General Physics
Physics 101
Test #2 – Fall 2015
Friday 10/30/15
Prof. Bob Ekey

Name (print):_____

I hereby declare upon my word of honor that I have neither given nor received unauthorized help on this work.

Signature:_____

Part I. Multiple Choice (3 pts each)

Instructions:

Please clearly circle one and only one answer for each of the following.
Show all of your work. Partial credit may be given if you include your work.

Questions:

1. At the Great Wolf Lodge waterpark there is a pipe that spins in a circle. As water fills the 1.5 m long-pipe, the water pressure causes the pipe to spin around its center. It takes 15 s for the pipe to spin from rest to its maximum speed, while it made 20 revolutions. What is the angular acceleration of the pipe as it spins up?

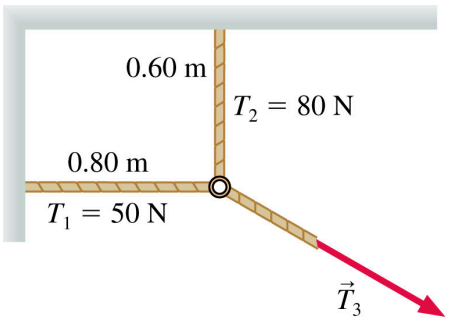
(a) 1.1 rad/s^2
(b) 0.56 rad/s^2
(c) 0.18 rad/s^2
(d) 0.089 m/s^2

2. In your quest for the perfect room arrangement, you decide to move your desk from one side of the room to another. The 75 kg desk slides with constant velocity, and you push with a 100 N horizontal force. What is the coefficient of friction between the desk and the floor?

(a) 0.75
(b) 0.14
(c) 0.10
(d) 0.20

3. Stuck in the middle of a frozen lake with a surface so slippery you (100 kg) cannot walk ($\mu_k=\mu_s=0$). You have a 1.0 kg rock that you can throw with a velocity of 10 m/s in 0.10 seconds. What is your acceleration during the throw?

(a) 0.0 m/s^2
(b) 100 m/s^2
(c) -1.0 m/s^2
(d) -1.0 x 10^2 m/s^2



4. The three ropes shown are tied to a very light ring. Two of these ropes are anchored to the walls at right angles with the tensions shown. What is the angle that the third rope pulls with?

(a) 58º below the horizontal
(b) 32º below the horizontal
(c) 53º below the horizontal
(d) 37º below the horizontal

5. A ball on a string spins with a constant tangential speed. If you halve the radius of the string while halving the tangential speed, the centripetal acceleration will be…

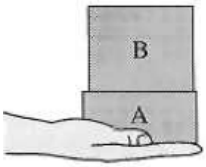
(a) Twice the original centripetal acceleration.
(b) Half the original centripetal acceleration.
(c) The same as the original centripetal acceleration.
(d) One quarter the original centripetal acceleration.

6. You kicked a rock and it is now sliding across the sidewalk. How many forces are acting on the rock? As usual, ignore air resistance.

(a) 1
(b) 2
(c) 3
(d) 4

7. You spin a bicycle wheel and measure the initial angular velocity to be 12 rad/s with an angular acceleration of -0.050 rad/s^2. After 20 seconds, what is the angular velocity of the wheel?

(a) 1.0 rad/s
(b) 1.1 rad/s
(c) 2.0 rad/s
(d) 11 rad/s



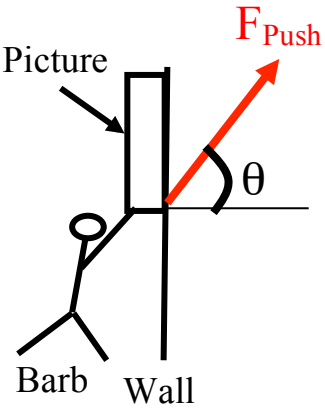
8. Block A and B move are lifted with a uniform force by a hand. Which of the following net force equations is correct?

(a) $\sum F_B = m_B a = F_{AonB}$

(b) $\sum F_A = m_A a = F_{Lift} - m_A g + F_{BonA}$

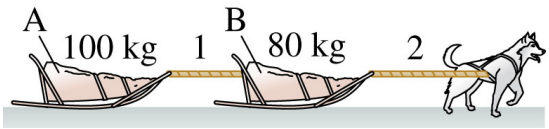
(c) $\sum F_A = m_A a = F_{AonB} - m_A g$

(d) $\sum F_{tot} = (m_A + m_B)a = F_{lift} - F_{g,A} - F_{g,B}$



9. Barb is holding a big picture (m=25 kg) on the wall by pushing on the picture with a force of 2000 N at an angle of 30.00º. If the picture doesn't move, what is the magnitude of the normal force?

