General Physics
Physics 101
Test #2 – Fall 2009
Friday 10/30/09
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:_____

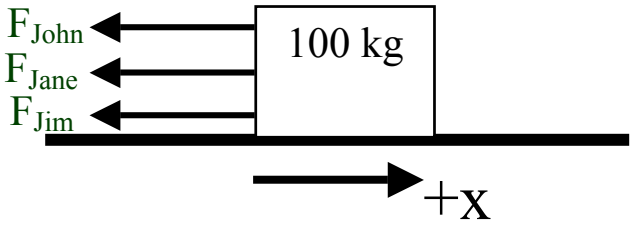
Part I. Multiple Choice (3 pts each)

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. John, Jane and Jim are pushing horizontally on a 100 kg cart in the negative x-direction. If each person pushes with a force of 50 N, what is the net acceleration of the cart? Pretend friction doesn't exist.



(a) 0.33 m/s^2
(b) 0.50 m/s^2
(c) -0.67 m/s^2
(d) -1.5 m/s^2

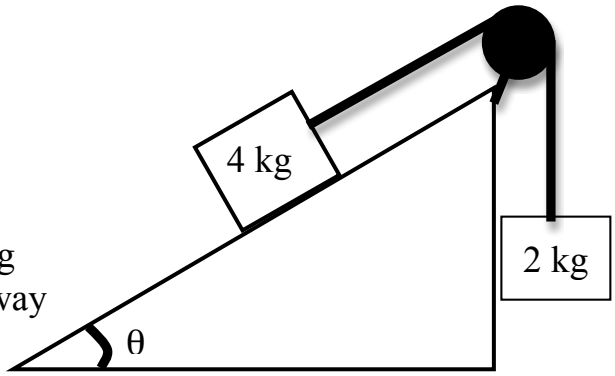
2. You spin a 1.0 kg ball on the end of a 1.0 m long string from rest with an angular acceleration of 1.0 rad/s^2. What angle has the ball traveled when the ball has an angular velocity of 2.0 rad/s?

(a) 2.0 radians
(b) 1.0 radians
(c) 4.0 radians
(d) 0.5 radians

3. A constant force applied to A causes A to accelerate at 5 m/s^2. The same force applied to B causes B to accelerate at 3 m/s^2. What is the ratio of m_A / m_B of the masses of A to the mass of B?

(a) 5/3
(b) 3/5
(c) 15/1
(d) 1/15

4. A 4.0 kg box is on a frictionless 30º ramp and is connected via a massless string over a massless, frictionless pulley to a hanging 2.0 kg weight. If you gently release the box, which way will it move on the ramp?

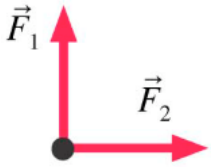


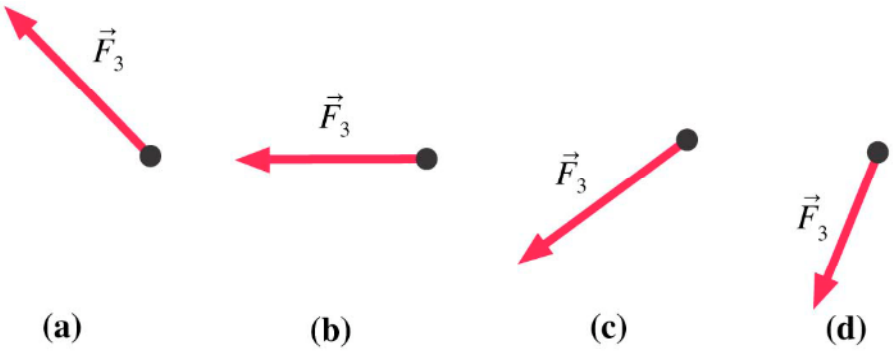
(a) Up the ramp
(b) Down the ramp.
(c) It will not move.
(d) Need more information

5. 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, and calculate the angular velocity to be 19 rad/s. What is the pebbles centripetal acceleration?

(a) 1.1×10^2 N
(b) 1.2×10^3 N
(c) 2.2×10^2 N
(d) 2.7 N

6. Two of three forces are shown. If the net force points to the left, which vector could represent the third force?





7. A 10 g bullet with velocity of 400 m/s strikes a block of wood and penetrates to a depth of 12 cm. What magnitude of resistive force (assumed to be constant) does the wood exert on the bullet?

(a) 6.7×10^5 N
(b) 4.0 N
(c) 17 N
(d) 6.7×10^3 N

8. After 4 hours of working on your physics homework, you decide to pound your head against the wall. You apply a large enough force on the wall with your head that your head goes through the wall. Which statement is true in this situation?

