**Force and Projectile Motion Problems**

1. Lily and Aliena and Maddie want to hit Miss Takken’s car and put a dent in it. If they can only launch a 4 kg Physics textbook horizontally off a 10.1 m high roof and the car is parked 12 m away with which velocity do they need to launch the book to ensure a direct hit?

2. Alison and Katherine are sitting in a 2000 kg parked car when Sierra and Lieza suddenly slam into the front of their car with a moving 1500 kg car imparting a 45 000 N force. If the coefficient of friction between Alison and Katherine’s car and the road is 0.36 determine the acceleration of their car. Include a FBD with all applicable values.

3. Zack is at the airport flying off to a sunny destination. Zack decides to ride the movable sidewalk (velocity 4 m/s [E]) at the airport (not because it is any faster than walking but when do you get to ride a movable sidewalk otherwise!). Zack looks down and notices a duck walking at a speed of 2 m/s [S] on the same sidewalk. Having always been secretly afraid of ducks, Zack turns around and runs at a velocity of 5 m/s [W]. According to Josh located beside the movable sidewalk at a speed of 0 m/s

a. What is Zack’s velocity relative to Josh?

b. What is velocity of the duck relative to Josh?

4. Hayden and Jon are trying to push a large cumbersome physics device, with Jackson, Jackson and Josh sitting on top with a mass of 220 kg combined, across the floor. Hayden pushes with a force of 450 N [NE] with his mass of 66 kg and Jon pushes with a force of 560 N [S50°E] with his 65 kg. If the coefficient of friction between the floor and the 400 kg physics device is 0.35 how far can they push the device in 10 s (assuming they start from rest and continue to apply the same unbalanced force the whole time)?

5. Joe, Nick and Matt are trying to pull a 150 kg sled up a 15° incline. As well Isaac, Grace and Katie are sitting on the sled and each have a mass of 70 kg (very large sled). If the coefficient of friction between the sled and the incline is 0.34, what force do each of the three students need to apply to move the sled up the incline with constant velocity? (Assume they share the load equally and act straight up the incline)

6. a. The force of gravity between Planet Kayla and Planet Brynn is 5.6 x 104 N. If they are at a distance of 4.5 time the radius of the earth from each other what are their respective masses? (Assume Kayla and Brynn have the same mass)

b. If Brynn went to Jupiter what would her mass be?

c. If Kayla went to the moon what would be her weight? (g = 1.6 m/s2)

7. Bonnie and Sierra play a game involving pushing a box full of physics textbooks (50 kg) and seeing how far it will slide. The box and floor have a coefficient of friction of 0.22. If Bonnie gives the box an initial velocity of 5 m/s during her turn how far will the box travel before stopping? If Sierra gives the box an initial velocity of 6 m/s, but Grace throws in two extra books of 3 kg each (just before she lets go), how far is she able to slide the box before it comes to rest?