TEST #1

Equations:

\[ S = S_0 + v \cdot t \]

\[ S = S_0 + v_0 \cdot t - \frac{1}{2} \cdot 9.81 \cdot t^2 \]

\[ v = v_0 - 9.81 \cdot t \]

Remember:  * Pick the BEST answer to each question.

* Some questions may give you more information than what you need to solve them.
1. A figure skater is rotating with counterclockwise angular velocity in an overhead view. If her angular acceleration is clockwise at that time, this implies that:

(a) she is not changing the speed of her rotation.
(b) her rotation is speeding up.
(c) her rotation is slowing down.

2. Which of the following is true?

(a) If location is constant, velocity has to be zero.
(b) If velocity is constant, acceleration has to change at a constant rate.
(c) If acceleration is constant, velocity also has to be constant.

3. A bus is moving forward at 12.5 m/s. You are inside the bus, moving laterally relative to the seats in the bus (i.e., sideways from a seat on the right side of the bus to a seat on the left side of the bus) at 4.6 m/s. What is the value of your resultant velocity vector relative to the street?

(a) between 0.00 m/s and 5.00 m/s
(b) between 5.01 m/s and 9.00 m/s
(c) between 9.01 m/s and 13.00 m/s
(d) between 13.01 m/s and 16.00 m/s
(e) more than 16.01 m/s

4. Two bobsledding competitors push their sled for 3.2 s with a combined horizontal force of 110 N. The mass of the sled is 65 Kg. Assume that there are no friction forces between the sled and the snow. Calculate the horizontal acceleration of the sled.

(a) between 0.0 m/s² and 2.0 m/s²
(b) between 2.1 m/s² and 4.0 m/s²
(c) between 4.1 m/s² and 7.0 m/s²
(d) between 7.1 m/s² and 8.5 m/s²
(e) more than 8.6 m/s²

5. A 200 meter swimming race takes place in a 50 meter pool. Assume that the positive direction is the direction of swimming in the first stretch (first 50 meters). How will the acceleration of the swimmer be when the swimmer is slowing down to make his second turn, that is, as he approaches the 100 meter point of the race?

(a) positive
(b) negative
(c) zero
6. If we ignore the effects of air resistance, the sum of the horizontal forces exerted on a gymnast while she is in the air:

(a) is zero.
(b) depends on the mass of the gymnast.
(c) is equal to the weight of the gymnast.
(d) depends on the current horizontal velocity of the gymnast.

7. Which of the free-body diagrams below is correct? The system is the soccer player who is kicking the ball; the ball is NOT a part of the system.

(a)  
(b)  
(c)  
(d)  

8. A cyclist is riding in the positive horizontal direction at 12.3 m/s on a horizontal level surface. She encounters an air resistance force of 27 N. The actions on the pedals by the cyclist cause a backward force of 153 N to be exerted by the rear wheel on the ground. The mass of the cyclist-plus-bike system is 61 Kg. Calculate the horizontal acceleration of the center of mass of the system. (HINT: first make a free-body diagram of the system.)

(a) between -20.0 m/s² and -2.5 m/s²
(b) between -2.4 m/s² and -0.4 m/s²
(c) between -0.3 m/s² and +0.3 m/s²
(d) between +0.4 m/s² and +2.4 m/s²
(e) between +2.5 m/s² and +20.0 m/s²

9. ________________ is a direct measurement of inertia in translations.

(a) force
(b) mass
(c) acceleration
(d) weight
(e) velocity
10. A motion in which velocity changes by the same amount with every second that passes by is called:

(a) variably accelerated motion.
(b) uniform motion.
(c) uniformly accelerated motion.

11. If your location is changing from a positive value to a negative value, you can be sure only of one of the following things:

(a) Your velocity is decreasing.
(b) Your acceleration is negative.
(c) Your velocity is positive.
(d) Your velocity is negative.
(e) Your acceleration is constant.

12. A weight lifter is making a vertical upward force of 925 N on a 50 Kg barbell. Calculate the vertical acceleration of the barbell. Hint: Draw first a free-body diagram of the barbell, putting all the forces exerted on the barbell. Then get the resultant of all the forces exerted on the barbell, and go on from there.

