General Physics
Physics 101
Test #2 – Fall 2013
Friday 10/25/13
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.

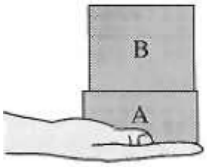
Signature:_____

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. Block A and B are 5.0 kg and 10.0 kg respectively. As shown, these blocks are lifted with a uniform acceleration of +2.0 m/s^2. What is the magnitude of the force of block A on block B?

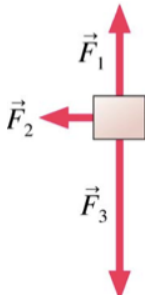
(a) 1.2 x 10^2 N
(b) 20 N
(c) 78 N
(d) 59 N

2. Suppose you push a hockey puck of mass *m* across frictionless ice for a time Δt starting from rest giving it a speed *v*. If you repeat the experiment with a puck of mass *2m*, and apply the same push force, how long will you have to push for the puck to reach the same speed v?

(a) $2\,\Delta t$
(b) Same Δt
(c) $\frac{1}{2}\,\Delta t$
(d) $\sqrt{2}\,\Delta t$

3. The Earth revolves around the Sun in 365 days in a nearly circular orbit with a radius of 1.50 x 10^{11} m. Assuming that the Earth orbital motion is a uniform circular motion, what is the Earth's acceleration as it "falls" towards the Sun?

(a) 1.99 x 10^{-7} m/s^2
(b) 0.006 m/s^2
(c) 4.44 x 10^8 m/s^2
(d) 5.95 x 10^{-3} m/s^2



4. Three forces are acting on an object as shown.
In what general direction does the net force point?

(a) North-West
(b) South-West
(c) Due West
(d) The net force is zero

5. Which of the following statements is true?

(a) The force of gravity and the normal force are Newton 3rd law pairs.

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

(c) An object in uniform circular motion has a non-zero acceleration.

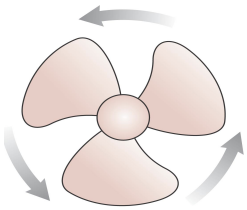
(d) A box that doesn't slide in the back of a stopping truck is in equilibrium.

6. 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. How big is the friction force on the truck?

(a) 34078 N
(b) 3.8×10^4 N
(c) 3.4×10^4 N
(d) 10 kN

7. A 3.0 cm diameter crankshaft that is rotating at 2500 rpm comes to a halt in 1.5 s. What is the magnitude of the tangential acceleration of a point on the surface?

(a) 1.7×10^2 m/s^2
(b) 25 rad/s^2
(c) 1.0×10^5 rad/s^2
(d) 2.6 m/s^2



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

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

9. Angry with physics you decide to punch a wall (not recommended), and your fist goes through the wall. In this situation, the magnitude of the force of the wall on your fist is _____ your fist on the wall.

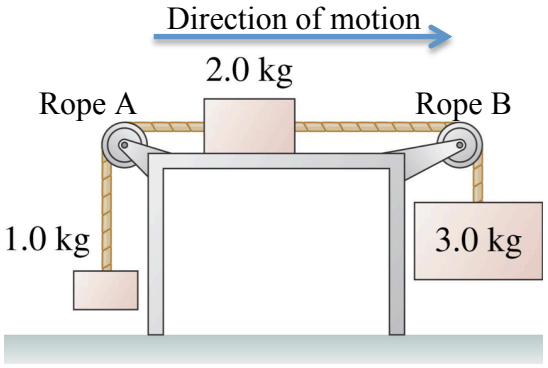
(a) greater than
(b) the same as
(c) less than
(d) impossible to tell

10. A car with rubber tires is braking on concrete and the wheels are locked (no rolling friction). The car is initially traveling at 12.5 m/s and comes to a halt over a distance of 10 m. What is the coefficient of friction between the rubber tires and the concrete road?

