

# Physics 12

Assignment #9/10

Projectile Motion

Due Friday, June 2<sup>nd</sup>, 2017

1. A 50kg diver is standing on a 4.2m long diving board that has a mass of 30kg. The other end is bolted with 3 bolts that are in a line and they are all 1.5m from the pivot point. Determine the force exerted by each bolt on the diving board.
2. Albert has mass of 100kg and wants to play on the teeter totter with his brother Jimmie and his sister Emma. The problem is Jimmie only has a mass of 50kg and Emma has a mass of 40kg so even together they can't get Albert up in the air. Assuming that Jimmie sits on the end and Emma sits 40cm in front of him, determine what they could do to reach equilibrium with Albert if the length of the teeter totter is 4m. The mass of the pole they are sitting on is 20kg.
3. Determine the forces in the two cables that support the flower pot in figure 9.4. The cables are attached to a solid beam that is 4ft long and weighs 5lbs. The beam is supported by another beam that is applying a force of 30lbs and is attached at a point 3ft from the wall.
4. Cally is driving her 2006 Pontiac G5 at 72km/h in a direction of  $N15^\circ E$  when she collides with Trevor (intentionally). Trevor is driving a 2001 Ford F-150 at 90km/h in a direction of  $E15^\circ N$ . After the collision Cally is travelling at 75km/h in a direction of  $E5^\circ N$ . What Trevor's velocity after the collision if truck has a mass of 4000kg and Cally's car has a mass of 3200kg?
5. A bomb, sitting at rest, having a mass of 18.0 kg explodes into three pieces that fly out horizontally in opposite directions. One piece was found to have a mass of 3.00 kg and flew off with a speed of 80 m/s west. The mass of the second piece was 5.0 kg, and flew off with a velocity of 60 m/s at  $112^\circ$ . State the direction and velocity of the third piece.
6. Divers at Acapulco dive from a cliff that is 61m high. A) If the rocks below the cliff extend outward for 23m, what is the minimum horizontal velocity a diver must have to clear the rocks safely? B) What would the diver's final velocity be just before they hit the water? (include the angle)
7. Trailing by 2 points, and with only 1.2 seconds left on the clock in a high school basketball game, Stretch Jones throws up a jump shot at an angle of  $55^\circ$  at a velocity of 10m/s. The release point is 2.55m above the floor and the basket is 3.05m. He hits the shot. a) How much time is left on the clock when the basket is made? b) If the 3-point line is at a radius of 6.02m from the basket, did he tie the game or win the game?
8. A hunter aims a rifle directly at a squirrel on a branch of a tree. The squirrel sees the flash of the rifle's firing. Should it stay where it is or drop from the branch in free fall at the instant the rifle is fired? Explain.
9. A stunt rider is attempting to jump her motorcycle over a line of buses parked end to end by driving up a  $25^\circ$  ramp at a speed of 40m/s. How many buses can she clear if the top of the takeoff ramp is at the same height as the bus tops and the buses are 20.0m long?
10. A football is kicked at  $42^\circ$  from the ground level and travels 50 yards before hitting the ground. a) What was the initial velocity? b) How long was the ball in the air? c) How high did it go?

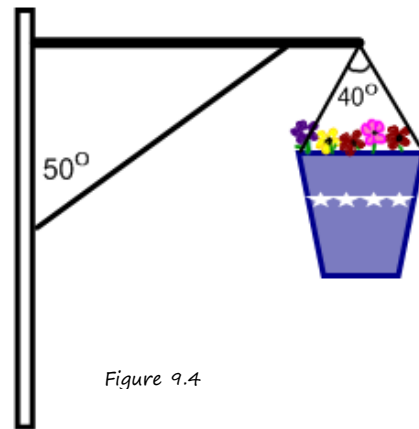


Figure 9.4

\*\*\*PRACTICE QUESTIONS\*\*\*

11. A girl throws a water-filled balloon at an angle of  $50^\circ$  above the horizontal with a speed of  $12.0 \text{ m/s}$ . The horizontal component of the balloon's velocity is directed toward a car that is approaching the girl at a constant speed of  $8.00 \text{ m/s}$ . a) If the balloon is to hit the car at the same height at which it leaves her hand, what is the distance the car can be from the girl when the balloon is thrown? b) What is the maximum height of the ball? (29.94m, 4.31m)
12. You are playing tennis and get a little under the ball and hit it over the fence, which is  $4.8 \text{ meters}$  high. The ball lands at a distance of  $12.4\text{m}$  away from the fence. You throw the ball back towards the court with an initial velocity of  $12.1\text{m/s}$  at an angle of  $55^\circ$ . The ball is  $1.05\text{m}$  high when you release it. Did the ball go over the fence, hit the fence or land before the fence? (Hits the fence)
13. A small airplane is traveling with a velocity  $270\text{mph}$  at an altitude of  $10\ 000\text{ft}$  when the plane's wheel falls off. How far will the plane travel before the wheel hits the ground? (1.87miles)
14. A baseball player hits a baseball at an initial velocity of  $30.0\text{m/s}$  at an angle of  $50^\circ$ . Immediately after the ball is hit an outfielder runs at  $4.0\text{m/s}$  toward the infield and catches it at the same height as it was hit.(1.5m) (a) Find the time it takes to get to maximum height. b) Find the maximum height that the object reaches above the ground. c) When is the ball caught? d) How far away was the outfielder from the batter initially? (2.345sec, 28.44m, 4.69s, 109.2m)
15. A girl, standing on top of a small building  $4.00 \text{ m}$  high throws a Molotov cocktail with an initial velocity of  $15.0 \text{ m/s}$  at an angle of  $25^\circ$  with the ground. (a) Find the maximum height that the object reaches above the ground. (b) Find the total time it is in the air. (c) Find the range of the Molotov cocktail. (6.05m, 1.758s, 23.90m)
16. A ball is hit at  $20\text{m/s}$  at  $60^\circ$  towards a fence that is  $30\text{m}$  away and is  $8\text{m}$  high. If the ball is hit from a height of  $1\text{m}$  will it clear the fence? (yes)
17. A football kicker kicks a successful field goal from a distance of  $40 \text{ yards}$  away from the goal post. Find the initial velocity of the football if he kicks it an angle of  $40^\circ$  and it clears the crossbar by  $5\text{ft}$ . The height of the crossbar is  $10\text{ft}$ . State your answer in  $\text{ft/s}$ .
18. a) Determine the force in the cable if the mass of the support pole is  $10 \text{ kg}$ . Use Figure 9.3. (882N)

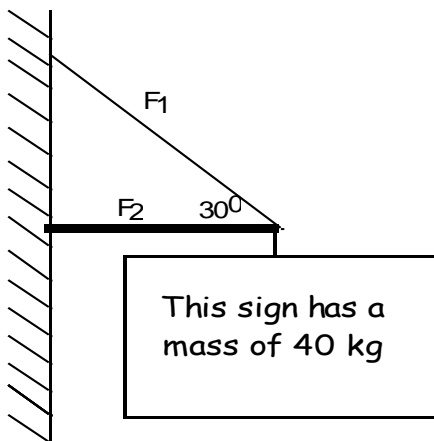


Figure 9.3