

PHY 2053C Final Chapter 1 - Chapter 10

Directions: Please do all problems and **show all work**. You will be graded on your work in addition to your answers, so if you do not show your work you risk losing points. To simplify your math please use $g = 10 \text{ m/s}^2$.

Note: Please do not write on the test. Write all work and answers on a separate sheet of paper. Please clearly indicate all answers. Remember to draw a free-body diagram on problems where you use Newton's Three Laws.

1. Define Kinematics. What assumption must be true to use Kinematics? Write down the most important Kinematics equations.
2. Write down Newton's 3 Laws of Motion. What assumptions must be made for Newton's Laws to be valid?
3. What quantities have we learned about that are conserved? What must be true for each to be conserved?
4. A rifle is aimed horizontally at a target 50 m away. The bullet hits 1.25 m below the target. **(a)** What was the bullet's flight time? **(b)** What was the bullet's speed as it left the barrel?
5. A 1000-kg car traveling at a speed of 40 m/s skids to a halt on wet concrete where $\mu_k = 0.8$. How long are the skid marks?
6. A 1000-kg safe is 2 m above a heavy-duty spring when the rope holding the safe breaks. The safe hits the spring and compresses it 50 cm. What is the spring constant of the spring?
7. A solid cylinder of radius 4 cm has the same mass as a solid sphere of radius R . If the cylinder and sphere have the same moment of inertia about their centers, what is the sphere's radius?
8. A 20-g ball of clay traveling east at 3 m/s collides with a 30-g ball of clay traveling north at 2 m/s. What are the speed and direction of the resulting 50-g blob of clay?
9. A curve at a racetrack has a radius of 100 m and is banked at an angle of 45 degrees. On a rainy day, the coefficient of static friction between the cars' tires and the track is 0.6. What is the maximum speed at which a car could go around this curve without slipping?
10. Ships A and B leave port together. For the next two hours, ship A travels at 30 mph in a direction 30 degrees west of north while ship B travels 60 degrees

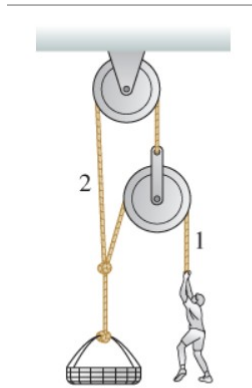


Figure 1: Problem 11

east of north at 20 mph. (a) What is the distance between the two ships two hours after they depart? (b) What is the speed of ship A as seen by ship B?

11. In rock climbing, various rope and pulley systems have been devised to help haul up heavy loads, including injured climbers. A rescuer is hauling up an injured climber who has a mass m using the rope and pulley system shown in Figure 1. (The ropes in this figure are drawn at various angles for clarity, but you can assume they're all vertical). You may assume both pulleys are massless. Write your answers in terms of the mass m and g . (a) What is the tension in rope 1? (b) What is the tension in rope 2?