Physics 200 Name: ________________________

Newton's Laws (1-D) Version 2

1. A car is traveling forward on a level surface. Suddenly the driver steers the car leftward. Which of the following best describes the new force that pushes the car leftward?
   a. Road friction pushing the tires
   b. Driver pushing the steering wheel
   c. Car exhaust pushing the car
   d. Engine force pushing the drive shaft
   e. Steering wheel pushing the tires

2. A stone is thrown directly upward into real air (including air resistance). It goes up; it comes down. At what point in the stone's flight is it truly in "free-fall?" In other words, when is it experiencing only one force – gravity?
   a. On the way up
   b. On the way down
   c. At the top
   d. The whole time
   e. Never

3. A stone is thrown directly upward into real air (including air resistance). It goes up; it comes down. After the initial throw, when does the speed of the stone change at the fastest rate?
   a. On the way up
   b. On the way down
   c. At the top
   d. Speed changes at the same rate the whole time.

4. Some steel cars and some rubber cars crash into some brick walls and some straw walls. In which collision is the force applied to the wall greater than the force applied to the car?
   a. Steel car, brick wall
   b. Steel car, straw wall
   c. Rubber car, brick wall
   d. Rubber car, straw wall
   e. Never. The forces are always equal.

5. As an astronaut travels from the international space station to the Earth, what happens to her mass and weight?
   a. Mass increases, weight stays the same.
   b. Weight increases, mass stays the same.
   c. Both mass and weight increase.
   d. Both mass and weight stay the same.

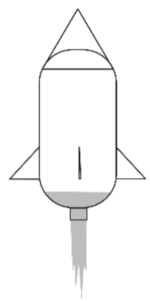
6. Assuming that two falling objects experience the same force of drag, which of the following must be true?
   a. They must take the same amount of time to fall.
   b. They must have the same terminal velocity.
   c. They must have the same weight.
   d. They must have the same shape.
   e. None of these answers must be true.

7. 20kg Sally is using a massless rope to drag her 0.2kg stuffed owl. Sally, the owl, and the rope are accelerating together at a rate of $1 m/s^2$. In this case,
   a. The rope exerts a stronger force on Sally than it does on the owl.
   b. The rope exerts a stronger force on the owl than it does on Sally.
   c. The rope exerts equally strong forces on Sally and the owl.
   d. The rope does not exert force on either Sally or the owl.

9. An object of mass m is hanging by a string from the ceiling of an elevator. The elevator is moving with constant upward acceleration. What is the tension in the string?
   a. less than mg
   b. exactly mg
   c. greater than mg

Short Answer:

1. The water rocket in the diagram below currently has a mass of **0.24kg**, and it is accelerating upward at a rate of 1,000m/s$^2$. The force of thrust provided by the water pushing the rocket upward is $\mathbf{F_{thrust}}$ **= 248N**. On the diagram, draw **all** of the **individual** forces that are acting on the rocket. Use arrows to show the direction of each force. Label each arrow with an appropriate **name** of the force, the **correct magnitude of the force,** and the **correct units**. *[Assume that there is air resistance.]*



3. A **1kg** brick is dropped from a helicopter. The brick falls until it reaches terminal velocity, and then it hits the ground. The table below provides incomplete descriptions of four moments during the brick's descent (labeled A-D). They are intentionally scrambled so that they are not in order! Use the second column to correctly order the moments in time. Also enter the correct drag force and net force for each of the moments.

| Moments in the descent | Order (1=occurs first, 3 = occurs last) | Brick Weight [Not Graded] | Force of Drag on brick | Net Force acting on brick | Brick Acceleration |
|---|---|---|---|---|---|
| A | | | | | 0m/s$^2$ |
| B | | | | | -9.8m/s$^2$ |
| C | | | | | -4m/s$^2$ |

Problems:

1. A student has a mass of 40kg.

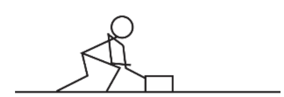
a. What is her weight on Earth?

b. On a different planet the same student has a weight of 1,200N. What is the acceleration due to gravity on that planet?

2. Klem has a 2kg block of wood.

a. How fast does Klem's block of wood accelerate when there is a **net force** of 20N acting on the block?

b. Klem's 2kg block of wood is at rest. If the block has a coefficient of static friction ($\mu_s$) of 0.4, how much force does he have to apply in to the resting block in order to start it moving?

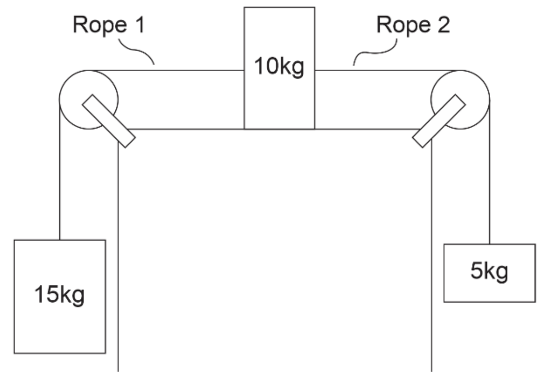


c. Klem's block of wood has a coefficient kinetic friction ($\mu_f$) equal to 0.3. If Klem keeps pushing the block with the same force that you calculated in part B, how fast will the block accelerate?

d. Suppose Klem accelerates the block of wood until its velocity is 1m/s. If he then wants to maintain a constant 1m/s velocity, how much force must he apply to the block? (Keep using $\mu_k$=0.3)

3. A student is standing on a bathroom scale in an elevator, and the scale currently reads 500N. The elevator is accelerating upward at a rate of 2m/s$^2$. What is the student's mass?

5. The diagram on the right shows three masses connected by frictionless, massless strings passing over frictionless pulleys. The surface that is in contact with the 10kg mass has a $\mu_k = 0.6$. The masses and strings are in motion.




a. Find the acceleration of the entire system of masses and ropes.

b. Find the tension in Rope 1

c. Find tension in Rope 2.