Honors Physics **1-d Motion problems #2**

1.) If a body has uniform (constant) velocity, what is the relationship among its initial, final, and average velocities? If a body has a uniform (constant acceleration), what is the relationship among its initial, final, and average velocities?

2.) Light from the sun reaches the earth in 8.3 minutes. The speed of light is 3.0×10^8 m/s. In kilometers, how far is the earth from the sun? 1.5×10^8 km

3.) The distance from home plate to the pitcher's mound is 18.5 m. If a pitcher is capable of throwing a ball at 38.5 m/s (about 83 mi/h), how long does it take a thrown ball to reach home plate? 0.481 s

4.) A diver travels the length of the Pennsylvania Turnpike (576 km) in 6.0 hours and 40.0 minutes. What is her average speed (a) in km/h? (b) in mi/h? 86 km/h 53 mi/h

5.) If, while you are driving along at 45 km/h, your attention wanders for 0.50 s, how far (in meters then feet) do you travel "blind" during that half second? 6.3 m 21 ft

6.) A train travels at 100.0 km/h for 0.520 hours, at 60.0 km/h for the next 0.240 hours, and then at 117 km/h for the next 0.710 hours. What is the average speed? 102 km/h

$\mathbf{a} = \Delta\mathbf{v} / \Delta\mathbf{t}$

7.) Each of the following changes in velocity takes place in a **10 second** - interval. What is the magnitude, the algebraic sign, and the direction of the average acceleration in each interval?

a.) At the beginning of the interval, a body is moving toward the right at 5.0 m/s and, at the end, it is moving toward the right at 20.0 m/s. +1.5 m/s^2 right

b.) At the beginning it is moving toward the right at 20.0 m/s and, at the end, it is moving toward the right at 5.0 m/s. -1.5 m/s^2 left

c.) At the beginning it is moving toward the left at 5.0 m/s and, at the end, it is moving toward the left at 20.0 m/s. -1.5 m/s^2 left

d.) At the beginning it is moving toward the left at 20.0 m/s and, at the end, it is moving toward the left at 5.0 m/s. +1.5 m/s^2 right

e.) At the beginning it is moving toward the right at 20.0 m/s and, at the end, it is moving toward the left at 20.0 m/s. -4.0 m/s^2 left

f.) At the beginning it is moving toward the left at 20.0 m/s and, at the end, it is moving toward the right at 20.0 m/s. +4.0 m/s^2 right

g.) In which of the above instances did the body slow down? b, d

8.) An airplane starting from rest has a uniform acceleration of 4.0 m/s^2. What is the velocity at the end of 30.0 s if this acceleration is maintained? 120 m/s

9.) During an interval of 10.0 seconds, a train on a straight track changes its velocity from 15.0 km/h to 20.0 km/h. Determine the acceleration and the average velocity during that period assuming that the change occurred uniformly. 0.500 km/h·s or 0.138 m/s^2 17.5 km/h

Other kinematics formulas can be derived from the graphs and algebraic substitution.

$v_{avg} = (v_i + v_f) / 2$ $\Delta x = v_0\Delta t + \frac{1}{2}a\Delta t^2$ $v_f^2 = v_i^2 + 2a\Delta x$

10.) Nolan Ryan pitched a baseball that that traveled from the pitcher's mound to home plate (a distance of 18.5 m) in 0.411 s. (a) What was the speed of the ball in km/h? (b) in mi/h? (c) If the catcher allowed his mitt to recoil backward 0.075 m while catching the ball, what was the acceleration of the ball while it was being slowed down by the catcher (in m/s^2)? 160 km/h 1.0×10^2 mi/h $-14{,}000\ m/s^2$

11.) A spacecraft increases speed at a rate of 0.02 km/s^2. How much time is required for the speed to increase from 7.0 km/s to 8.0 km/s? How far does it travel during this time? How far will it travel during the ninth second (that's not during the first nine seconds, but during the ninth second)? 50 s 400 km 7 km

12.) A train has an acceleration of 3.0 m/s^2 in a direction opposite to that of its motion. (a) How long a time will the train require to stop if it is initially going 30.0 m/s? (b) How far does it travel during this time period?
1.0×10^1 s 150 m

13.) A body moving with constant acceleration covers the distance between two points 60.0 m apart in 6.0 seconds. Its velocity as it passes the second point is 15 m/s. (a) What is its velocity at the first point? (b) What is the acceleration? 5.0 m/s $1.6\ m/s^2$

14.) A bus traveling along a straight street at 16.7 m/s increasing its speed at the rate of 1.33 m/s each second. (a) Find the distance covered in 6.00 s. (b) If its speed is decreasing at the rate of 1.33 m/s each second, find the distance traveled in 6.00 seconds and the time it takes to come to rest.
124 m 76.3 m 12.8 s

15.) A 1.0 kg stone is dropped from a tall building. What is its displacement after it falls freely for 3.0 s? -44 m

16.) A small object is given an initial downward velocity of 3.0 m/s. (a) What is its velocity after it falls freely for 5.0 s? (b) What is its displacement from the initial position? -52 m/s -140 m

17) A ball dropped from a bridge requires 5.0 s to strike the ground below. How high is the bridge in meters?
125 m

18) A ball is thrown nearly vertically upward from a point near the corner of a tall building. It just misses the edge on the way down, and passes a point 50.0 m below its starting point 5.00 s after it leaves the throwers hand. (a) What was the initial velocity of the ball? (b) How high did it rise above its starting point? (c) What was the ball's velocity at the 50.0 m point? (d) What were the magnitude and direction of its velocity at the highest point?
14.5 m/s 10.7 m -34.5 m/s zero,none

19) A pitcher throws a baseball straight up, with an initial speed of 25 m/s. (a) How long does it take to reach the highest point? (b) How high does the ball rise above its release point? (c) How long will it take for the ball to reach a point 25 m above its release point? 2.6 s 32m 1.4 s and 3.7 s

20) A small fish is dropped by a pelican that is rising steadily at 0.50 m/s. (a) After 2.5 seconds, what is the velocity of the fish? (b) How far below the pelican is the fish after 2.5 seconds?
-24 m/s 33 m