General Physics
Physics 101
Test #2 – Spring 2014
Friday 3/14/14
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:

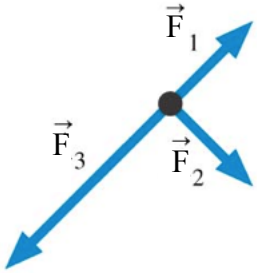
1. You have a 10 kg box is sitting in the bed of your truck. The truck traveling at 10 m/s comes to rest in 5.0 s, and the box does not slide. What is the magnitude of the friction force between the bed of the truck and box?

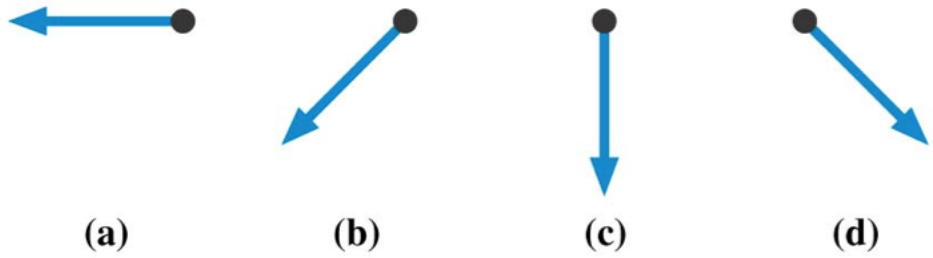
(a) 20 N
(b) 100 N
(c) 2.0 N
(d) Need more information

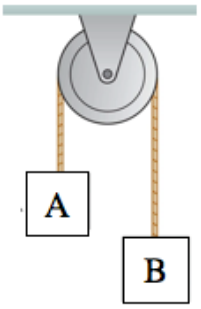
2. A drill is spinning counter-clockwise at 20 rad/s slows to 10 rad/s and makes 20 complete revolutions. What is the angular acceleration of the drill?

(a) -1.2 rad/s^2
(b) - 2.0 rad/s^2
(c) 2.4 rev/s^2
(d) 7.5 m/s^2

3. For the force vectors shown, which of the following vectors represents the net force?

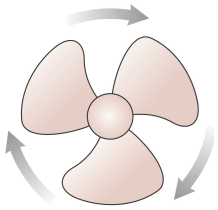






4. For the Atwood's machine shown $m_A = 2.0$ kg and $m_B = 1.0$ kg
What is the acceleration of the system when released?

(a) 3.3 m/s^2
(b) 4.9 m/s^2
(c) 6.5 m/s^2
(d) 29 m/s^2



5. The fan blade shown is slowing down. What are the signs of ω and α?

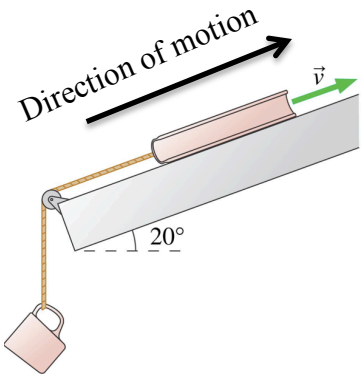
(a) ω is positive and α is negative.
(b) ω is negative and α is positive.
(c) ω is positive and α is positive.
(d) ω is negative and α is negative.

6. An object is held in place by friction on an inclined surface. The angle of incline is increased until the object starts moving. If the surface is kept at the angle, the object…

(a) slows down.
(b) moves at uniform speed.
(c) speeds up.
(d) none of the above

7. A block pushed along the floor with velocity, *v*, slides a distance, d, after the` pushing force is removed. What is the distance traveled if the mass of the block is doubled, and it is sent with the same initial velocity as before?

(a) *d*
(b) ½*d*
(c) *2d*
(d) $\sqrt{2}d$



8. The physics book (m_b = 1.0 kg) shown is connected by a string to a coffee cup (m_c=500g). The book is given a push up the slope and released with a speed, v, and experiences an acceleration, a. Which of the following net force equations is true?

(a) $\sum F_c = m_c a = -T + m_c g$

(b) $\sum F_{b\parallel} = m_b a = m_b g \sin\theta - T - f_{k,b}$

(c) $\sum F_{b\perp} = m_b a = n - m_c g \cos\theta$

(d) $\sum F_{tot} = m_{tot} a = -m_c g - F_{g\parallel,\, b} - f_{k,b}$

9. Which of the following statements is false?

(a) When breaking a board with your hand, the force the hand exerts on the board is the same as the force the board exerts on the hand.