(a) between 0.00 m/s² and 1.00 m/s²
(b) between 1.01 m/s² and 2.00 m/s²
(c) between 2.01 m/s² and 5.00 m/s²
(d) between 5.01 m/s² and 10.00 m/s²
(e) more than 10.01 m/s²

13. A break-dancer is spinning on his back, rotating about a vertical axis. Seen from above, the rotation appears as clockwise. In which direction will his angular velocity vector point?

14. A football player throws the ball, and at the instant of release the ball has horizontal and vertical velocities of 7.4 m/s and 3.6 m/s, respectively. How long will it take the ball to reach its peak height?

(a) between 0.00 s and 0.10 s
(b) between 0.11 s and 0.50 s
(c) between 0.51 s and 2.00 s
(d) between 2.01 s and 8.00 s
(e) more than 8.01 s
15. The motion of the amusement park boat shown below is:

(a) rotation.
(b) curvilinear translation.
(c) rectilinear translation.
(d) general motion.

16. Which of the following statements is TRUE?

(a) In the absence of air resistance, the vertical velocity of a projectile is constant.
(b) The path of a projectile can be changed in mid-air without external forces from solids or fluids.
(c) In the absence of air resistance, the horizontal velocity of a projectile changes at a constant rate.
(d) If two projectiles are released with the same horizontal velocity, the one with the largest vertical velocity at release will land farther away.

17. What are the units for linear impulse?

(a) N·s
(b) Kg·s
(c) Kg·m
(d) Kg
(e) N·m

18. Biomechanics research in the automobile and aerospace industries is concerned mainly with:

(a) the effects of accelerations.
(b) the achievement of maximum performance.
(c) the mechanics of the workplace.
(d) the development of rehabilitation exercises.
19. Look at the statements below. If you think that one of them is incorrect, answer with the letter of the incorrect statement. If you think that all three statements are correct, answer with the letter "d".

When a force is exerted on a body:

(a) For a given mass, the larger the force, the larger the acceleration.
(b) For a given force, the larger the mass, the larger the acceleration.
(c) For a given mass, the larger the impulse, the larger the change in the velocity.

20. Annie Oakley from the Buffalo Bill traveling circus takes a shot with her rifle barrel in a perfectly horizontal orientation. The rifle barrel is at a height of 1.50 m above ground level, and the initial velocity of the bullet is: v_x = 530 m/s; v_y = zero. As she shoots, she accidentally drops a cartridge that she had placed (for later use) on top of the hat that she was wearing. The bullet that drops from the hat starts off from a height of 1.60 m above ground level, and its initial velocity is v_x = zero; v_y = zero. If we assume that there is no air resistance on either of the two bullets, which bullet will hit the ground first?

(a) the bullet that was shot
(b) the bullet that was dropped
(c) Both will reach the ground at the same time.

21. A ski jumper is landing with a linear velocity vector v. We want to break down the velocity vector into two components. Which of the following is a correct breaking down of vector v into two components c_1 and c_2?

(a) ![Diagram](a)
(b) ![Diagram](b)
(c) ![Diagram](c)
(d) ![Diagram](d)

22. The arm of a softball pitcher is rotating at 835 degrees/s. The distance between her shoulder and the ball is 0.67 m. What is the linear velocity of the ball?

(a) between 0.00 m/s and 1.00 m/s
(b) between 1.01 m/s and 3.00 m/s
(c) between 3.01 m/s and 6.00 m/s
(d) between 6.01 m/s and 10.00 m/s
(e) more than 10.01 m/s
23. The weight of any given body will be:
   (a) larger on the Earth than on the moon.
   (b) the same everywhere in the Universe.
   (c) larger on the moon than on the Earth.

24. One second before a swimmer touched the end of the pool near the half-way point of a 100 m race in a 50 meter swimming pool, her velocity was 2.40 m/s. Two seconds after touching the end of the pool, her velocity was -3.35 m/s. What was her average acceleration during that whole period of time?
   (a) between -5.00 m/s² and -0.50 m/s²
   (b) between -0.49 m/s² and +0.10 m/s²
   (c) between +0.11 m/s² and +0.50 m/s²
   (d) between +0.51 m/s² and +2.00 m/s²
   (e) between +2.01 m/s² and +5.00 m/s²

25. Linear kinematics studies translation and its causes.
   (a) TRUE
   (b) FALSE