump from a railroad bridge into the Snohomish River below. The swimmers stepped off the bridge, and I estimated that they hit the water 1.5 s later. **(a)** How high was the bridge? **(b)** How fast were the swimmers moving when they hit the water? **(c)** What would the swimmer's drop time be if the bridge were twice as high?
13. A model rocket blasts off and moves upward with an acceleration of 12 m/s^2 until it reaches a height of 26 m, at which point its engine shuts off and it continues its flight in free fall. **(a)** What is the maximum height attained by the rocket? **(b)** What is the speed of the rocket just before it hits the ground? **(c)** What is the total duration of the rocket's flight?