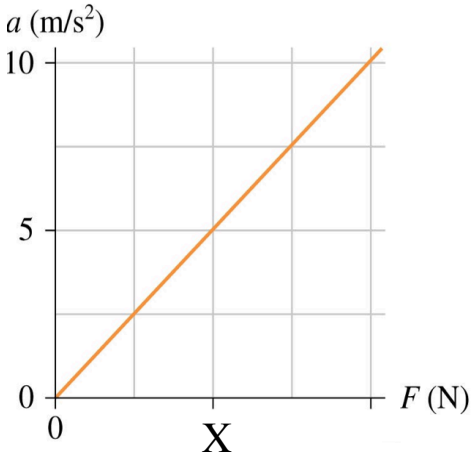
(b) Friction always points in the opposite direction of motion.

(c) In uniform circular motion there is a non-zero acceleration.

(d) Two points on a rigid wheel undergoing an angular acceleration always have the same angular velocity at a given time.

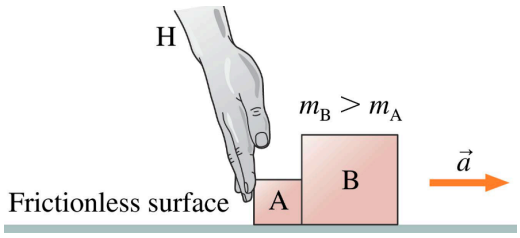
10. As you turn a 50 m radius corner in your car, you continue to move forward and as the car turns, you strike the door. As you are now a "scholar" of physics, you know that acceleration required to turn you is 1.33 m/s^2. With what angular speed were you traveling as you made the turn?

(a) 0.0 rad/s
(b) 0.027 m/s
(c) 8.2 rad/s
(d) 0.16 rad/s



11. The graph shows an acceleration versus force graph for a 100 g object. What force value should be below the tick mark labeled "X" on the force axis?

(a) 500 N
(b) 0.50 kg m/s^2
(c) 20 mN
(d) 1.5 kg m/s



12. Two blocks with masses m_A=5.00 kg and m_B = 10.0 kg are pushed on a frictionless surface with a force of 15.0 N as shown. Determine the net force (mag & dir) acting on mass A.

(a) 15.0 N
(b) 5.00 N
(c) 10.0 N
(d) – 5 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 4000 kg truck is parked on a 15º slope and the coefficient of static friction between the tires and the road is 0.90.

(a) What is the magnitude and direction of the normal force acting on the truck? Be sure to explicitly state the direction of the force.

(b) What is the magnitude and direction of the friction force acting on the truck? Be sure to explicitly state the direction of the force.

(c) If the angle of the slope was increased by a few degrees, the truck would still be stationary. Explain how this is possible in terms of the friction force. No new calculations are necessary, but words are required.

(d) A big drum of oil was "accidently" spilled on the hill and the truck begins to slide. If the coefficient of kinetic friction between the tires and the road are 0.10, what is the net force (mag + dir) experienced by the truck?

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

A model rocket is attached to the end of a 2.0 m long rigid rod. The other end of the rod rotates on a frictionless pivot causing the rocket to move in a horizontal circle. The rocket accelerates constantly at 1.0 m/s^2 for 10 s, starting from rest.

(a) What is the angular acceleration of the rocket?

(b) What is the angular speed of the rocket at 2.0s?

(c) What is the centripetal acceleration at 2.0s? Be sure to explicitly state a direction.

(d) The angular acceleration constantly increases the angular speed of the rocket. Does the magnitude of the tangential acceleration of the rocket throughout its 10s motion increase, decrease or stay the same? Explain using words and theory. No calculations are necessary.

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

Blocks of mass 3.0 kg, 2.0 kg and 1.0 kg are lined up in a row on a frictionless table. All three are pushed forward force applied to the 3.0 kg block. The entire system accelerates at 2.0 m/s^2, and the blocks stay together the entire motion.

(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 push force applied to the 3.0 kg block.

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

While at Akron Children's Hospital, my son and I observed the elevators in the lobby. We measured that an elevator travels 50 cm from rest in 0.50 seconds before the elevator reached its operational speed.

(a) If the elevator has a mass of 1,000 kg, what is the tension in the cable holding the elevator when it is at rest?

(b) What is the acceleration of the elevator as it is moving upward from rest?

(c) What is the tension in the cable holding the elevator when it is accelerating upward?

(d) If the elevator is traveling downward and slowing down, which is bigger the magnitude of the force of gravity or the tension in the cable? Please explain your answer with words and possibly a force-diagram.