

Practice Exam #2

SECTION I: MULTIPLE CHOICE. No partial credit. Each question = 5 points.

1.) Sally is in space, 4 Earth radii away from Earth's surface. The size of the acceleration due to gravity (g) at her location is:

- a.) 0 m/s^2 b.) 0.39 m/s^2 c.) 0.61 m/s^2 d.) 1.96 m/s^2 e.) 9.8 m/s^2

Questions #2-4 refer to the following:

A boy is swinging a 2 kg bucket of water in a vertical circle of radius 1 m. At its highest point, the bucket's speed is 5 m/s.

2.) The net force on the bucket at this point is:

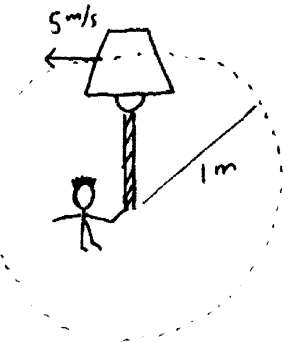
- a.) 0 N b.) 10 N c.) 30 N d.) 50 N e.) 70 N

3.) The tension on the bucket at this point is:

- a.) 0 N b.) 10 N c.) 30 N d.) 50 N e.) 70 N

4.) When the bucket reaches the bottom of the swing, which of these vectors will point horizontally?

- a.) tension b.) force of gravity c.) centripetal acceleration
d.) velocity e.) More than one of these.



Questions #5-6 refer to the following:

A crate on a flat surface is being pushed to the left by a horizontal pushing force.

5.) The work done by the pushing force on the crate will be:

- a.) negative b.) zero c.) positive d.) Not enough info.

6.) The work done by the friction force on the crate will be:

- a.) negative b.) zero c.) positive d.) Not enough info.

Questions #7-8 refer to the following:

Two ice skaters (Abe and Bob) are skating in opposite directions, when they have a head-on collision and come to rest.

7.) Which of the following is true about the Abe+Bob system?

- a.) The mechanical energy of the system is decreased.
b.) The mechanical energy of the system is constant.
c.) The momentum of the system is decreased.
d.) Both skaters must have the same initial speed.
e.) None of these.

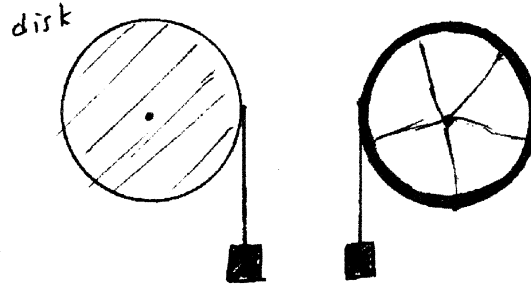
8.) Abe had an initial speed of 10 m/s and a mass of 70 kg. If Bob is twice Abe's mass, then his initial speed was:

- a.) 1 m/s b.) 5 m/s c.) 10 m/s d.) 20 m/s e.) None of these.

9.) A car performs a U-turn which is a perfect half-circle. If the car starts the turn at an angular speed of 2ω , and finishes it at ω , the size of his angular acceleration during the turn must have been:

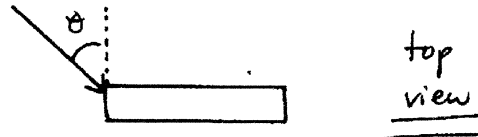
- a.) $\frac{\omega^2}{2\pi}$ b.) $\frac{\omega^2}{\pi}$ c.) $\frac{3\omega^2}{2\pi}$ d.) $\frac{2\omega^2}{\pi}$ e.) 0

10.) A solid disk and a thin ring (of equal mass, outer radius) are attached by their centers to frictionless pivots. Strings are wrapped around both, on which identical masses are hung. If the hanging masses are both let go from rest (at the same height above ground) which will hit the ground first?



- a.) the disk's hanging mass.
 b.) the ring's hanging mass.
 c.) Neither, they will hit at the same time.
 d.) There is not enough info to determine this.

