1-D Kinematics Test Review and Practice Problems

- Newton's three laws (short and long form)
- Value of g (acceleration due to gravity)
- 3 equations of 1-D Kinematics
- how to graph displacement, velocity, and acceleration
- air resistance, terminal velocity

1. A ball is thrown straight up with an initial speed of 30 m/s. How high does it go, and how long is it in the air (ignoring air resistance)?

2. If there were no air drag, how fast would raindrops fall from a cloud 1 kilometer above the Earth?

3. Very few athletes can jump more than 2 feet off the ground. How much hang time does an athlete experience in a 2-foot jump?

4. While rolling balls down an inclined plane, Galileo observes that a ball rolls one cubit as he counts to ten. How far will the ball have rolled when he counts to twenty?

5. Chad drops two rubber balls from a tower - one having a mass of 1 kg and the other having a mass of 2.5 kg. We measure the terminal velocity of the lighter ball to be 10 m/s. What is the terminal velocity of the heavier ball?

6. What is the acceleration of a car that moves at a steady velocity of 100 km/h for 100 seconds?

7. For a cannonball of 20 kg. dropped in a vacuum, what is its acceleration after 5 seconds of fall? After 10 seconds?

8. What is the force (in newtons) required to support a 3-ton boulder at a height of 2 feet above the ground?

9. A PT Cruiser with a mass of 2000 kg has an engine that can supply a force of 10,000 Newtons. What would the car's best 0-to-60 mph time be?

10. A grocery bag can withstand 300 N of force before it rips apart? How many pounds of apples can it safely hold?

11. A rocket becomes progressively easier to accelerate as it travels through space? Why is this so?

12. In a car race, Kathleen gives Chad a head start of 100 yards. They start moving at the same time. Kathleen accelerates her car at 3 m/s^2. Chad accelerates his car at 2 m/s^2. How long will it take Kathleen to overtake Chad?

13. Chad is cruising at 28 m/s down Presbyterian Rd. He notices a deer jump into the road at a location 62.0 m in front of him. He first reacts to the event, then slams on his brakes and decelerates at -8.10 m/s^2, and ultimately stops a picometer in front of the frozen deer. What is Chad's reaction time? (i.e., how long did it take him to react to the event prior to decelerating?)

14. A two-stage rocket accelerates from rest at +3.57 m/s/s for 6.82 seconds. It then accelerates at +2.98 m/s/s for another 5.90 seconds. After the second stage, it enters into a state of free fall. Determine:

1. the maximum speed
2. the maximum altitude
3. the height of the rocket after 20.0 seconds
4. the total time the rocket is in the air (assuming it is launched from the ground)