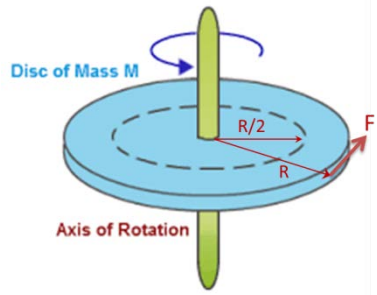
Physics 1100 (T6Sec.), SP2017 Exam#3a (1 hour), Name_____, ID#_____, Score_100/100

1. (**Rotational motion – kinematics/dynamics, 5/ea.**) A force of 50 N exerts on 10-kg uniform disk with a radius R = 0.2 m for 1 second time period to initiate (t = 0) spinning of the disk. Assumption: frictionless.



(a) What is the torque applied to the disk? **Ans.** _____10 N.m.
(b) What is the angular acceleration during the first 1-second period? **Ans.** ___50 rad./s^2
(c) What is the angular velocity when t = 1 s? **Ans.**_____50 rad./s
(d) What is the total rotated angle during the first 1-second? **Ans.** ____25 rad.
(e) What is the total rotated angle during the second 1-second time period? **Ans.**_____50 rad.

2. (**Rotational motion – dynamics/energetics, 5/ea.**) Refer to the problem #1 **(double-check your results in the first problem)**, find:

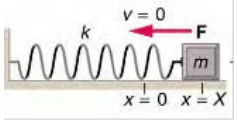
Refer to the diagram in 1.

(a) the work done by the torque. **Ans.**_____250 J
(b) the rotational kinetic energy at the end of the first 1 s. **Ans.**_____250 J
(c) the angular momentum at the end of the first 1 s. **Ans.**_____10 kg.m^2/s

If a point-mass with mass of 5 kg is adhered to the disk at r = R/2 as shown at the end of first 1 s, find:

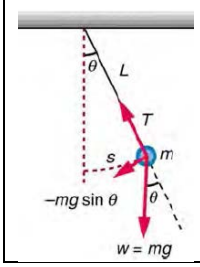
(d) the rotational inertia for the disk with the point-mass? **Ans.** _____0.25 kg.m^2 , and
(e) the new angular velocity assuming the angular momentum is conserved? **Ans.**_____40 rad./s

3. (**Oscillatory motion: spring with a point-mass, 5/ea.**) A 1-kg point-mass with zero initial velocity connected with a spring is being displaced by X_m = 0.15 m. Assume (1) the force constant of the spring (K) is 9 N/m, and (2) the motion of spring/object is frictionless and t = 0 when the point-mass is at x =0 m.



(a) What is the oscillation period of the point-mass, T? **Ans.** _____2.1 s
(b) What is the oscillation frequency of the point-mass? **Ans.** _____0.5 Hz
(c) What is value of x (t) for t = 2T? **Ans.** _____0
(d) What is the maximum kinetic energy of the point-mass? **Ans.**_____0.1 J
(e) What is the work done by the spring-force when the point-mass is being displaced from X to the origin x = 0? **Ans.** _____0.1 J

4. (**Oscillatory motion: pendulum, 5/ea.**) A pendulum system with L = 1 m and m = 2 kg is initially energized by giving a potential energy of 0.2 J to the system. Assumption: frictionless, g = 9.8 m/s^2



(a) What is the maximum kinetic energy of the point-mass? **Ans.** _____0.2 J
(b) What is the maximum velocity of the point-mass (magnitude only)? **Ans.** _____0.45 m/s
(c) What is the maximum displacement of the point-mass, S_m? **Ans.** _____0.14 m
(d) What is the maximum force exerts on the point-mass? **Ans.**_____2.7 N
(e) What is the net force exerts on the point-mass when it has the maximum velocity? **Ans.**_____0

<Equations given below are for your reference only>

Rotational motion	$I = (1/2)mr^2$ for uniform disk	$I = mr^2$ for a point mass		
	$\theta = \theta_0 + \omega_0\Delta t + (1/2)\alpha\Delta t^2$ $\omega = \omega_0 + \alpha\Delta t$	$\tau = Fr$; $L = I\omega$	$\tau = I\alpha$; $W = \tau\Delta\theta$	$KE_{rot} = (1/2)I\omega^2$
Oscillatory motion – *spring with a point-mass*	$F = -Kx$; $F = ma$ $\omega = (K/m)^{1/2}$	$x(t) = X_m \sin(\omega t)$; $v(t) = X_m\omega \cos(\omega t)$;	$a(t) = -X_m\omega^2 \sin(\omega t)$	$PE_m = (1/2)kX^2$; $KE_m = (1/2)mv_m^2$
Oscillatory motion -- *pendulum*	$\omega = (g/L)^{1/2}$	$s(t) = S_m \sin(\omega t)$; $v(t) = S_m\omega \cos(\omega t)$;	$a(t) = -S_m\omega^2 \sin(\omega t)$	