Name: _____ Hour: _____

CH 2 & 3: DESCRIBING MOTION WITH EQUATIONS

Solve the problems below. Show your work and answers with correct units.

Average Speed = Total Distance / Total Time

Acceleration = final velocity – starting velocity / time it takes to change velocity

$$d = v_i * t + \frac{1}{2} * a * t^2 \qquad v_f^2 = v_i^2 + 2 * a * d \qquad v_f = v_i + a * t \qquad d = \frac{v_i + v_f}{2} * t$$

Velocity Equations

Velocity is the speed of an object in a particular direction. Velocity changes as speed or direction changes. Below calculate velocity. Be sure to include the final direction traveled.

1. A plane travels 500 miles west and lands in Arizona. Then the plane travels another 644km west and lands in California. The entire trip was completed in 5 hours. What is the average velocity of the plane in mi/hr? (1 mi = 1609.34 m)

Givens:	Unknown:	Equations:	Substitute	Solve

2. A girl on a bicycle rides down a hill 600 meters. Then the girl rides up the hill 100 meters and falls off her bicycle. The entire bicycle trip lasted 50 seconds. What is the average velocity of the girl in m/s?

3. In 1960, U.S. Air Force Captain Joseph Kittinger broke the records for the both the fastest and the longest sky dive…he fell an amazing 19.5 miles! (Cool facts: There is almost no air at that altitude, and he said that he almost didn't feel like he was falling because there was no whistling from the wind or movement of his clothing through the air. The temperature at that altitude was 36 degrees Fahrenheit *below* zero!) His average speed while falling was 254 miles/hour. How much time did the dive last in minutes?

4. The Voyager I spacecraft was launched 40 years ago. Since that time the spacecraft has had an average speed of about 31,000 miles/hour. Assuming Voyager I has traveled in a straight line, how far has it traveled in 40 years? Give your answer in meters. (1 year = 365 days, 1 mi = 1609.34 m)

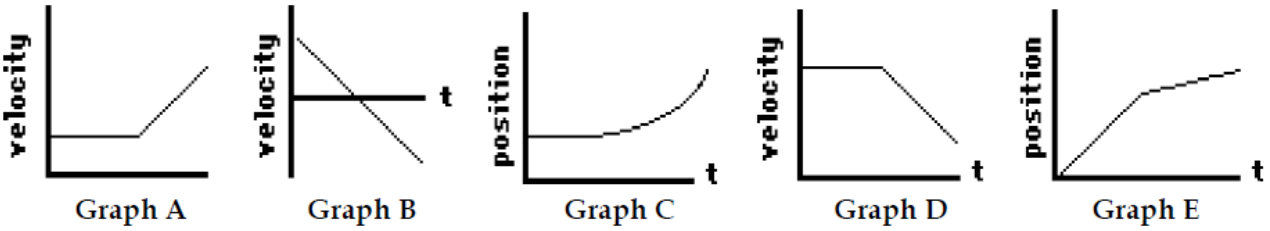
Acceleration Equations

5. A runner accelerates from a velocity of 5 miles/hour east until reaching a velocity of 10 miles/hour east in 20 seconds. What was the runner's acceleration?

6. An engineer is designing the runway for an airport. Of the planes that will use the airport, the lowest acceleration rate is likely to be 3 m/s^2. The takeoff speed for this plane will be 65 m/s. Assuming this minimum acceleration, what is the minimum allowed length for the runway?

7. You're driving along a dark stretch of highway with a speed of 25 m/s. Suddenly, you see that a bridge has been washed out ahead. You apply the brakes of your car, and come to a stop in a time of 4.0 seconds. Determine the acceleration and stopping distance of the car.

The graphs below depict the motion of several different objects. Note that the graphs include both position vs. time and velocity vs. time graphs.



Graph A Graph B Graph C Graph D Graph E

The motion of these objects could also be described using words. Analyze the graphs and match them with the verbal descriptions given below by filling in the blanks.

Verbal Description	Graph
a. The object is moving fast with a constant velocity and then moves slow with a constant velocity.	_____
b. The object is moving in one direction with a constant rate of acceleration (slowing down), changes directions, and continues in the opposite direction with a constant rate of acceleration (speeding up).	_____
c. The object moves with a constant velocity and then slows down.	_____
d. The object moves with a constant velocity and then speeds up.	_____
e. The object maintains a rest position for several seconds and then accelerates.	_____

Extra

8. Two Metra trains are on separate but parallel tracks running east and one west. One has a speed of 90 km/hr, the other 80 km/hr. Initially, the two trains are 2.71 km apart. How long will it take the two trains to have the same position along the east-west direction?