Newton's Laws

Assignment # 2
Due Tuesday, April 9th, 2019
Show Your Work and Draw your FBDs (and fill them in)
Multiple Choice

Open Response (Remember to include all equations and FBDs

1. Raymond is dragging bags of potatoes on a pallet across a floor in a large storage building. He applies a force of 250N of force to start moving the bags. If the mass of the bags is 100kg and the force of static friction is 196N determine:
    a. The coefficient of static friction.
    b. The acceleration of the pallet.

2. Newton is out on his wind surfer that is made to go on ice. The coefficient of static friction is 0.2 and the coefficient of kinetic friction is 0.08. The total mass of him and the windsurfer is 120kg.
    a. The wind provides a force of 250N. What is his acceleration when he first starts?
    b. What is his acceleration after he gets moving?

3. Researchers are testing tires at a private testing facility. They have two test vehicles. Vehicle A has a mass of 1500kg. Vehicle 2 has a mass of 2200kg. Both vehicles wear identical tires. If both vehicles are driven at 108km/h and then the brakes suddenly applied which will take a greater distance to stop. Assume they slide to a stop. Show your work.

4. Draw and label FBDs for the following scenarios: (if the forces are equal indicate accordingly, if they aren't equal draw the larger force as a longer force)
    a. A wagon is pulled at a constant velocity
    b. An elevator accelerates upward
    c. A coaster car coasts to a stop on a coaster track
    d. Wayne is pulling a sled that is slowing down

5. A car with a mass m suddenly brakes with an acceleration a. Determine an equation to find the coefficient of friction.

6. You have been hired by your neighbors to select a cable to be used at their mansion. The cable is being used in the garage for lifting large storage items to the second level. The gentleman hired to run the garage tells you the maximum load that the lift will see is 1 metric tonne. The lift motor is designed such that the maximum acceleration of the load will be 0.20m/s^2. Determine the force of tension that the cable should be able to endure.

7. You have found yourself in a precarious situation. You are up in your kid's tree house and it is raining, preventing you from climbing down the tree without risking injury. The tree house is 5m above the ground so you can't jump safely. Your mass is 75kg and the rope will hold a maximum tension of 700N.
    a) Can you hang and slowly lower yourself down? Why or why not?
    b) What is your downward acceleration?
    .

8. You are running down the hallway in the Science wing and run straight into one of the grade 10 students in your advisory class. You go from a speed of 5.0m/s to a complete stop in 0.5seconds (ouch!). a) If your mass is 75kg, determine the force your classmate puts on you. b) How much force do you put on your classmate if their mass is i) 75kg ii) 100kg?

9. You are standing on a bathroom scale in an elevator. If your mass is 50kg and the elevator is accelerated upward at $1.\text{m/s}^2$ what would the scale say your weight is?

10. A large crate is placed in the back of a pick up truck. The crate has a mass of 300kg. If the truck can accelerate at 2.5m/s^2 determine the minimum coefficient of friction required to keep the crate from sliding in the truck. Draw the FBD for the crate with the forces that apply to the crate?

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Practice Problems

1. A cable is required to lift an object, with an acceleration, from the floor to a height of 8m in 4 seconds. If the maximum weight of any object lifted will be 1000lbs., how much tension should the cable be able to support? **(1100lbs)**

2. You have been hired by your neighbors to select a cable to be used at their mansion. The cable is being used in the garage for lifting large storage items to the second level. The gentleman hired to run the garage tells you the maximum load that the lift will see is 1800kg. The lift motor is designed such that the maximum acceleration of the load will be 1.85m/s^2. Determine the force of tension that the cable should be able to endure. **(20970N)**

3. Your boss has asked you to move some boxes in a warehouse. In each box is a refrigerator that has a mass of 60kg. a) If the μ_s is 0.25 would you be able to move the box with a force of 200N? b) What is the minimum force required to make the boxes move? **(Yes,>147N)**

4. A large crate has a mass of 200kg and the coefficient of static friction between the box and the floor is 0.4. If you apply 400N will it move? What is the minimum force required to start the crate moving? **(No, >784N)**

5. The record for the longest skid marks on public road was reportedly set in 1960 by a 1200kg Jaguar on the M1 highway in England. The marks were 290m long. The coefficient of kinetic friction was found to be 0.60. a) How fast was the vehicle moving when the brakes were applied? b) How long would the skid marks be if a 2000kg truck were travelling at the same velocity and the coefficient of friction stays the same? **(~192km/h, 0.29km)**

6. You have found yourself in a precarious situation. You are up in your kid's tree house and it is raining, preventing you from climbing down the tree without risking injury. The tree house is 5m above the ground so you can't jump safely. Your mass is 65kg and the rope will hold a maximum tension of 600N.
    a) Can you hang and slowly lower yourself down? Why or why not? **(No)**
    b) What is your downward acceleration? **(-0.57m/²)**
    c) How long will it take to reach the ground? **(4.19s)**

7. An 80 kg sled is moving at 10 m/s over smooth ice when it enters a rough stretch of ice 20 m long in which the force of friction is 160 N. a) What is the acceleration of the sled? b) With what speed does the sled emerge from the rough stretch? **(-2.0m/s², 4.47m/s)**