PHYS 21800 PRACTICE EXAM 2

Part I – Multiple Choice Questions [2 pts each]

Directions: Circle the one alternative that best completes the statement or answers the question. Unless otherwise stated, assume ideal conditions (no air resistance, uniform gravity, etc.)

1) Which of the following is NOT a unit for angle?
(A) deg

(B) rad

(C) rev

(D) rpm

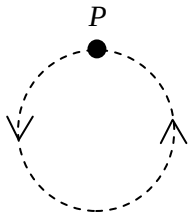
2) A wheel spins 30 times in 6 seconds. Its period of revolution equals
(A) 0.2 sec

(B) 5 sec

(C) 6 sec

(D) 30 sec

3) A car moves at constant speed counterclockwise along a circular track. What is the direction of the centripetal force acting on the car when it reaches point *P*?



(A) ↑

(B) →

(C) ↓

(D) ←

4) A change or transfer of momentum is known as
(A) energy.

(B) force.

(C) impulse.

(D) work.

5) A ball is dropped from a very tall building. Ignore friction. As the ball falls, which of the following quantities is conserved?
(A) Momentum only.

(B) Mechanical energy only.

(C) Both momentum and mechanical energy.

(D) Neither momentum nor mechanical energy.

6) A guy throws a bowling ball along a bowling alley. As it travels toward the pins, the ball has which of the following kinetic energies?
(A) Translational kinetic energy only.

(B) Rotational kinetic energy only.

(C) Both translational and rotational kinetic energy.

(D) Neither translational nor rotational kinetic energy

7) A bullet is shot from a rifle. At the instant that the bullet begins moving, what is the relationship between the momentum of the bullet (magnitude = $|p_B|$) and the momentum of the rifle (magnitude = $|p_R|$)?
(A) $|p_B| = |p_R|$

(B) $|p_B| > |p_R|$

(C) $|p_B| < |p_R|$

(D) Not enough info.

8) A solid ball and a hollow ball of equal mass and equal outer radius start at the top of a ramp. When they are released, the balls roll to the bottom. Which of two will reach the bottom first?
(A) The solid ball.

(B) The hollow ball.

(C) They reach the bottom simultaneously.

(D) Not enough info.

9) An ice skater is spinning upright with her arms outstretched. As she pulls her arms inward, which of the following quantities remains constant?
(A) angular speed

(B) angular displacement

(C) angular momentum

(D) angular velocity

10) The First Condition of Static Equilibrium prevents which of the following motions?
(A) Rotation only.

(B) Translation only.

(C) Translation and rotation only.

(D) Translation and vibration only.

Part II – Word Problems [20 pts each]

Directions: Show your work to receive full credit. Box your final answer and record its appropriate unit.

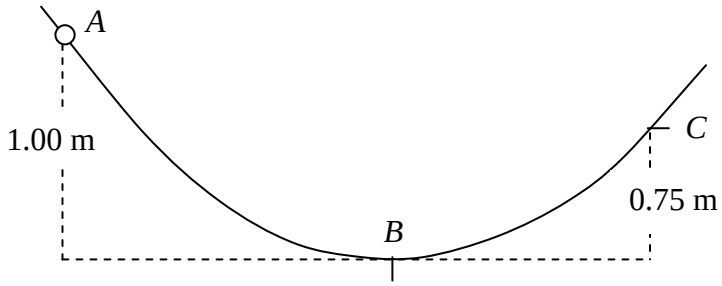
Problem 1

A wheel initially turning at 2000 rpm uniformly increases its speed to 6600 rpm in 9.00 sec.
Calculate

(A) the angular acceleration of the wheel in rad/s^2.

(B) the number of revolutions turned by the wheel during the 9.00-sec interval.

Problem 2



A bead (mass = 0.300 kg) is able to slide along a curved wire as shown in the diagram.
(A) The bead has a downward speed of 0.800 m/s at point *A* (at a height of 1.00 m above point *B*). Calculate the bead's speed at point *C* (at a height of 0.75 m above point *B*) if there is no friction present.
(B) Suppose that friction is present. The bead starts at point *A* with a speed of 0.800 m/s and slides to point *C* where it stops momentarily (before it slides back down). Calculate the energy lost by the bead in sliding from point *A* to point *C*.

