# General Physics
# Physics 101
# Test #2 – Spring 2020
# Wednesday 3/4/20
# 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:

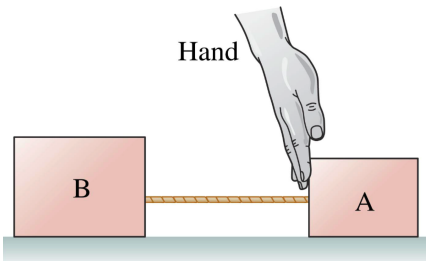
1. A fan experiences a counter-clockwise angular acceleration of 2.0 rad/s$^2$ for 2.0 s. If it is initially rotating with a clockwise angular velocity of 6.0 rad/s, what is the final angular velocity of the fan?

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

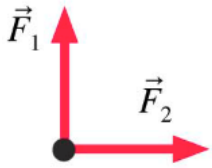
2. A 4000 kg truck is parked on a 15º slope and the coefficient of static friction between the tires and the road is 0.90. How big is the friction force on the truck?

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

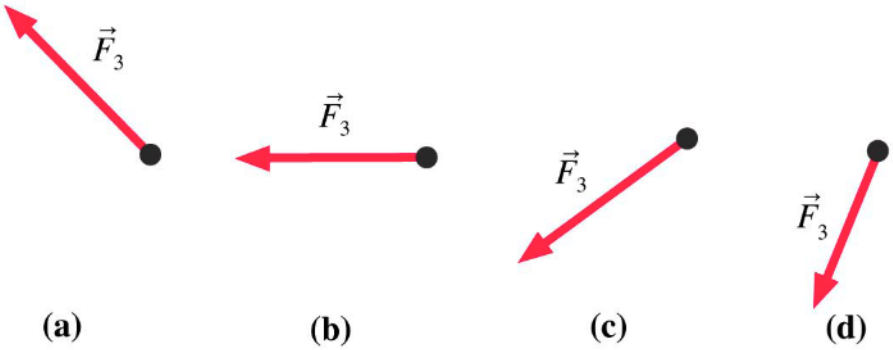
3. Block A and B, with masses 1 kg and 2 kg respectively, are connected via a massless string. If the hand exerts a 9 N force on block A, what is the force exerted on mass B by the string?




(a) 12 N
(b) 9 N
(c) 6 N
(d) 3 N




4. Two of three forces are shown. If the net force points to the right, which vector could represent the third force?




5. Which of the following statements is true?

(a) Two points on a rigid wheel undergoing an angular acceleration do not have the same angular velocity at a given time.

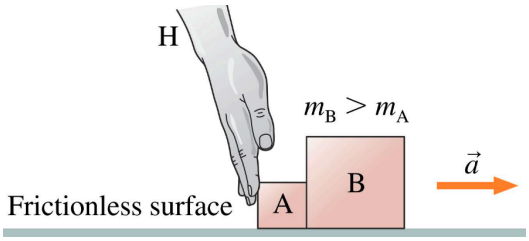
(b) In non-uniform circular motion the total acceleration points radially inward.

(c) To vertically lower an object on a string, you have to pull upward on the string.

(d) Friction can never point in the same direction as the motion.

6. You are pulling your friend on a sled across a level bit of ground that is covered with snow with a rope at an angle above the ground. You have been walking at a steady 1.50 m/s and the mass of your friend and the sled is 60.0 kg. The rope pulls the sled with components of 100.0 N upward and 50.0 N to the right. What is the normal force acting on the sled?

(a) 538 kg m/s
(b) 488 N
(c) 588 kg m/s$^2$
(d) 688 N




7. Two blocks with masses $m_A$=5.0 kg and $m_B$=10.0 kg are pushed on a frictionless surface. If the force of A on B is 20 N, what the acceleration of the system?

(a) 2.0 m/s$^2$
(b) 4.0 m/s$^2$
(c) 1.3 m/s$^2$
(d) Not possible to determine with the information given.

8. The 40 cm diameter wheels on your car makes 40 revolutions as it rolls with constant velocity along the tarmac over 60 seconds. How far did the car travel?

(a) 15 km
(b) 0.10 km
(c) 50 m
(d) 2.4 x 10$^3$ m

9. A ball on a string spins with a constant angular speed with centripetal acceleration at a radius. If the ball spins with half the centripetal acceleration and half the angular speed, the new radius of the system is

(a) Twice the original radius
(b) Half the original radius
(c) The same as the original radius
(d) One quarter the original radius

10. A rocket has a motor than can produce 3.0 x 10$^5$ N of thrust accelerates at $a_y$ = 5.2 m/s$^2$. Ignoring air resistance, what is the mass of the rocket?

(a) 57692 kg
(b) 2.0 x 10$^4$ kg
(c) 6.5 x 10$^4$ kg
(d) 5.8 x 10$^4$ kg

11. 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 Jesup unexpectedly pushes Biff with a force of 1.5 kN. If the push takes 100 ms, what is the speed of Jesup post push?

(a) 1.0 m/s
(b) 2.0 m/s
(c) 0.0 m/s
(d) Need more information

12. A block is sliding up and down a ramp and there is friction.
When is the net force parallel to the ramp the greatest?

(a) The net force is the same throughout the motion.

(b) When sliding up the ramp

(c) At the turn-around point

(d) When sliding down the ramp

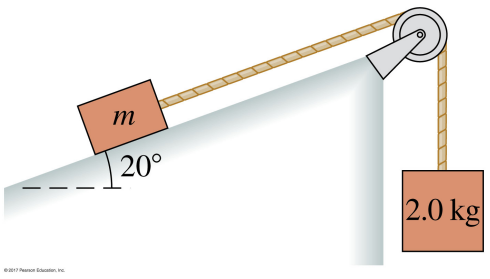
# Part II. Short answer problems (12 pts each)

## 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 "m" 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 2.0 kg mass is held in place?

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

(c) If you release the 2.0 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 2. Grade this problem? Yes or No (circle one)**

A large 1.5 kg book is pushed horizontally into a wall with a force of +40 N. The book is slipping down the wall with an acceleration of -1.0 $m/s^2$.

(a) What is the normal force acting on the book?
Explicitly state a direction for the force.

(b) What is the friction force on the book?
Explicitly state a direction for the force.

(c) What is the coefficient of friction between the book and wall?

(d) For a moment you are able to stop the book and you again apply the same 40N push force but the book does not move. Please explain why this is the case physically.

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

A 5.0 m diameter merry-go-round is initially turning CCW with a period of 4.0 seconds. A child sits on the edge/rim of the merry-go-round during this motion – because that's what kids do.

(a) What centripetal acceleration does the child experience at the beginning of the motion? Be sure to state a magnitude and direction.

(b) If a second child was sitting closer to the center of merry-go-round, how do the two children's angular velocities compare? Explain using words and possibly equations.

The merry-go-round slows uniformly and stops in 20s

(c) What is the angular acceleration of the merry-go-round as it slows?

(d) How many revolutions does the merry-go-round make as it stops?

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

A 50 kg box hangs from a rope and is being lowered with a speed of 5.0 m/s that is slowing to 2.5 m/s over a distance of 2.0 m.

(a) Determine the acceleration of the box as it slows.

(b) Draw a force diagram showing the tension and force of gravity acting on the box 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 tension in the rope as the box slows?

(d) The rope breaks and the box hits the ground traveling at 2.0 m/s. If the net force it experiences is 200 N upwards from the floor, what is the acceleration of the box as it comes to rest?