General Physics
Physics 101
Test #2 – Fall 2021
Wednesday 10/13/21
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.

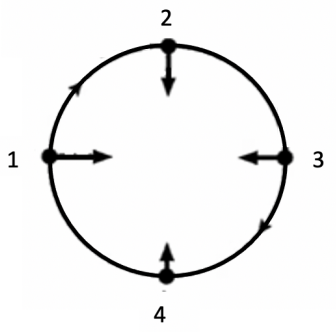
Signature:_____

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:

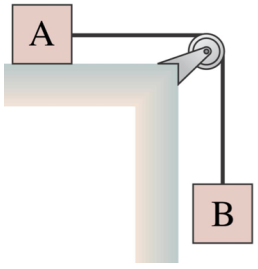


1. The following figure shows the radial acceleration vector at four successive points on the trajectory of a particle rotating clockwise. What is the sign of the angular acceleration?

(a) Postive
(b) Zero
(c) Negative
(d) Imposible to determine

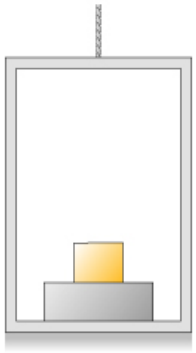
2. A video on the tick-tock shows a 2000 kg truck parked on a 30º hill that when the door is slammed shut, the truck begins to slide down the hill. If it is "so obvious" that the coefficient of kinetic friction is 0.10, what is the net force applied to the truck as it slides down the hill?

(a) 11497 N
(b) 9.8×10^3 N
(c) 8.1 kN
(d) 7.8×10^3 kg m/s^2



3. Two blocks $m_A = 3.0$ kg and $m_B = 2.0$ kg are released from rest. Block A rests on a frictionless table-top, the string is massless and equally stretched, and the massless pulley has no friction. What is the net acceleration for the system?

(a) 6.5 m/s^2
(b) 3.9 m/s^2
(c) 5.9 m/s^2
(d) 9.8 m/s



4. A block sits on a scale on the floor of an elevator. The elevator is moving downward at an increasing speed. The magnitude of reading of the scale is _____ the magnitude of the force of the earth on the block.

(a) less than
(b) equal to
(c) greater than
(d) unknown compared to

5. The Moon revolves around the Earth in 27.3 days in a nearly circular orbit with a radius of 3.8×10^5 km. Assuming that the Moon's orbital motion is a uniform circular motion, what is the Moon's acceleration as it "falls" towards the Earth?

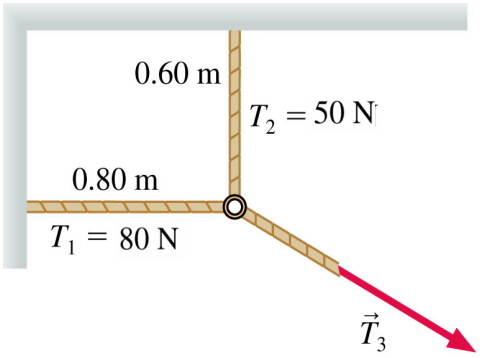
(a) 2.7 m/s^2
(b) 1.0 m/s^2
(c) 2.7×10^{-3} m/s^2
(d) 1.0×10^3 m/s^2

6. 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 4d before stopping?

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

7. 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) 1.0
(d) 0.80



8. The three ropes shown are tied to a very light ring. Two of these ropes are anchored to the walls at right angles with the tensions shown. What is the angle that the third rope pulls with?

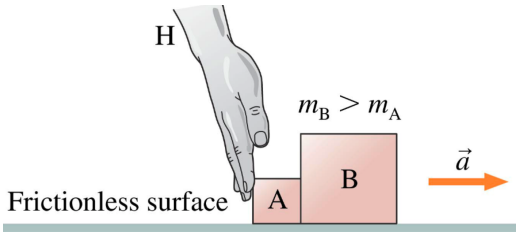
(a) 58° below the horizontal
(b) 37° below the horizontal
(c) 53° below the horizontal
(d) 32° below the horizontal

9. Biff (75 kg) and Jesup (150 kg) are wrestling on an icy pond, which we can assume to be friction free. They are at a standstill and Biff unexpectedly pushes Jesup with a force of 1.5 kN. If the push takes 0.10 second, what is the magnitude of the acceleration of Biff?

