General Physics
Physics 101
Test #2 – Fall 2017
Wednesday 10/11/17
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.

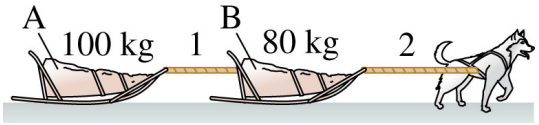
Signature:_____

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:



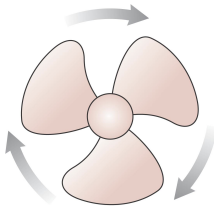
1. A sled dog drags sled A and B across the snow. The coefficient of friction between the sleds and snow is 0.102. If the tension in rope 1 is 300 N, what is the acceleration of the sleds?

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

2. A rocket-powered hockey puck has a thrust of 2.0 N and a total mass of 2.0 kg. It is released from rest on a tall, frictionless table 4.0 m from the edge, what is the velocity when it reaches the end of the table?

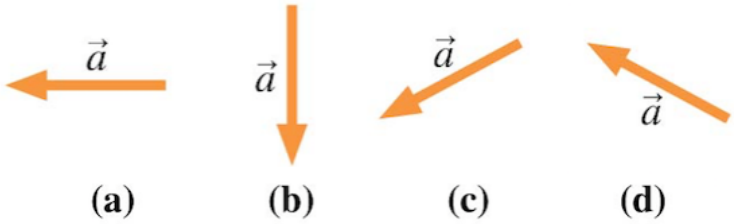
(a) 1.0 m/s^2
(b) 8.0 m/s
(c) 4.0 m/s
(d) 2.8 m/s

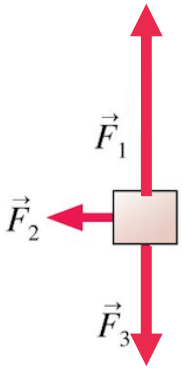
3. The fan blade shown is slowing down. What are the signs of ω and α?



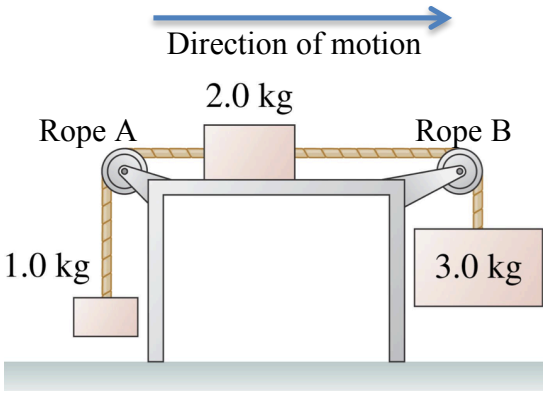
(a) ω is positive and α is negative.
(b) ω is negative and α is positive.
(c) ω is positive and α is positive.
(d) ω is negative and α is negative.

4. In which direction does the object shown accelerate?





5. Three masses are connected by massless strings over massless-frictionless pulleys as shown. The tabletop is very slippery, thus you can ignore friction. Which of the following net force equations is not correct?



(a) $\sum F_1 = m_1 a = T_A - F_{1g}$

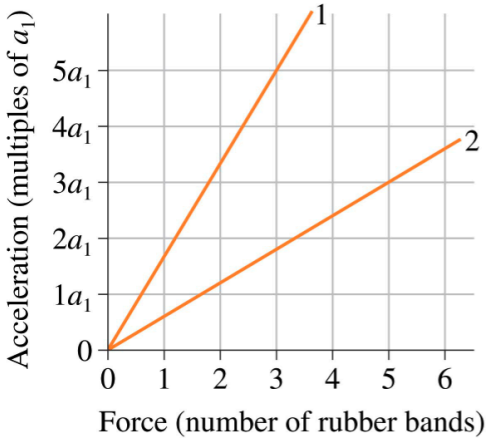
(b) $\sum F_2 = m_2 a = -T_A + T_B$

(c) $\sum F_{tot} = (m_1 + m_3) a = F_{3g} - F_{1g}$

(d) $\sum F_3 = m_3 a = F_{3g} - T_B$

6. The figure shows acceleration versus force graphs for two objects pulled by rubber bands. What is the mass ratio of m_2 to m_1?

(a) 9/25
(b) 25/9
(c) 5/3
(d) 15/15



7. A large, 2.0 m diameter, wheel rolls from rest with an angular acceleration of 1.0 rad/s^2. After 1.0 s, what arc length has the wheel traveled?

