UCONN Physics:

Name: _____
Date: _____ Period _____

CHAPTER 2: *Describing Motion: Kinematics in One Dimension*

Questions:

1. Can an object have a varying speed if its velocity is constant? If yes, give examples.

2. In drag racing, is it possible for the car with the greatest speed crossing the finish line to lose the race? Explain.

3. Can an object have a northward velocity and a southward acceleration? Explain.

4. Can the velocity of an object be negative when its acceleration is positive? What about vice versa?

5. Give an example where both the velocity and acceleration are negative.

6. Can an object be increasing in speed as its acceleration decreases? If so, give an example. If not, explain.

7. A baseball player hits a foul ball straight up into the air. It leaves the bat with a speed of 120km/h. In the absence of air resistance, how fast will the ball be traveling when the catcher catches it?

8. Which one of these motions is *not* at constant acceleration: a rock falling from a cliff, an elevator moving from the second floor to the fifth floor making stops along the way, a dish resting on a table?

9. Can an object have zero velocity and nonzero acceleration at the same time? Give examples.

10. Can an object have zero acceleration and nonzero velocity at the same time? Give examples.

Problems

Speed and Velocity

1. (II) You are driving home from school steadily at $95\,\text{km/h}$ for 130 km. It then begins to rain and you slow to $65\,\text{km/h}$. You arrive home after driving 3 hours and 20 minutes. (*a*) How far is your hometown from school? (*b*) What was your average speed?

2. (II) A person jogs eight complete laps around a quarter-mile track in a total time of 12.5 min. Calculate (*a*) the average speed and (*b*) the average velocity, in m/s.

3. (II) Two locomotives approach each other on parallel tracks. Each has a speed of $95\,\text{km/h}$ with respect to the ground. If they are initially 8.5 km apart, how long will it be before they reach each other?

4. (II) An airplane travels 3100 km at a speed of $790\,\text{km/h}$, and then encounters a tailwind that boosts its speed to $990\,\text{km/h}$ for the next 2800 km. What was the total time for the trip? What was the average speed of the plane for this trip?

5. (III) A bowling ball traveling with constant speed hits the pins at the end of a bowling lane 16.5 m long. The bowler hears the sound of the ball hitting the pins 2.50 s after the ball is released from his hands. What is the speed of the ball? The speed of sound is $340\,\text{m/s}$.

Acceleration

6. (I) A sports car accelerates from rest to $95\,\text{km/h}$ in 6.2 s. What is its average acceleration in m/s^2?

7. (II) At highway speeds, a particular automobile is capable of an acceleration of about $1.6\,\text{m/s}^2$. At this rate, how long does it take to accelerate from $80\,\text{km/h}$ to $110\,\text{km/h}$?

8. (II) A sports car moving at constant speed travels 110 m in 5.0 s. If it then brakes and comes to a stop in 4.0 s, what is its acceleration in m/s^2? Express the answer in terms of "*g*'s," where ($1.00\,g = 9.80\,\text{m/s}^2$.)

Motion at Constant Acceleration

9. (I) A light plane must reach a speed of 33m/s for takeoff. How long a runway is needed if the (constant) acceleration is $3.0\ \text{m/s}^2$?

10. (II) In coming to a stop, a car leaves skid marks 92 m long on the highway. Assuming a deceleration of 7.00m/s^2, estimate the speed of the car just before braking.

11. (III) A car is behind a truck going 25m/s on the highway. The car's driver looks for an opportunity to pass, guessing that his car can accelerate at $1.0\ \text{m/s}^2$. He gauges that he has to cover the 20-m length of the truck, plus 10 m clear room at the rear of the truck and 10 m more at the front of it. In the oncoming lane, he sees a car approaching, probably also traveling at 25m/s. He estimates that the car is about 400 m away. Should he attempt the pass? Give details.

Falling Objects [neglect air resistance]

12. (I) A stone is dropped from the top of a cliff. It hits the ground below after 3.25 s. How high is the cliff?

13. (II) A ballplayer catches a ball 3.0 s after throwing it vertically upward. With what speed did he throw it, and what height did it reach?

14. (II) A helicopter is ascending vertically with a speed of $5.20\,\mathrm{m/s}$. At a height of 125 m above the Earth, a package is dropped from a window. How much time does it take for the package to reach the ground? [*Hint*: The package's initial speed equals the helicopter's.]

15. (II) A stone is thrown vertically upward with a speed of $18.0\,\mathrm{m/s}$. (*a*) How fast is it moving when it reaches a height of 11.0 m? (*b*) How long is required to reach this height? (*c*) Why are there two answers to (*b*)?

16. (III) A rock is dropped from a sea cliff, and the sound of it striking the ocean is heard 3.2 s later. If the speed of sound is $340\,\mathrm{m/s}$, how high is the cliff?