FORCES SUMMARY

Unit 2: Forces

October 26, 2016

CHAPTER 3 NEWTON'S LAWS OF MOTION

- What is a force?
- 4 Fundamental forces
- Types of forces
- FBD's
- Newton's 1st Law of Motion
- Newton's 2nd Law of Motion
- Newton's 3rd Law of Motion

CHAPTER 4 APPLICATION OF FORCES

- Force of gravity
- Mass vs. Weight
- Friction
  - Static Friction
  - Kinetic Friction

SOME THINGS TO KEEP IN MIND !!

$\vec{F}_{NET}$

- The only force that can make an object accelerate is a ????
- If you have a situation where 2 objects are connected and both are moving you must set the direction of motion as positive for each object (the big problem we did yesterday)
- If 2 objects are connected they must accelerate at the same rate.
- If 2 objects are connected by a string, rope, cable, etc., the F_T is the same in each FBD.

PG. 177 #1

1. A 0.170 kg hockey puck is initially moving at 21.2 m/s [W] along the ice. The coefficient of kinetic friction for the puck and the ice is 0.005. T/I
   (a) What is the speed of the puck after travelling 58.5 m? [ans: 21.1 m/s]
   (b) After being played on for a while, the ice becomes rougher and the coefficient of kinetic friction increases to 0.047. How far will the puck travel if its initial and final speeds are the same as before? [ans: 6.24 m]

b) $v_i = 21.2\ m/s$

$v_f = 21.1\ m/s$

$\vec{a} = -0.46\ m/s^2$

$v_f^2 = v_i^2 + 2a\Delta d$

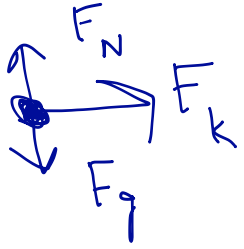
$(21.1)^2 = (21.2)^2 + (2)(-0.46)(\Delta d)$

$\Delta d = \frac{21.1^2 - 21.2^2}{2(-0.46)}$

$\Delta d = 4.6\ m$

FBD Puck

W ⟷ E



$F_{NET} = F_k$

$ma = \mu_k F_N$

$ma = \mu_k mg$

$\vec{a} = (0.047)(9.8\ m/s^2)$

$\vec{a} = 0.46\ m/s^2$

PG. 177 #4

$$\mu_k = \frac{F_k}{F_N} = \frac{200\,N}{(125\,kg)(9.8\,m/s^2)} = 0.16$$

4. An electric motor is used to pull a 125 kg box across a floor using a long cable. The tension in the cable is 350 N and the box accelerates at 1.2 m/s^2 [forward] for 5.0 s. The cable breaks and the box slows down and stops. T/I C
   (a) Calculate the coefficient of kinetic friction. [ans: 0.16]
   (b) How far does the box travel up to the moment the cable breaks? [ans: 15 m]
   (c) How far does the box travel from the moment the cable breaks until it stops? [ans: 11 m]

b) $\Delta d = v_i \Delta t + \frac{1}{2} a \Delta t^2$ → motion (+)

Initially

$F_{NET} = ma$

$F_{NET} = (125\,kg)(1.2\,m/s^2)$

$F_{NET} = 150\,N$

$F_{NET} = 350\,N - F_K$

$150\,N = 350\,N - F_K$

$\therefore F_K = 200\,N.$

When cable breaks

$v_f = v_i + a\Delta t$

$= 0\,m/s + 1.2\,m/s^2(5.0\,s)$

$v_f = 6\,m/s$

Broken Cable

c) $V_i = 6\ m/s$

$V_f = 0\ m/s$

$\vec{a} = -1.6\ m/s^2$

$\Delta d = ?$

$F_K = F_{NET}$

$200N = m\vec{a}$

$200N = 125kg\ \vec{a}$

$\vec{a} = \frac{200N}{125kg}$

$\vec{a} = 1.6\ m/s^2$

Box is slowing down

$\therefore \vec{a} = -1.6\ m/s^2$

$V_f^2 = V_i^2 + 2a\Delta d$

$\Delta d = \frac{V_f^2 - V_i^2}{2a}$

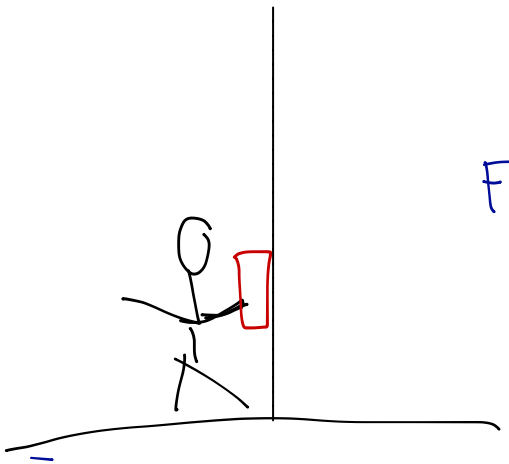
$= \frac{0^2 - 6^2}{2(-1.6)}$

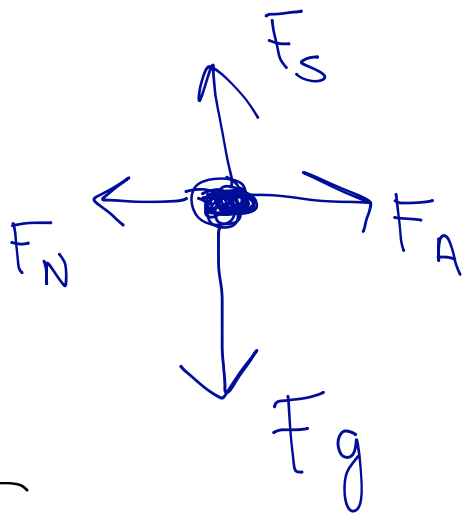
$\Delta d = 11.25\ m$

$\Delta d = 11\ m$ 2 sig digs.

PG. 178 #4

4. A student puts a 0.80 kg book against a vertical wall and pushes on the book toward the wall with a force of 26 N [R]. The book does not move. T/I
   (a) Calculate the minimum coefficient of static friction.
   (b) Describe two ways the student could make the book accelerate down without changing the applied force.





$F_N = F_A = 26\,N$

$$\mu_s = \frac{F_s}{F_N}$$

$$= \frac{(0.8\,kg)(9.8\,m/s^2)}{26\,N}$$

$$\mu_s = 0.3$$

REMINDERS

- Quiz tomorrow (Thursday) – there will be no pulley question
- Unit Test – Monday, October 31
- Read Sections 4.4 and 4.5 (pages 179 – 188)
  - Fair game for MC questions on test
- A few questions to prepare for quiz
  - Pg. 200 # 34, 36-38
- Test prep