Your name:	
Your TA:	
Your section Day/Time:	

PHY 101 Practice Exam I

Monday, September 25

Please be sure to show your work where it is requested. If no work is shown where it is requested, you will not receive any points. Also, partial credit will be given where appropriate, so *show me your physics thoughts.*

Please answer the following multiple choice questions. Circle only one answer per question.

(1) On a graph of v_x versus time, the slope represents
A. the change in the x part of the velocity, Δv_x
B. the x part of the displacement, Δx
C. the x part of the velocity, v_x
D. the x part of the acceleration, a_x

(2) To be dimensionally consistent, distance (length), velocity (length/time), and acceleration (length/time^2) must be related as follows:
A. Distance=velocity/acceleration
B. Distance=velocity^2/acceleration
C. Distance=velocity $\times$ acceleration
D. Distance=velocity^2 $\times$ acceleration

(3) When a rock is thrown straight upwards, at the exact top of its path, its
A. velocity is zero and its acceleration is zero.
B. velocity is zero and the magnitude of its acceleration is 9.8 m/s^2.
C. velocity is 9.8 m/s and its acceleration is zero.
D. velocity is 9.8 m/s and its acceleration is 9.8 m/s^2.

(4) One millimeter = 10^{-3} m and one micron = 10^{-6} m, what is the relationship between these units?
A. 1 millimeter = 10^{-3} micron
B. 1 millimeter = 10^{3} micron
C. 1 millimeter = 10^{-9} micron
D. 1 millimeter = 10^{9} micron

(5) When a force is called a "normal" force, it is
A. the usual force expected, given the arrangement of a system.
B. a force that is perpendicular to the surface of the Earth at any given location.
C. a force that is always vertical.
D. a contact force that is perpendicular to the contact surfaces between two solid objects.

(6) The net force on a moving object suddenly becomes zero. The object then
A. stops abruptly.

B. stops during a short time interval.
C. changes direction.
D. continues at a constant velocity.

(7) Two balls are thrown from the top of a building. One is thrown up and the other is thrown down, both with the same initial speed. What are their speeds when they hit the street?
A. They are traveling at the same speed
B. The one thrown down is traveling faster.
C. The one thrown up is traveling faster.
D. It depends on the height of the building.

(8) Displacement is
A. the distance traveled from the first position to the final position.
B. the distance traveled from the origin to the final position.
C. the change in the position from the initial position to the final position.
D. the change in the position from the final position to the origin.

(9) A projectile is fired horizontally in a region of no air resistance. The projectile maintains its horizontal component of velocity because
A. the projectile is not acted upon by any forces.
B. the projectile has no vertical component of velocity to begin with.
C. the projectile is not acted upon by any horizontal forces.
D. the net force acting on the projectile is zero.

(10) Which of the following is a scientific hypothesis?
A. The universe is filled with undetectable particles.
B. There are things we will never understand.
C. The candy Starbursts contain no sugar.
D. There are parts of the universe that will never be found by humans.

(11) A space probe leaves the solar system to explore interstellar space. Once it is far from any stars, when must it fire its rocket engines?
A. All the time in order to keep it moving.
B. Only when it wants to slow down.
C. Only when it wants to speed up.
D. When it wants to speed up, slow down, or turn.

(12) To cause an object to start moving on a frictional surface requires
A. less force than is needed to keep it moving on the surface.
B. the same force as is needed to keep it moving on the surface.
C. more force than is needed to keep it moving on the surface.
D. a force equal to the weight of the object.

Now respond to the following short answer questions. Please answer THREE out of FOUR for questions (13)-(16). CLEARLY indicate which ones you would like to be graded.

(13) Do you remember when Professor Schwarz pushed horizontally on a cart on a track? The cart had a ball in it. The ball was lauched vertically in the air as the cart continued to move horizontally along the track and eventually the ball fell back into the cart. Discuss what physics concept/principle Professor Schwarz was demonstrating.

(14) You are standing on one end of a light wooden raft that has floated 3 m away from the pier. If the raft is 6 m long and you are standing on the raft end nearest to the pier, can you propel the raft back toward the pier where a friend is standing with a pole and hook trying to reach you? You have no oars. Make suggestions of what to do without getting yourself wet.

(15) Think back to your first lab with cart, the track, and the motion detector. A cart is moving eastward with a constant acceleration along a frictionless track during a time interval of 10 seconds. *Sketch* the displacement, the velocity, and the acceleration of the train as a function of Δt. Use three separate graphs and carefully label which one is which.

(16) Does a person weigh more at the North Pole or at the equator, assuming the Earth is a perfect sphere? (The Earth is actually not a perfect sphere but a spherical shape that is squashed at the poles and bulging at the equator due to its rotation.) Does the person weigh more at the top of Mt. Everest or at the base of the mountain? Explain what physics equation is at work here.

Now answer THREE of the following FOUR quantitative questions (17)-(20). Please clearly indicate which ones you would like to be graded. You are welcome to approximate g as 10 m/s^2 to obtain numbers. See how close you come to reaching a number without the use of a calculator.

(17) A softball is thrown horizontally from a height of 10 m above the ground with a speed of 20 m/s.
(a) Sketch the force(s) on the softball after it is released.

(b) Where is the softball after half a second has elapsed in terms of both x_f and y_f? Again, if you approximate g as 10 m/s^2, you can get closer to a number for y_f.

(c) If the softball was thrown at an angle θ from the horizontal, how would the equations you used in (a) to compute x_f and y_f be modified?

(18) A 3 kg block is at rest on a horizontal floor. If the block is pushed horizontally on the block with a 15 N, it just starts to move.
(a) Sketch the forces on the block.

(b) What is the coefficient of static friction?

(19) Estimate the surface area of skin covering a human body by assuming that the body can approximated as a 2 m tall cylinder with a radius of 10 cm along with two cylindrical arms of length 1 m and radius of 5 cm. Note that surface area of a cylinder is $2\pi rh + 2\pi r^2$, where h is the height and r is the radius. Also note that the area of a circle is πr^2. You can approximate π as 3 to get closer to a number.

(20) A 500 gram model rocket with a weight of 5 N (using $g = 10m/s^2$) is launched straight up. The small rocket motor burns for 2 s and has a steady upward thrust of 20 N. Its initial velocity is zero.

(a) What is the acceleration of the rocket during the first 2 s?

(b) What is the height of the rocket above the surface of the Earth (the altitude) at 2 s? What is its velocity at 2 s?

(c) What is the maximum altitude the rocket reaches in its trajectory? Note that the motor stops working after 2 s.