(a) The magnitude of the force of your head on the wall is greater than the force of the wall on your head.
(b) The magnitude of the force of your head on the wall is equal to force of the wall on your head.
(c) The magnitude of the force of your head on the wall is less than the force of the wall on your head.
(d) Need more information.

9. A block is sliding down a ramp, and there is friction.
How many forces are acting on the block?

(a) Four
(b) Three
(c) Two
(d) One

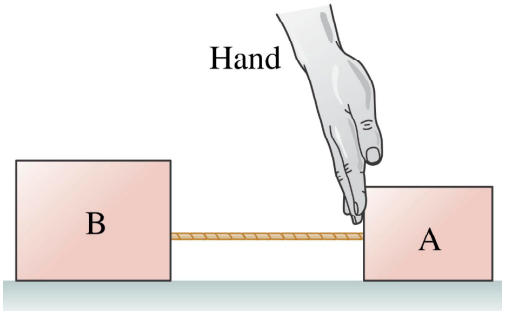
10. A wheel of radius 1.5 m rotates with a constant angular speed.
What statement about a point on the rim of the wheel is true?

(a) It is experiencing no acceleration
(b) It is experiencing only tangential acceleration
(c) It is experiencing only angular acceleration
(d) It is experiencing only centripetal acceleration

11. You push a 10 kg box across a room by applying a 5.0 N force, which is parallel to the floor. This force causes the box to move across the room with a constant velocity. What is the coefficient of kinetic friction between the floor and the box? Draw a picture if it helps.

(a) $\mu_k = 0.051$
(b) $\mu_k = 0.040$ N
(c) $\mu_k = 19.6$
(d) $\mu_k = 0.051$ N

12. 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 force exerted on mass B by the string?



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

You decide to save some energy and possibly time, and take the elevator in Bracy to go from the 1st to the 3rd floor. For uniformity of answers we'll assume you have a mass of 100 kg. Also, for some reason there is a scale in the elevator that you decide to stand on during your trip. Recall that the reading on a scale gives you the magnitude of the normal force.

(a) Before you start to move, what is the reading on the scale (in Newtons) that you are standing on when the elevator is at rest?
Please provide the reasoning behind your answer.

(b) The elevator starts to move upwards at an acceleration of 3.0 m/s^2.
What is the reading on the scale (in Newtons) during this acceleration?

(c) The 1.0 m radius pulley that is connected to the cable on the elevator rotates as the elevator moves from the 1st to the 3rd floor, which is a total distance of 8.0 m.
What angular displacement did the pulley turn through during the ride?

If (hypothetically) the cable on the elevator would break, you, the elevator and the scale would experience free fall. Let's hope this is left as a thought exercise.
(d) What is the reading on the scale? Use words and possibly equations in your answer.

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

Blocks of mass 1.0 kg, 2.0 kg and 3.0 kg are lined up in a row on a frictionless table. All three are pushed forward by a 12 N force applied to the 1.0 kg block.

(a) Draw a force diagram clearly identifying all forces acting on each block parallel to the surface (no vertical forces are necessary).

(b) Calculate the net acceleration for the system.

(c) Determine the force (mag + dir) that the 2.0 kg block exerts on the 3.0 kg block.

(d) Determine the force (mag + dir) that the 2.0 kg block exerts on the 1.0 kg block.

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

According to the manufacturer when the ceiling fan is operating the room feels 8º F cooler. The blades of the fan running at low speed turn at 250 rpm.

(a) Do all points on the fan blades have the same angular velocity? Explain.

You say to yourself, "it doesn't feel 8º cooler", so you switch the fan from low speed to "high speed". The rotation rate of the fan increases uniformly from 250 rpm to 350 rpm in 5.00 seconds.

(b) What is the angular acceleration (magnitude and direction) of the blades in rad/s^2?

(c) What angle did the blades turn through while the fan is accelerating?

Still not cool enough, you decide to open the window (assuming it is not painted shut). You turn off the fan and it slows to a stop from its 350 rpm operating speed over 20.0 s.

(d) What is the angular acceleration (magnitude and direction) of the blades in rad/s^2?

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

You are pulling your friend on a sled across a level bit of ground that is covered with snow with a rope at an angle above the ground. You have been walking at a steady 1.5 m/s and the mass of your friend and the sled is 60.0 kg. The rope pulls the sled with components of 100.0 N upward and 50.0 N to the right.

(a) Determine the magnitude of the friction force acting on the sled.

(b) Calculate the normal force acting on the sled.

(c) Calculate the coefficient of kinetic friction between the sled and the snow.

(d) You stop to take a break, and your friend convinces you to start pulling again. You pull with the same force as before, but now the sled will not move. Explain why this is the case in terms of net force and the friction force. Words are necessary in your answer, calculations are not.