# General Physics
# Physics 101
# Test #2 – Fall 2019
# Wednesday 10/9/19
# 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.

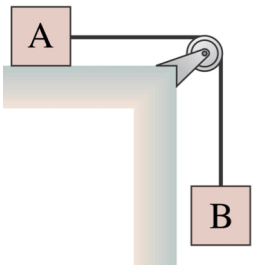
Signature:_____

# 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. 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 acceleration of the system?

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

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$^2$

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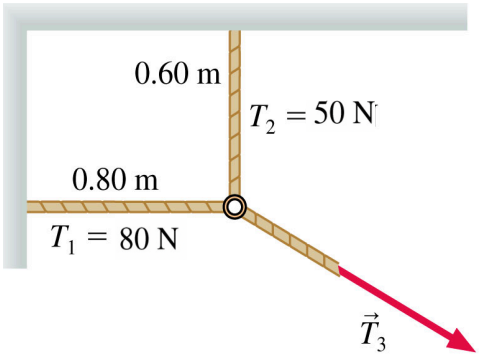
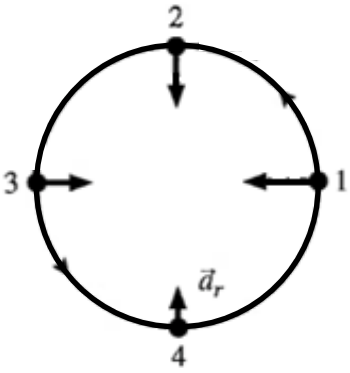
3. A block pushed along the floor with velocity, *v*, slides a distance, d, after the pushing force is removed. What initial velocity is necessary, if you want the block to travel a distance of 4d before stopping?

(a) $2v$
(b) $4v$
(c) $8v$
(d) $\sqrt{2}v$



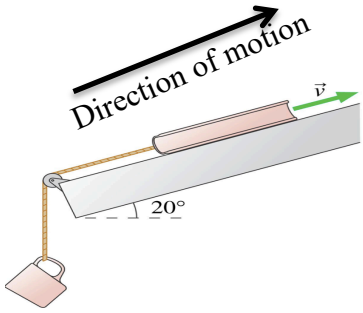

4. The three ropes shown are tied to a very light ring. Two of these ropes are anchored to the walls at right angles with the tensions shown. What is the angle that the third rope pulls with?

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




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

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




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

7. 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) $7.5 \times 10^4$ N
(b) 0.0 N
(c) $1.2 \times 10^8$ N
(d) 0.075 kg m/s$^2$

8. You push a 10 kg box across a slippery surface by applying a 5.0 N force, which is parallel to the surface. This force causes the box to move across the surface with a constant velocity. What is the coefficient of kinetic friction between the surface and the box?

(a) $\mu_k = 0.50$
(b) $\mu_k = 0.051$
(c) $\mu_k = 19.6$ N
(d) $\mu_k = 0.040$

9. A cylinder rotates with a constant angular speed of 60 rpm. Through what angle does the cylinder turn through in 60 seconds?

(a) 360 radians
(b) 60 revolutions
(c) 376.9 radians
(d) 592 revolutions

10. Which of the following statements is true?

(a) Friction always points in the opposite direction of motion

(b) In uniform circular motion, there is no acceleration.

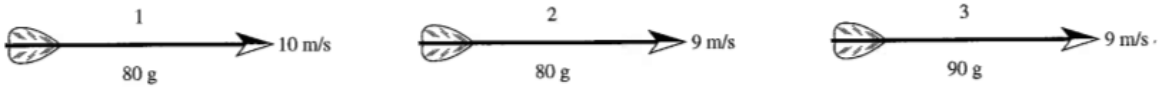
(c) A block sliding down a ramp with friction has 4 forces acting on it.

(d) A box in your car that doesn't slide when you stop is not in equilibrium

11. A 50.0 kg person stands on a scale in an elevator which is traveling vertically at 2.50 m/s and slowing at 5.00 m/s$^2$. What is the reading on the scale during this motion?

(a) 490 N
(b) 740 N
(c) 240 N
(d) 2.5 x $10^2$ N

12. Three arrows are shot horizontally. They have left the bow and are initially traveling parallel to the ground. Air resistance is negligible. List from largest to smallest the magnitudes of the horizontal force acting on each arrow.




(a) 3>1=2
(b) 3>1>2
(c) 1<2<3
(d) 1=2=3

# 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)**

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 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). Please identify the NIII law action/reaction pairs.

(b) If the force of the 3.0 kg block on the 2.0 kg block is -9.0 N, what is the acceleration of the system?

(c) Determine the push force acting on the 1.0 kg block.

(d) Determine the force (mag + dir) that the 2.0 kg block exerts on the 1.0 kg block. Please state the direction in words.

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

A 2.0 kg block is sliding down a ramp from rest that has an angle of 20.0º with respect to the horizontal. The block experiences an acceleration of 2.0 m/s$^2$ down the ramp.

(a) What is the magnitude of the normal force acting on the block?

(b) What is the magnitude and direction of the friction force acting on the system?

(c) What is the coefficient of friction between the block and ramp?

(d) If the block is slid back up the ramp, explain whether the magnitude of the net force on the block has increases, decreases or stays the same? Words and possibly a force diagram or a sum of all forces are required in your justification.

**Question 3.** **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 constantly accelerates tangentially at 1.0 $m/s^2$ for 10 s, starting from rest.

(a) During this acceleration the rocket's tangential speed increases. Explain whether the angular acceleration of the rocket increases, decreases or stays the same. Words and possibly equation(s) are necessary in your justification; calculations are not.

(b) What is the angular speed of the rocket after 2.0 seconds?

(c) What is the magnitude and direction of the centripetal acceleration of the rocket after 2.0 seconds?

(d) Through what angle in degrees has the rocket turned through after 2.0 seconds?

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

Mr. Scribbles, your pet gerbil, is on a mission to explore an unknown planet. His 50 kg spaceship is approaching the surface and is slowing its descent by firing its rocket motor, which exerts an upward thrust force of 500 N in magnitude on the ship. Ignore "air" resistance.

(a) Draw a force diagram showing the thrust force and force of gravity acting on the ship 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) The ship was initially traveling at 50 m/s downward and slows to 10 m/s downward, while descending 100 m, what is the acceleration of the ship?

(c) What is the magnitude of the acceleration due to gravity on this planet?

(d) As the lander lands contacts the surface of the planet, Mr. Scribbles (71 g) experiences a force of 100 N upward, which causes him to come to rest. What acceleration does Mr. Scribbles experience during the landing?