

## Physics 111 Session 16

- 1) A car's tire weighs 20 kg, and has a radius of 25 cm. If the car accelerates from 0 m/s to 30 m/s in 5.6 seconds,
  - a) What is the car's acceleration?  $5.35 \text{ m/s}^2$
  - b) Find the tire's angular velocity at  $t=2.0$  seconds, and at  $t=5.6$  seconds  $42.9 \text{ rad/s}$ ,  $120 \text{ rad/s}$
  - c) What is the tire's angular acceleration?  $21.4 \text{ rad/s}^2$
  - d) What is the total kinetic energy of the tire? (assume the tire is cylindrical,  $I = \frac{1}{2}mr^2$ )  $5400 \text{ J}$
- 2) A block that has mass 8kg compresses a spring with force constant 4,000 N/m by 20 cm. If there is no friction, what is the speed of the block when it is released?  $PE = \frac{1}{2} kx^2$ ,  $4.47 \text{ m/s}$
- 3) A propeller on an airplane has radius 0.4m, and spins at 180 rad/s. What is the centripetal acceleration of the tip of the propeller?  $12960 \text{ m/s}^2$
- 4) In an inelastic collision, what is conserved?
  - a) Kinetic energy
  - b) **Momentum**
  - c) Both
  - d) neither
- 5) A baseball is thrown with spin. Its mass is 0.5kg and its moment of inertia is 0.01 kgm<sup>2</sup>. If it is thrown at 35 m/s with angular velocity 50 rad/sec, what is its total energy?  $KE = \frac{1}{2} mv^2 + \frac{1}{2} I\omega^2$
- 6) A 3kg mass is being pulled up an inclined plane by a force of 10N. if the plane is at a 30-degree angle from the horizontal, the displacement is 0.7m, and the coefficient of kinetic friction is 0.25, what is the work done by the force?
- 7) An amusement park ride consists of a horizontal circle of radius 6m, that is spun from rest to 1.2 rad/s in 24 seconds. What is the tangential acceleration of the passengers during this time?  $0.3 \text{ m/s}^2$
- 8) In an inelastic collision, 2 hockey pucks ( $m=0.15\text{kg}$ ) collide. The first one is going at  $\langle 8\text{m/s } x, -6\text{m/s } y \rangle$ , and the second one is going at  $\langle -4\text{m/s } x, 7\text{m/s } y \rangle$ . After the collision, the first puck is going  $\langle 5\text{m/s } x, 2\text{m/s } y \rangle$ . What is the final velocity of the second puck?

9) What is the center of mass of the objects in the diagram to the right?

