General Physics
Physics 101
Test #2 – Fall 2011
Friday 10/28/11
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:

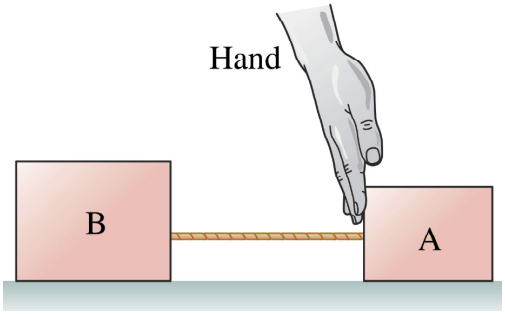
1. The wheel on a car has a radius of 0.25 m and undergoes 10 revolutions without slipping as it accelerates from rest in 2.0 seconds. What is the value of the angular acceleration of the wheel during this time?

(a) 64 rad/s^2
(b) 10 rad/s^2
(c) 5.0 rad/s^2
(d) 31 rad/s^2

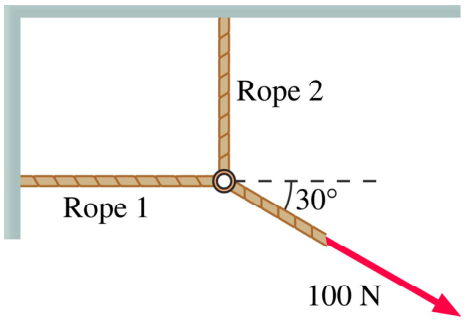
2. A 1.0 kg block with a massless string is being pulled upward at a constant velocity. How does the magnitude of the tension in the string compare with the force of gravity acting on the block?

(a) The same as the force of gravity
(b) Greater than the force of gravity
(c) Less than the force of gravity
(d) Impossible to tell without more information.

3. Block A and B, with masses 1 kg and 2 kg respectively, are connected via a massless string. If the hand exerts a 9 N force on block A, what is the net force exerted on mass A?



(a) 12 N
(b) 9 N
(c) 6 N
(d) 3 N



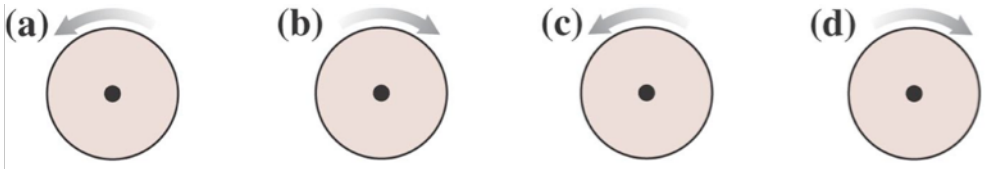
4. The three ropes shown are tied to a small, very light ring. Two of the ropes are anchored to walls at right angles, and the third rope pulls as shown. What is the magnitude of the tension in rope 2?

(a) 1.0×10^2 N
(b) 87 N
(c) 50 N
(d) 0.0 N

5. A compact car and a large truck collide head on and stick together. Which undergoes the larger acceleration during the collision?

(a) car
(b) truck
(c) Both experience the same acceleration.
(d) Can't tell without knowing the final velocity of combined mass.

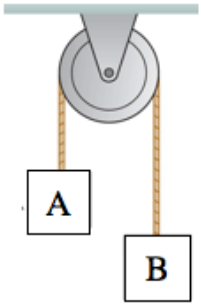
6. Which of the following has a negative angular acceleration?



Speeding up | Slowing down | Slowing down | Constant speed

7. Frustrated in studying for this test, you decided to punch your pillow, which made you think of more physics. You determine the mass of your hand is 0.50 kg, its initial velocity is 4.0 m/s, its final velocity is zero and it takes 2.0 ms for your hand to stop. What force is experience by your hand?