Problem 3

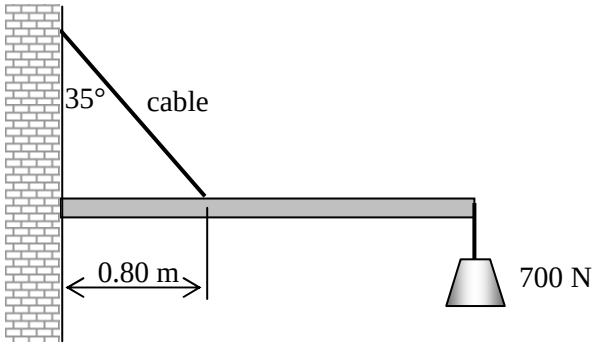
A 7.00×10^{-3} kg bullet moving horizontally at 200 m/s strikes and passes through a 0.150-kg tin can sitting on a table. Immediately after impact, the can has a horizontal speed of 0.180 m/s.

(A) Draw a momentum conservation ("before and after") diagram.

(B) Calculate the velocity of the bullet immediately after the collision.

(C) Calculate the impulse experienced by the can as a result of the collision.

Problem 4



A 2.00-meter long uniform beam weighs 500 N and supports a 700-N load at one end. The beam is hinged to a wall and is held at rest by a cable.
(A) Calculate the tension in the cable.
(B) Calculate the horizontal force acting on the beam from the hinge.
(C) Calculate the vertical force acting on the beam from the hinge.

Formulas and Constants

$F_{net} = ma$ $\quad w = mg$ $\quad f = \mu n$ $\quad F_{grav} = \dfrac{Gm_1m_2}{r^2}$

$s_{av} = \dfrac{d}{t}$ $\quad v_{av} = \dfrac{\Delta x}{t}$ $\quad a_{av} = \dfrac{\Delta v}{t}$ $\quad G = 6.67\times10^{-11}\ \mathrm{N\cdot m^2/kg^2}$

$\Delta x = v_i t + \frac{1}{2}at^2$ $\quad v_f = v_i + at$ $\quad \Delta x = \frac{1}{2}(v_i + v_f)t$ $\quad g = 9.8\ \mathrm{m/s^2}$

$v_{fy} = v_{iy} - gt$ $\quad \Delta y = v_{iy}t - \frac{1}{2}gt^2$ $\quad v_{fy}^2 = v_{iy}^2 - 2g\Delta y$ $\quad \Delta x = v_{ix}t$

$d = r\Delta\theta$ $\quad v = r\omega$ $\quad \omega = \dfrac{2\pi}{T}$ $\quad a_c = \dfrac{v^2}{r} = \omega^2 r$ $\quad F_c = ma_c$

1 rev = 2π rad = 360° $\quad v = \sqrt{\dfrac{GM}{r}}$ $\quad v = \dfrac{2\pi r}{T}$ $\quad a_T = r\alpha$

$\omega_f = \omega_i + \alpha t$ $\quad \Delta\theta = \frac{1}{2}(\omega_f + \omega_i)t$ $\quad \omega_f^2 = \omega_i^2 + 2\alpha\Delta\theta$ $\quad \Delta\theta = \omega_i t + \frac{1}{2}\alpha t^2$

$W = F\Delta x\cos\theta$ $\quad W_f = -\mu_k n\Delta x$ $\quad P = \dfrac{\Delta E}{t}$ $\quad K = \frac{1}{2}mv^2$ $\quad U_{grav} = mgy$

$U_{elastic} = \frac{1}{2}kx^2$ $\quad E = K + U$ $\quad E_1 + W_f = E_2$ $\quad p = mv$ $\quad \Delta p = m\Delta v$

$\Delta p = F_{net}t$ $\quad \tau = rF\sin\theta$ $\quad \tau_{net} = I\alpha$ $\quad K_{rot} = \frac{1}{2}I\omega^2$ $\quad L = I\omega$