11.) A uniform bar is lying on a flat frictionless table. A horizontal force F is applied as shown. Which of the following is true?



- a.) The net torque on the bar is zero.
 b.) There will be a net torque on the bar only if $\theta = 0$.
 c.) The bar's center of mass will remain stationary.
 d.) The bar will not accelerate translationally or rotationally.
 e.) The bar will have both translational and rotational acceleration.

END OF MULTIPLE CHOICE SECTION.

Name: _____

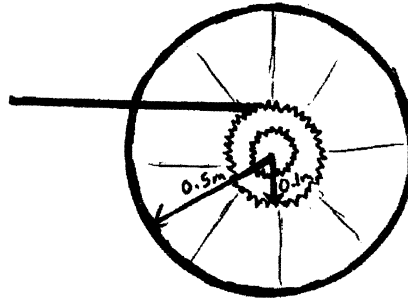
Long Answer: _____/50

+ Mult. Choice: _____/55

Total Score: _____/105

SECTION II: LONG ANSWER. Partial credit will be assigned. An answer with no work or insufficient to make it clear that the problem was done correctly will receive NO CREDIT. Each question is worth 25 points.

1.) A bicycle wheel has a mass of 8 kg, very nearly all at its outer radius of 0.45 m. A gear disk (a 7 kg solid disk) of radius 0.2 m is attached to its center. Initially, the wheel/gear system is not spinning, but a chain attached to the outer edge of the gear disk applies a constant 6 N force to the system.



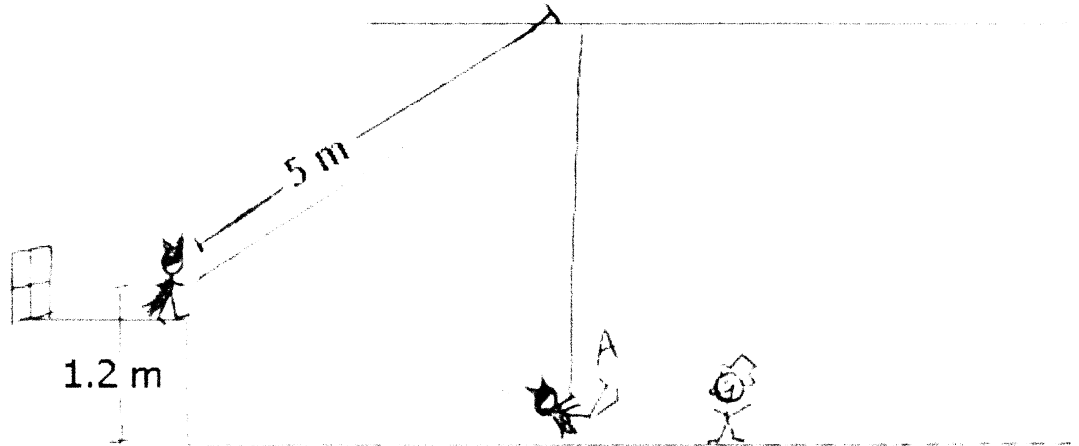
- a.) What is the rotational inertia of the wheel/gear system?

- b.) What will be the torque felt by the system due to the chain?

- c.) How long will it take for the edge of the wheel to be travelling at 10 m/s?

- d.) If the bike was switched to a "lower" gear (where the chain was closer to the pivot), explain what effect this would have on the torque.

- 2.) Batman (100 kg) comes in through the window and grabs a rope of length 5 m, which is tied to the ceiling.
- I.) He swings down a vertical distance of 1.2 m on it. When he arrives at ground level, the rope is vertical.
- II.) He then lets go of the rope and slides across the frictionless floor until he collides with the Joker (70 kg, initially at rest). They stick together and slide across the floor.



- a.) How fast is Batman travelling when he arrives at ground level (point A)?
- b.) What is the tension in the rope at this moment (point A)?
- c.) Find how fast the Batman/Joker system goes after their collision.
- d.) Explain conceptually what happens to the mechanical energy of the Batman/Joker system over the course of the problem.