Newton's Laws

Assignment # 3

Due Wednesday, March 28th, 2018

Show Your Work and Draw your FBDs (and fill them in)

1. What would be the effect on the frictional force on an object if you did the following:
   a) Double the applied force
   b) Double the mass of the object
   c) Double the coefficient of friction

2. James pulls a sled with a mass of 80kg across his lawn. He pulls with 150N of force. a) Determine the force of friction if the acceleration is 05m/s². b) What is the coefficient of friction?

3. A steel crate with a weight of 3920N is pulled across a steel deck on a truck. a) What is the force of friction when you slide this crate along the deck? b) What force is required to move the block with an acceleration of 2.5m/s²?

4. 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) Determine the force of static friction.
   b) Determine the force of kinetic friction.
   c) The wind provides a force of 250N. What is his acceleration when he first starts?
   d) What is his acceleration after he gets moving?

5. Your boss has asked you to move some boxes in a warehouse. In each box is a refrigerator that has a mass of 80kg. 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? c) What would be the required coefficient of friction in order to move the boxes with a constant velocity if the applied force was 100N?

6. 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? (You might need to use kinematics)
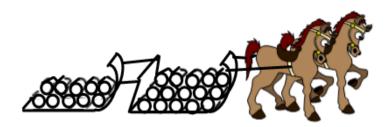

Newton's Laws

Assignment # 4

Due Wednesday, April 4th, 2018

Show Your Work and Draw your FBDs (and fill them in)

1. 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/s². Determine the force of tension that the cable should be able to endure.

2. 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?

   c) How long will it take to reach the ground?

3. 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?

4. A pair of horses is hauling two sleighs full of logs that are connected. The first sleigh behind the horses has a mass of 4000kg, the second sleigh has a mass of 2000kg and the mass of each horse is 500kg. The force on the last hitch, hauling the second sleigh is 2960N. The coefficient of friction for the sleighs and the ground is 0.10.

   a) Determine the acceleration of the sleighs and the horses.

   b) Determine the force in the hitch that connects the horses to the first sleigh

   c) Why is the force on the back of the first sled less than the force on the front of the sled?

Practice Problems

1. 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)**

2. 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)**

3. 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)**

4. 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. **(0.2)**

b. The acceleration of the pallet. **(0.54m/s²)**

c. What would happen to the net force if he pulled 50kg bags instead of 100kg bags, assuming he still applied the same force? Explain or determine the magnitude of the new net force.

5. Marc is texting while driving his car when he runs into the back of a parked lunch truck (the kind that make hot lunches and parks near businesses). The lunch truck has a mass of 4200kg and as a result of the collision has a velocity of 5m/s within 1 sec. a) Determine the force that the car put on him. b) Determine the acceleration of the car if its mass is 1240kg. (Note: no one was seriously injured in the collision)

6. Ashley and Jon are out for a day of mud-slinging fun in their trucks. Eventually Ashley's red 1400kg Jeep Cherokee breaks in the mud. Jon hooks a tow rope to her jeep and pulls her out with his Silver Toyota Tundra truck. The acceleration is 0.75m/s². If the coefficient of friction from the mud is 0.65 determine:
a) The force of friction
b) The force on the hitch on the front of Ashley's jeep.
c) The force on the hitch on the back of Jon's truck.

7. 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)**

8. 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 0.50. a) How fast was the vehicle moving when the brakes were applied? b) How long would the skid marks be if a 3000kg truck were travelling at the same velocity and the coefficient of friction stays the same? **(191.92km/h, 0.29m)**

9. 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)**