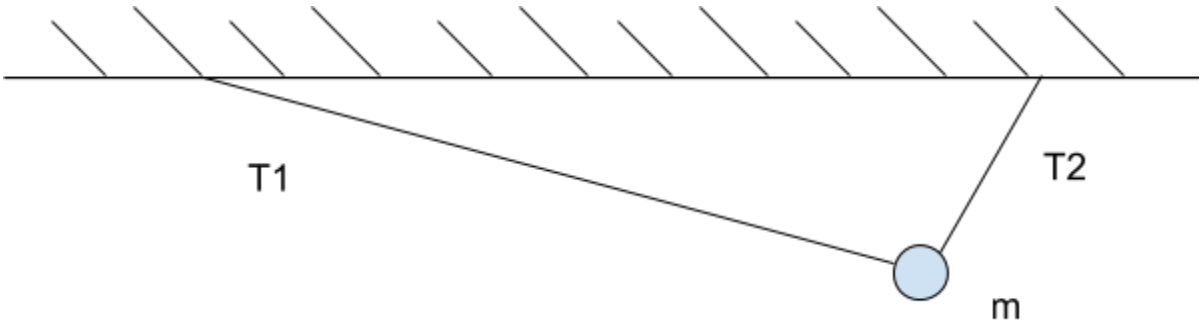
Test 2: Forces

1. If the coefficient of static friction between a car and the pavement that it is on is .7 and the car weighs 1000 N, what is the maximum amount of force that needs to be exerted on the car before it begins to move?
2. Newton's first law is also known as the law of _____
3. If a person pulls on a rope with 50 N of force, what force is the rope exerting on the person?
4. Is the tension at the top of a non-ideal rope greater than, less than, or equal to the tension at the bottom of the rope? Explain.
5. True or False: Any off-axis force (a force that has components that are in the x AND y directions) will always be less impactful than an on-axis force of the same magnitude. Explain.
6. Which setup can be used to calculate the coefficient of kinetic friction between a block and a given surface?

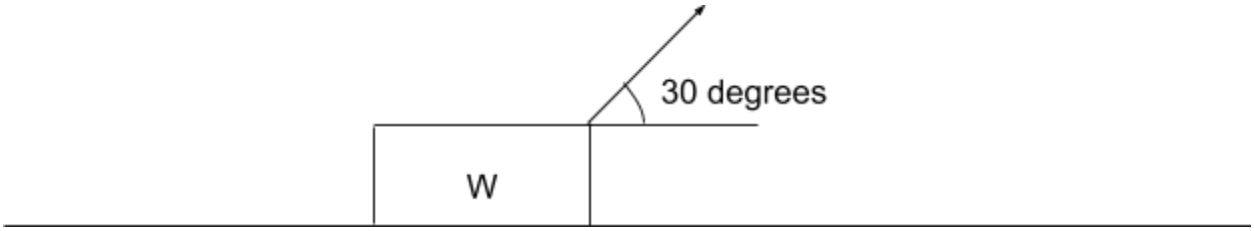
A) Pulling a stationary block with a force meter progressively harder until it moves, recording the mass of the block and the force required to finally make it begin to move.
B) Putting a stationary block of known mass atop an incline with a known incline angle and progressively increasing the incline angle until the block begins to move down the ramp at a constant speed.
C) Pulling a block of known mass with a force meter progressively harder until it moves with a constant velocity, recording the mass of the block and the force required to make it move with a constant velocity.
D) A,B, and C
E) A and B
F) B and C
G) A and C
H) None of the above

7. True or False: Forces are responsible for changes in motion
8. True or False: Acceleration is inversely proportional to force
9. True or False: Acceleration is inversely proportional to mass
10. The statement "If I push something with a force of magnitude F, the object pushes against me with a force of magnitude F as well" is true when?
11. Which statement(s) about the tension forces depicted in the below figure is (are) true?



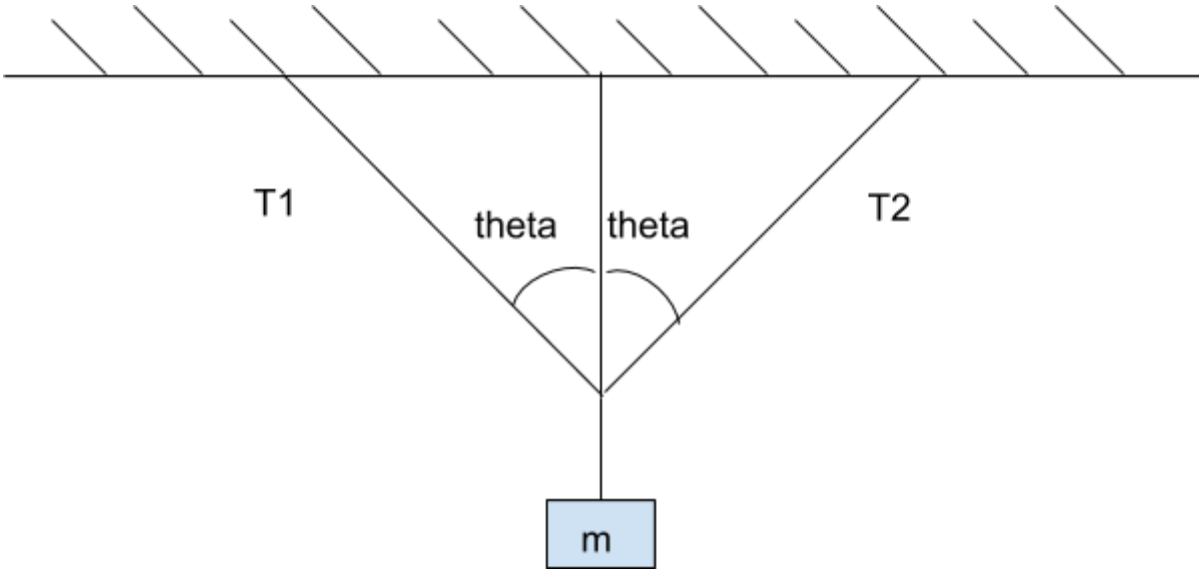
a. T1 > T2
b. T2 > T1
c. T1 = T2
d. T1 = mg
e. T2 = mg
f. T1 > mg
g. T2 > mg
h. T1 < mg
i. T2 < mg
j. T1 + T2 = mg

