

General Physics
Physics 101
Test #2 – Fall 2016
Friday 10/21/16
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:

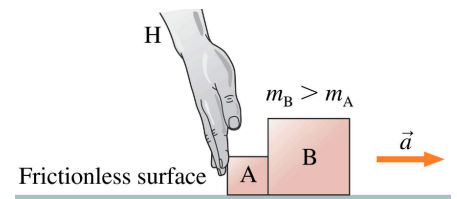
1. A space station is constructed as a rotating cylinder that rotates about its axis. The space station spins up for 300 seconds from rest to create artificial gravity with the outer deck of the space station rotates at 70 m/s, with a rotational period of 45 s. What is the radial distance from the axis of rotation to the outer deck?

- (a) 4.9 km
- (b) 5.0×10^2 m
- (c) 3.3 km
- (d) 1.0×10^3 m

2. A 200 g wooden block is set on a wooden ramp that has an angle of 20.0° with respect to the horizontal. What is the magnitude of the friction force?

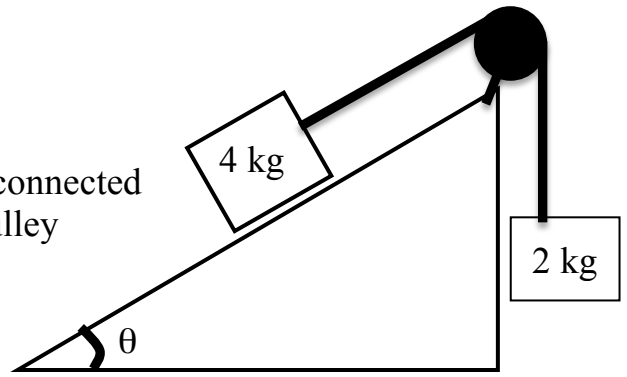
- (a) 0.921 N
- (b) 0.670 kg m/s^2
- (c) 1.84 N
- (d) 0.368 kg m/s

3. 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 net force (mag & dir) acting on mass A.



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

4. A 4.0 kg box is on a frictionless 30° ramp and is connected via a massless string over a massless, frictionless pulley to a hanging 2.0 kg mass. If you gently release the box, which way will it move on the ramp?

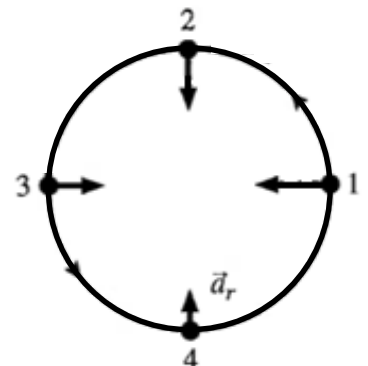


- (a) Up the ramp
- (b) Down the ramp.
- (c) It will not move.
- (d) Need more information

5. Which of the following statements is false?

- (a) Friction does not always point in the opposite direction of motion.
- (b) A decreasing + force on a + velocity causes the speed to decrease.
- (c) An object in uniform circular motion has non-zero acceleration.
- (d) The force of gravity and the normal force are not Newton 3rd law pairs.

6. 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) Positive
- (b) Zero
- (c) Negative
- (d) Impossible to determine

7. A 50 g mass attached to a string is lowered from rest by pulling upward on the string. If it takes 50 ms to travel 1.0 m, what is the net force on the mass?

- (a) -40 N
- (b) -0.080 kN
- (c) 0.49 N
- (d) 4.0×10^1 N

8. You spin a 1.0 kg ball on the end of a 1.0 m long string from rest with an angular acceleration of 1.0 rad/s^2 . What arc length has the ball traveled after the ball has traveled for 1.0 second?