(a) 2.0×10^3 N
(b) 1,000 N
(c) 1.0×10^3 N
(d) 1.0 N



8. You brought your Atwood's machine with you to planet X, and measure an acceleration for the system of 6.0 m/s^2. What is the acceleration due to gravity on Planet X? m_A = 2.0 kg and m_B = 4.0 kg

(a) 18 m/s^2
(b) 12 m/s^2
(c) 2.0 m/s^2
(d) 36 m/s^2

9. A block pushed along the floor with velocity, *v*, slides a distance, d, after the pushing force is removed. What initial velocity is necessary, if you want the block to travel a distance of 2d before stopping?

(a) $2v$
(b) $4v$
(c) $\frac{1}{4}v$
(d) $\sqrt{2}v$

10. A 2.0 kg wooden block sits motionless on a wooden ramp that has an angle of 26.7º with respect to the horizontal. What is the coefficient of friction between the block and ramp?

(a) 0.20 N
(b) 0.50
(c) 0.10
(d) 0.20

11. The edge of a 10 cm diameter wheel turns through an arc length of 5.00 m as it rotates. What angle did the wheel turn through during this movement?

(a) 0.020 radians
(b) 1.0 x 10^2 radians
(c) 50º
(d) 25 revolutions

12. Suppose you press your physics book against a wall hard enough to keep it from moving. What direction does the friction force on the book point? Assume your push is perpendicular to the wall.

(a) Out of the wall
(b) Up the wall
(c) Down the wall
(d) Either up or down, not possible to determine.

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 2.0 kg wooden block slides from rest down wooden ramp that is inclined at a 30º angle. The coefficient of kinetic friction is 0.20 between the wooden block and wooden ramp.

(a) Draw a force diagram showing all forces acting on the block including the net force. Be sure to label each force appropriately.

(b) Write an equation for the net force perpendicular to the ramp, including whether the net force in the perpendicular is zero or not. Then, calculate the normal force acting on the block.

(c) Calculate the friction force ($\mu_k = 0.20$).
Explicitly state the direction (up or down the ramp).

(d) Calculate the net acceleration on the block parallel to the ramp.
Explicitly state the direction (up or down the ramp).

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

Your roommate is working on his bicycle and has the bike upside down. He spins the 60 cm diameter wheel, and you notice that a pebble stuck in the tread goes by three times every second. Assume it is rotating counter-clockwise.

(a) What is the angular speed of the pebble?

(b) What is the centripetal acceleration of the pebble (magnitude and direction) when it is traveling at three revolution every second?

(c) Compare the tangential speed of the pebble to a point on the wheel at half the radius. Are they the same or is one bigger than the other? Be specific as to which is bigger/smaller or same. Words are necessary in your justification and equations may help. No calculations are required.

(d) Your roommate lets the bike spin and it takes 5.0 minutes to stop. What is the angular acceleration of the wheel as it comes to rest? Explicitly state whether this is in the same or opposite direction of the motion.

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

My son has wooden toy trains. Quite fun. He pushes the Big Train along the track with his hand and the Big train is pushing a Small Train. I've estimated the masses of the Big and Small Train to be 1.00 kg and 0.50 kg respectively.

(a) Draw a force diagram for the hand, Big Train and Small Train, including all horizontal forces (no vertical forces are necessary and ignore friction). Be sure to use proper labels for each force.

(b) I've measured the acceleration of the train to be 2.0 m/s^2. What is the magnitude and direction of the push force exerted by his hand on the Big Train?

(c) Calculate the net force (Magnitude and direction) acting on the Big Train?

(d) What is the magnitude and direction of the force of the Small Train on the Big Train?

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

You are pushing horizontally on a 50.0 kg wooden couch attempting to move it across a floor covered in shag carpet. While you are surprised that people still have shag carpets, you decide to play physics type games. In the textbook, you find the values for the coefficient of static and kinetic friction for wood on shag carpet to be 0.500 and 0.400 respectively. Mustering your strength, you push with a force of 225 N, and discover that the box moves with a constant acceleration.

(a) Calculate the kinetic friction force.

(b) Calculate the net acceleration of the couch.

(c) If the couch started from rest, how long did it take for you to push it 5.0 m?

(d) You pause for a moment and try to push the couch with the same force as before (225 N), but it does not move. Using the equation $f=\mu n$ and coefficient given, you calculate a static friction force of 245 N. Explain with words and possibly a diagram what is happening in this situation.