12. If a car has a mass of 100 kg and has a coefficient of friction between it and the floor, what is the requisite applied force in order to get the car to accelerate at 2 $\frac{m}{s^2}$?
13. The box below is of weight, W, and a force is applied at an angle 30 degrees above the horizontal, which of the following is (are) true?



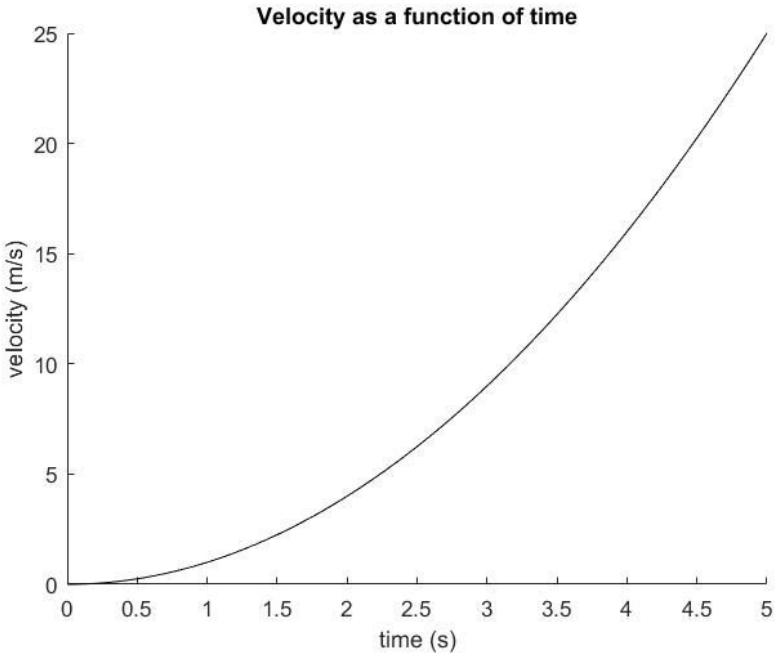
a. W > Force Normal
b. W > Force Applied
c. Force Applied + Force Normal = W
d. Force Applied + Force Normal > W
e. Force Applied + Force Normal < W
f. Force Normal = 0

14. Which of the following statement(s) is(are) true about W (assume strings are ideal)

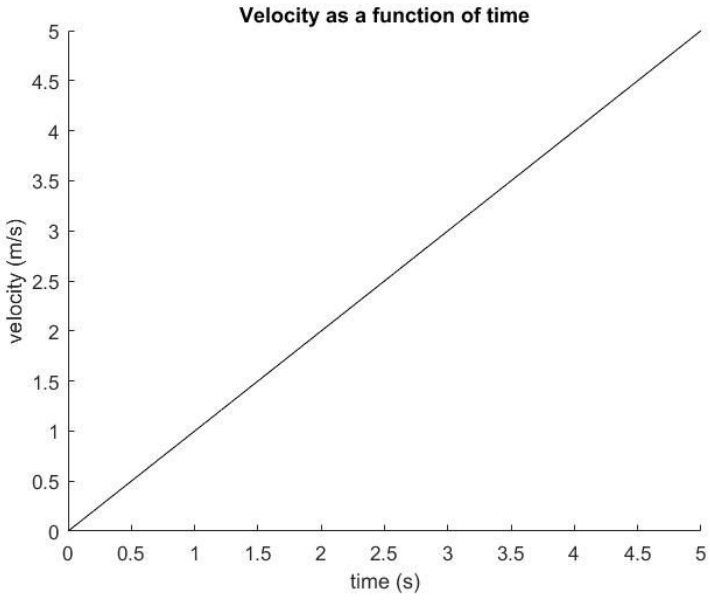


a) $W = T_1 cos(\theta) + T_2 cos(\theta)$
b) $W = T_1 sin(\theta) + T_2 sin(\theta)$
c) $W = T_1 tan(\theta) + T_2 tan(\theta)$
d) $3W cos(\theta) = T_1 + T_2$
e) $\frac{2W tan^2(\theta)}{csc^3(\theta)} = T_1$
f) None of the above