(a) 0.78 rev
(b) 50 cm
(c) 0.50 rad
(d) 1.0 m

8. A block of mass, m, is pushed along the floor with velocity, v, slides a distance, d, after the pushing force is removed. What is the distance traveled if initial velocity of the block is $\sqrt{2}v$?

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

9. A 31.4 cm diameter pie plate rotates in uniform circular motion with an acceleration of 3.14 m/s^2. After 3.14 s, what is the angular speed of the plate?

(a) 4.47 rad/s
(b) 62.8 rad/s
(c) 3.16 rad/s
(d) 20 rad/s

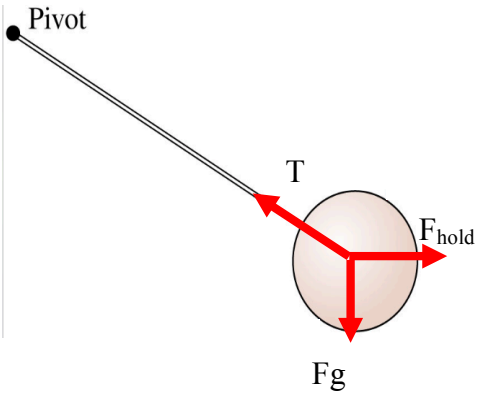
10. A heavy wooden block is pushed up a wooden ramp. After the push force is removed, how many forces are acting on the block?

(a) 5
(b) 2
(c) 3
(d) 4

11. A 2.5 mg mosquito at rest collides with a 4000 kg truck that is traveling at 30 m/s. The mosquito sticks to the windshield of the truck and is now traveling with the truck at 30 m/s. If the impact of the mosquito was 1.0 ms, what was the magnitude of the force on the truck from the mosquito?

(a) 0.075 kg m/s^2
(b) 0.0 N
(c) 1.2 x 10^8 N
(d) 7.5 x 10^4 N

12. A 2.0 kg mass is attached to a string and held in equilibrium with the horizontal force as shown. If the hold force is 10 N, what is the tension in the string?



(a) 12 kg m/s
(b) 30 N
(c) 22 N
(d) 5.5 kg m/s^2

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)

While writing this test, I was watching "The Hunger Games: Catching Fire". In the Quarter Quell arena, Katniss and company are on a small island in the middle of a lake that starts to spin from rest. The top speed of the island is one rotation every 3.0 seconds. Katniss is hanging near the edge of the island at 6.0 m from its axis of rotation and the island takes 15 s to reach top speed.

(a) During startup what is the angular acceleration of Katniss?

(b) How many revolutions does Katniss make during startup?

(c) During startup, does her tangential acceleration increase, decrease or staying the same. Be sure to include an equation and words in your answer. No calculations are necessary.

(d) What is the centripetal acceleration of the Katniss when she is at top speed? Be sure to explicitly state the direction of the acceleration.

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 18.0 N force applied to the 3.0 kg block.

(a) Calculate the net acceleration for the system.

(b) Determine the force (mag + dir) that the 2.0 kg block exerts on the 3.0 kg block. Be sure to state the direction in words.

(c) Determine the force (mag + dir) that the 2.0 kg block exerts on the 1.0 kg block. Be sure to state the direction in words.

(d) Rank the net force from largest to smallest on each block. No calculations are necessary but an explanation is using words, equations and theory.

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

Hannah was pulling her pet rabbit on a sled across a level bit of ground that was covered with snow using a rope at an angle above the ground. They were accelerating at +3.00 m/s^2. The mass of the rabbit and the sled was 50.0 kg. The rope pulled the sled with components of 100.0 N upward & 250.0 N to the right.

(a) What is the normal force acting upon the sled and rabbit?

(b) What is the friction force? Explicitly state what direction it is acting.

(c) What is the coefficient of friction between the sled and snow?

(d) If the sled stops and Hannah pulls again with the same forces, is it possible that the sled doesn't move? Explain with words why this could or could not be the case.

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

A robber is being lowered by a rope tied around his waste into a jewelry store. He slows from traveling with a speed of 2.0 m/s to rest in 1.0 seconds.

(a) Draw a force diagram showing the tension and force of gravity acting on the robber 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) What is the acceleration of the robber as he comes to rest?
Be sure to indicate the direction of the acceleration in words.

(c) If the tension in the rope is 1.2 kN as the robber slows, what is his mass?

(d) If the robber stops and hangs motionless above the floor, what is the tension in the cable?