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

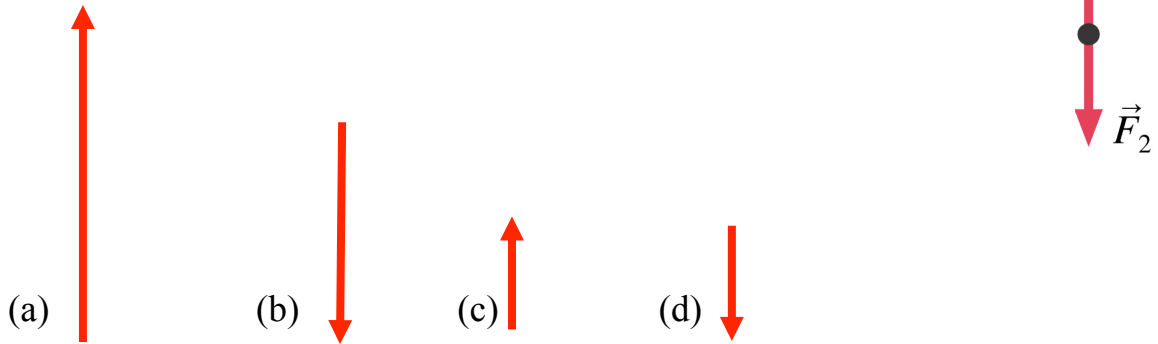
9. A block of mass m is pushed along the floor with velocity, v and slides a distance, d , after the pushing force is removed. What mass with the same initial velocity would slide a distance of $2d$ before stopping with the same surfaces in contact?

- (a) $2m$
- (b) $\frac{1}{2} m$
- (c) $m\sqrt{2}$
- (d) no mass would achieve this

10. A crankshaft that is rotating at 2500 rpm (261.8 rad/s) comes to a halt in 1.50 s via an angular acceleration of -174.5 rad/s^2 . What angle did it turn through as it came to rest?

- (a) 196 rad
- (b) 589 revolutions
- (c) 392 radians
- (d) 0.75 degrees

11. Two of three forces acting on an object are shown. If the object is in dynamic equilibrium, which vector could represent the third force?



12. In a thought experiment (do not attempt), you throw your physics book through the window. If the book is relatively unscathed, while the window is broken, who had the larger force acting on it during the collision?

- (a) The window
- (b) The book
- (c) They are the same
- (d) Need more information

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)

Last winter, a friend was pulling his pet Saint Bernard 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 1.5 m/s^2 . The mass of the dog and the sled was 100.0 kg .

The rope pulled the sled with components of 100.0 N upward & 250.0 N to the right.

(a) Sketch a free body diagram showing the forces on the sled.

Be sure to label all forces and include net force.

(b) Determine the magnitude of the friction force acting on the sled.

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

(d) Calculate the coefficient of kinetic friction between the sled and the snow.

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

An LP record has a diameter of 30 cm. It starts from rest and achieves $33 \frac{1}{3}$ rpm in by making 3.0 revolutions counter-clockwise. A white dot is painted on the edge.

(a) What is the angular acceleration of the dot?

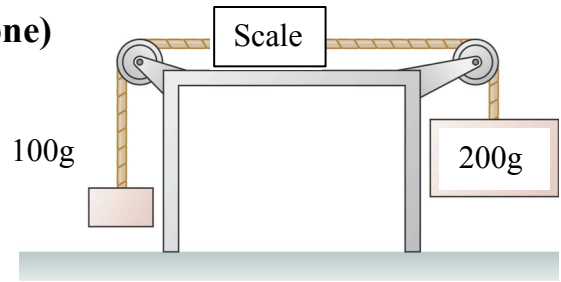
(b) How long does it take to start-up?

(c) What is the centripetal acceleration of the dot of paint when the record is at top speed? Be sure to explicitly state the direction of the acceleration.

(d) A scratch is located at 7.5 cm from the center of the record. When the record is at top speed, what is the ratio of the tangential speed of the dot to the scratch? Please explain your answer with words and equations.

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

In class, I brought in a 100g mass and 200g mass, suspended by pulleys, which had a scale in between to read tension. We will assume the pulley is massless and friction free, the scale has negligible mass, and the string is massless and equally stretched.



- (a) What is the acceleration on the system when the masses are released?
- (b) What is the reading on the scale in Newtons while the system is accelerating?
- (c) For the system, explain which block has the larger acceleration AND net force. Be sure to justify your answer with equations and/or words (no numerical answers required).
- (d) What is the reading on the scale in Newtons if I hold the 200 g mass?

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

A steel girder is raised into place and is slowing down to rest over a distance of 2.0 m from a velocity of 2.0 m/s.

(a) Draw a force diagram showing the tension and force of gravity acting on the girder 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 girder?

(c) If the tension in the cable is 20 kN as the girder slows, what is the mass of the girder?

(d) Without breaking the cable, is it ever possible for the tension in the cable to be zero? No calculations are necessary, but a sum of all forces statement and words are required in your answer and explanation.