(a) 1.0 N
(b) 0.063
(c) 0.80
(d) 1.0

11. A wheel spins clockwise at 3.00 rad/s and experiences an angular acceleration of +1.00 rad/s^2. Through what angle did the wheel turn through after 2.0 seconds?

(a) -4.0 radians
(b) -8.0 radians
(c) 6.0 radians
(d) 8.0 radians



12. 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) $\sum F_3 = m_3 a = F_{3g} - T_B$

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 Sharknado, a tornado filled with sharks, is spinning in the middle of campus and has many sharks at different radii from the center of the tornado. This is *Sharknado* II: *Electric Boogaloo*, if you will.

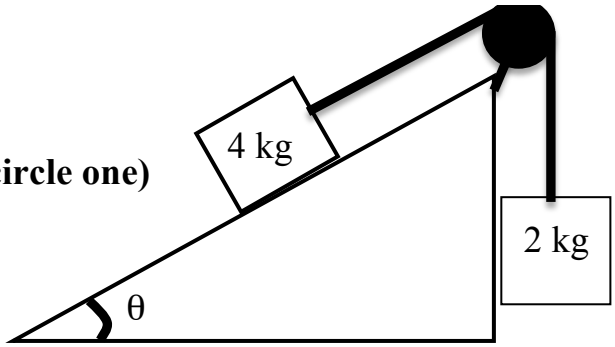
(a) A shark is rotating 10 m away from the center of the Sharknado, with a centripetal acceleration of 90 m/s^2. What is the angular velocity of the shark?

(b) How does the tangential speed of the shark rotating 10 m away from the center of the Sharknado compare to a shark that is at a smaller distance away from the center? Is it bigger, smaller or the same? No calculations are necessary, but words and equations are necessary in your explanation.

(c) The Sharknado begins to spin faster and faster and makes 10 revolutions and achieves an angular velocity that is twice as big as in (a). What is the angular acceleration of the Sharknado?

(d) How long did it take the Sharknado to double its angular velocity?

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



A 4.0 kg box is on a frictionless 20º slope and is connected via a massless string over a massless, frictionless pulley to a hanging 2.0 kg weight.

(a) What is the tension in the string if the 4.0 kg mass is held in place?

(b) What is the magnitude of the hold force?

(c) If you release the 4.0 kg box, what is the magnitude of the acceleration of the system?

(d) Does the block slide up or down the ramp? Justify your answer using words explaining how you know this is the case physically. No new calculations are required.

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

Joe is sliding a 50.0 kg box across a waxed floor and the box is moving with a constant velocity. Joe is pushing with +100 N of force in the horizontal direction, and an unknown amount of force in the vertical direction (could be up or down). The coefficient of kinetic friction between the floor and box is 0.150.

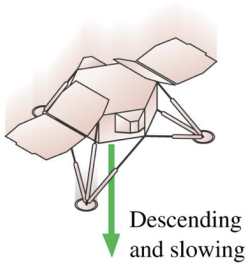
(a) Determine the magnitude and direction of the friction force acting on the box.

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

(c) Calculate the magnitude and direction of the push force of Joe in the vertical direction.

(d) Joe stops and then tries to push again with the same force. Unfortunately the box 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.

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



A 50 kg Martian lander is approaching the surface. It is slowing its descent by firing its rocket motor, which exerts an upward thrust force of 238 N in magnitude on the lander. Ignore "air" resistance.

(a) If the lander's initial velocity is 65.0 m/s downward, and it takes 1.0 minute to slow the lander to 5.0 m/s, what is the acceleration of the lander? Be sure to explicitly state a direction for the acceleration.

(b) Draw a force diagram showing the thrust force and force of gravity acting on the lander 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.

(c) What is the magnitude of the acceleration due to Martian gravity?

(d) As the lander lands it is traveling 5.0 m/s downward when it comes in contact with the Martian surface. If the net force it experiences is 500 N upwards from the Martian surface, what is the acceleration of the lander as it comes to rest?