(a) 10 m/s^2
(b) 20 m/s^2
(c) 0.0 m/s^2
(d) Need more information

10. A block floats on a cushion of air. It is pushed to the right with a force that remains constant as the block moves from 0 to 1 and from 1 to 2 the size of the force steadily decreases until it reaches half of its initial value. For the block which of the following is true?

(a) Slows down from 1 to 2
(b) Moves at a constant speed from 0 to 1
(c) Speeds up from 1 to 2
(d) From 0 to 1, speeds up at first and then has a constant speed



11. 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 force (mag & dir) of mass B on mass A.

(a) 15.0 N
(b) -10.0 N
(c) – 5.00 N
(d) +5.00 N

12. A fan experiences a counter-clockwise angular acceleration of 2.0 rad/s^2 for 2.0 s. If it is initially rotating with a clockwise angular velocity of 6.0 rad/s, what is the final angular velocity of the fan?

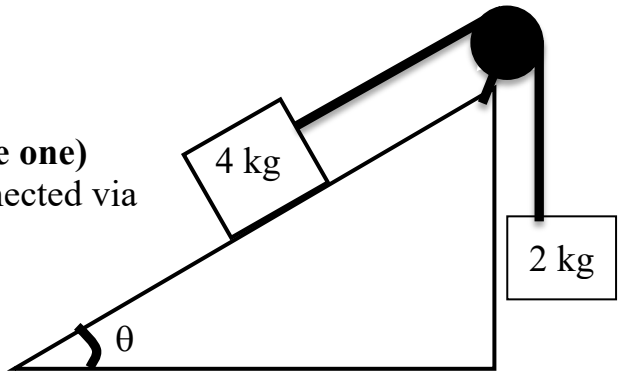
(a) 4.0 rad/s
(b) -10.0 rad/s
(c) -4.0 rad/s
(d) -2.0 rad/s

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

(a) If you hold the 2 kg mass, what is the tension in the string?

The block is released from rest, allowing the system to accelerate.
(b) What is the magnitude of the acceleration of the 4 kg block?

(c) Explain what direction the 4 kg block is sliding. You must use words and theory in your justification.

(d) What is the tension in the string while the block is accelerating?

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

Your 64 cm diameter car tire is rotating at 20 rad/s when suddenly you press down on the accelerator. After traveling 200 m, the tire's rotation has increased to 35 rad/s.
(a) How many revolutions has the tire made during this acceleration?

(b) What was the tire's angular acceleration?

(c) How long does this take?

(d) During this motion, explain whether (or not) all points on the wheel are undergoing uniform circular motion? Words and theory are necessary in your justification.

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

Biff is pushing an 82 kg crate across a level barn floor and the crate is accelerating at +1.00 m/s^2. He is pushing the crate with 200.0 N downward & 250.0 N to the right.

(a) What is the normal force acting upon the crate?

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

(c) What is the coefficient of friction between the crate and floor?

(d) If the crate stops and Biff pushes again with the same forces, is it possible that the crate 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)

In your quest of cow-tertainment™, you have designed a cow catcher, that allows them to jump from a high height and land without injury. The first cow jumps and has a vertical velocity of -10 m/s initially and it slows for 2.0 seconds over a 2.0 m distance. You do not know the final velocity.

(a) Draw a force diagram showing the force from the cow catcher and the force of gravity acting on the cow 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 cow during its descent?

(c) If the catch force was measured to be 7.5 kN, what is the mass of the cow?

(d) As the cow jumps out of the machine (as only cows can). It experiences a force of 1.0×10^4 N upward, which causes the cow to come to rest in 20 ms. What acceleration does the cow experience during this force?