If the following is a graph of an object's velocity as a function of time, answer the following questions:

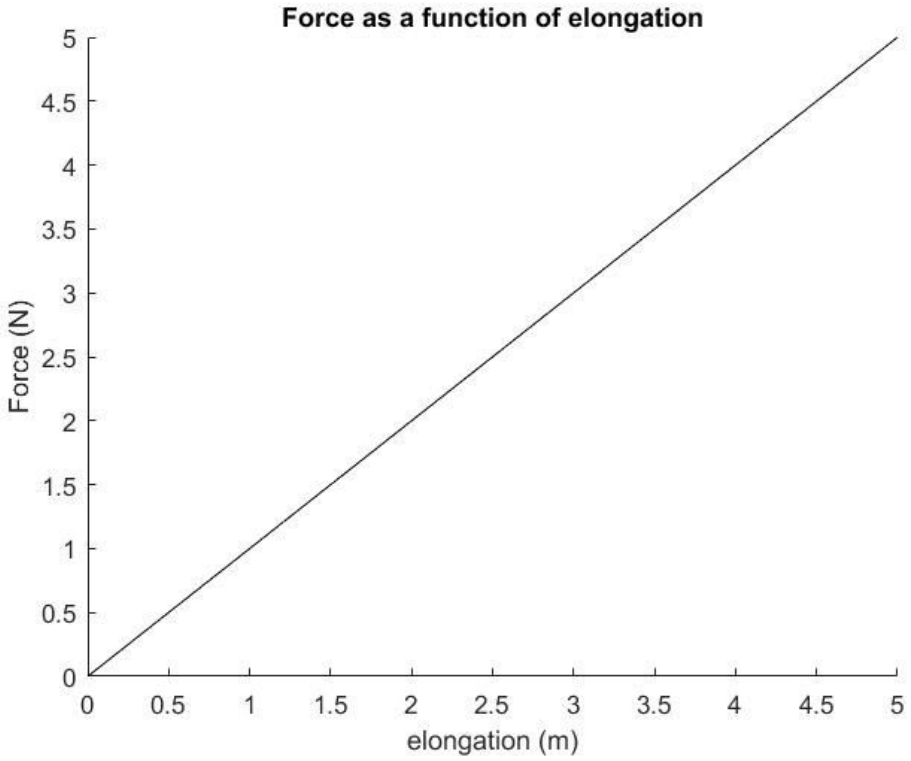


15. Sketch the following:
    a. The acceleration as a function of time graph
    b. The force as a function of time graph
16. How would the above question change if the velocity function looked like this:



17. A box of mass m is placed on top of a box of mass km, assume all the coefficients of friction are μ, and a force F pushes both boxes and gives them the same acceleration, what is the force accelerating the smaller box in terms of the givens and fundamental constants?
18. If an object is in static equilibrium, which of the following is (are) true?
    a. All forces are perpendicular
    b. All forces are parallel
    c. All forces are of the same magnitude
    d. The vector sum of all the forces is 0N
    e. The object is traveling at a constant velocity
    f. The object is traveling at a constant acceleration
    g. None of the above
19. A spring holds a mass of magnitude m, the spring has a spring constant of k, how far down has the spring stretched in order to keep the mass in place?
    a. If the original object were replaced with an object of twice its mass, how far would the spring now stretch?
    b. If the original object were replaced with an object of k times its original mass, how far would the spring now stretch?
20. If an object of mass m is against a wall where the coefficient of friction between it and the wall is μ, and a person is pushing up on the object to keep it from falling with a force of magnitude F at an angle θ below the horizontal,
    a. What is the expression to represent the friction force?
    b. What is an expression to represent the normal force?
    c. What would the applied force have to increase by if the mass of the object doubled?
    d. What would the applied force have to increase by if the mass of the object increased k times?
21. Suppose Joe is on an elevator and he is on a scale which records his weight, when the elevator and Joe are stationary, the scale reads his weight is W.
    a. When the elevator is accelerating upward, how does the scale reading compare to W
    b. When the elevator is accelerating downward, how does the scale reading compare to W
    c. When the elevator is at a constant speed, how does the scale reading compare to W
    d. List the scale readings in order of increasing magnitude

22. The graph below models the recorded force as a function of the elongation of a certain spring, what does the slope of the graph represent?



23. CC Sebathia throws a fast ball, what is the direction of the net force acting on the ball along its trajectory?
24. True or False: Forces are required to cause velocity to an object already in motion
25. True or False: increasing the incline angle causes an object to accelerate faster down the incline
26. True or False: the greater the mass of an object, the greater friction force acts on it.
27. True or False: There are always newton third law force pairs
28. True or False: as the speed of an object increases, the drag force becomes proportional to the object's velocity squared
29. True or False: eventually an object falling will reach terminal velocity
30. Find an expression for the terminal velocity of an object of mass, m and a drag force modeled by bv^2