(a) 2.5 x 10^2 N
(b) 1.0 x 10^3 N
(c) 1000 N
(d) 1732 N



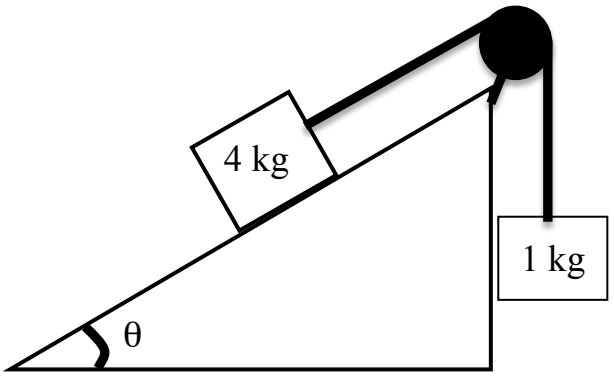
10. A sled dog drags sled A and B across the snow. The friction force on sled A and B are 100 N and 80 N for A and B respectively. If the tension in rope 1 is 300 N, what is the acceleration of the sleds?

(a) 2.00 m/s^2
(b) 1.67 m/s^2
(c) 1.11 m/s^2
(d) 3.00 m/s^2

11. A circular disk undergoes a constant negative angular acceleration, decreasing its angular speed. During this angular acceleration, what happens to the tangential acceleration of a point on the edge of the disk?

(a) Increases
(b) Remains the same
(c) Decreases
(d) Need more information

12. A 4.0 kg box is on a frictionless ramp and is connected via a massless string over a massless, frictionless pulley to a hanging 1.0 kg weight. For the 4.0 kg box to be motionless, what does the tension in the string have to be?



(a) 29 N
(b) 0 N
(c) 9.8 N
(d) 39 N

Part II. Short answer problems (12 pts each)

Instructions:

Solve three of the following four problems. If you try to solve all four problems, please clearly indicate which problems you wish to have graded. If you do not indicate this, I will assume you want me to grade problems one, two and three.

Please show all of your work, including equations without numbers.
Please provide units with all answers.
Partial credit may be given if you include your work.

Question 1. **Grade this problem? Yes or No (circle one)**

A long string is wrapped around a 6.0-cm-diameter cylinder, initially at rest, that is free to rotate on an axle. The string is then pulled with a constant acceleration of 1.5 rad/s^2 until 1.0 m of string has been unwound (no slipping).

(a) What angle does the cylinder turn through as the string is unwound?

(b) What is the angular speed of the cylinder after 1.0 m of the string is unwound?

(c) How long did it take the cylinder to turn through half of the angle found in (a)?

(d) As the string is unwound explain whether the centripetal acceleration is increasing, decreasing or staying the same. Be sure to include an equation and words in your answer. No calculations are necessary.

Question 2. **Grade this problem? Yes or No (circle one)**

A 200 g wooden block is set on a wooden ramp that has an angle of 20.0º with respect to the horizontal.

(a) What is the magnitude of the normal force acting on the block?

(b) What is the magnitude of the maximum static friction between the block and ramp?

(c) Calculate the component of the gravitational force acting on the block acting along the ramp. Explicitly state whether the force acts up or down the ramp.

(d) Explain whether the block is moving or not. You must include a net force equation parallel to the ramp in your explanation, along with words (no calculations are necessary).

Question 3. **Grade this problem? Yes or No (circle one)**

A 2,000 kg truck traveling at 20 m/s collides with a stationary 1,000 kg car.

(a) During the collision, which car experiences a larger acceleration? No calculations are necessary, but words and theory are necessary in your explanation.

Post accident, the truck still runs but the car does not. The truck pushes on the non-functioning car's bumper to help clear the accident. When the truck driver steps on the accelerator, the system accelerates at 1.5 m/s^2. Rolling friction can be neglected.

(b) What is the net force acting on the car (mag + dir)?

(c) What is the force (mag + dir) of the car pushing on the truck?

(d) What magnitude of force does the drive wheels of the truck push against the ground that causes the system to move forward?

Question 4. **Grade this problem? Yes or No (circle one)**

An elevator is traveling downward and is slowing down.

(a) Draw a force diagram showing the tension and force of gravity acting on the elevator drawn to scale. These do not need to be exact, but a larger force should have a larger length. Also explain the direction of the net force using your diagram.

(b) The elevator was traveling downward at 2.0 m/s, and slows to -1.0 m/s over a distance of 2.0 m. What is the acceleration of the elevator?

(c) If the tension in the cable is 10 kN as the elevator slows, what is the mass of the elevator?

(d) If the elevator stops, what is the tension in the cable?