

General Physics
Physics 101
Test #2 – Fall 2014
Friday 10/24/14
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: _____

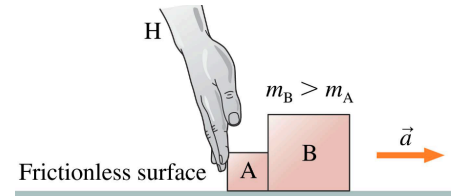
Part I. Multiple Choice (3 pts each)

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 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.

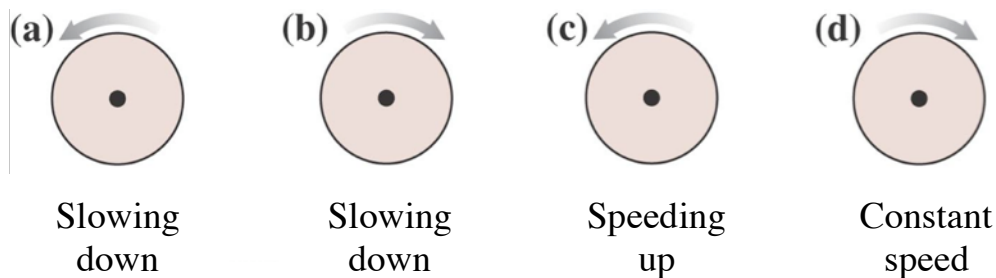


- (a) 15.0 N
- (b) -10.0 N
- (c) - 5.00 N
- (d) +5.00 N

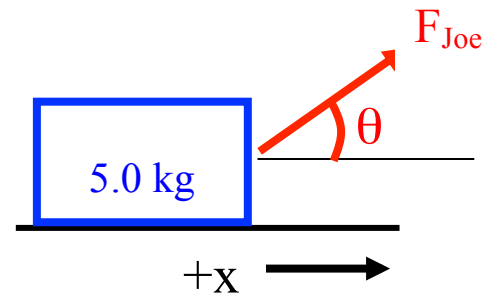
2. A constant force applied to A causes A to accelerate at 5 m/s^2 . The same force applied to B causes B to accelerate at 3 m/s^2 . What is the ratio of m_A / m_B of the masses of A to the mass of B?

- (a) 5/3
- (b) 3/5
- (c) 15/1
- (d) 1/15

3. Which of the following has a negative angular acceleration?

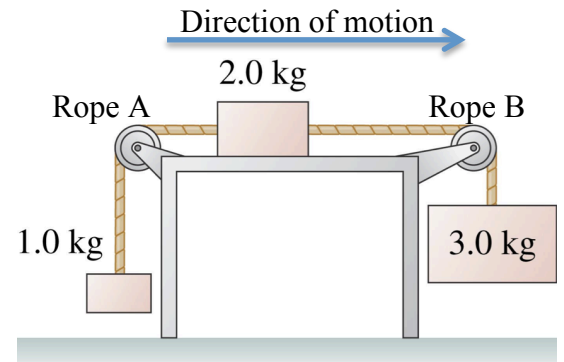


4. Joe is sliding a 5.0 kg box across the floor and the box is moving with a constant velocity. Joe is pulling with a force with components of 15N in the y-direction and 26 N in the x-direction. What is coefficient of kinetic friction?



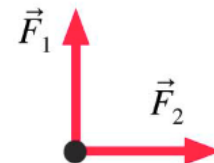
- (a) $\mu_k = 0.31$
- (b) $\mu_k = 0.76$
- (c) $\mu_s = 0.53$
- (d) $\mu_k = 0.44$ N

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

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



- (a)
- (b)
- (c)
- (d)

7. A 3.0 cm diameter drill rotates from rest to an operational angular speed of 1000 rad/s, while it experiences an angular acceleration of 100.0 rad/s^2 . What is the total angular distance traveled by the drill during this process?

- (a) $5.0 \times 10^3 \text{ rad}$
- (b) 5.0 rad
- (c) $1.5 \times 10^4 \text{ rad}$
- (d) 5000 rad

8. 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 $2d$ before stopping?

- (a) $2v$
- (b) $4v$
- (c) $\frac{1}{4}v$
- (d) $\sqrt{2}v$

9. You are holding a 5.0 kg block in your hand and are moving it vertically while applying an upward force of 75 N. What is the net acceleration of the block?

- (a) 5.2 m/s^2
- (b) 9.8 m/s^2
- (c) 25 m/s^2
- (d) 15 m/s^2

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

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

11. John (50 kg) is stuck on an oil slicked floor (assumed to be frictionless), and his only option is to throw his 1.0 kg back-pack to try and help him leave the middle of the room. If he throws the backpack from rest with an acceleration of $+1.0 \text{ m/s}^2$ over a time of 0.50 s, what is John's acceleration during the throw?

- (a) -1.0 m/s^2
- (b) -0.020 m/s^2
- (c) 0.010 m/s^2
- (d) 0.50 m/s^2

12. A wooden block of 2.0 kg slides up a wooden ramp angled at 20° above the horizontal. As the block slides back down the ramp, what is the magnitude of the net force acting on the block? Please include friction.

- (a) 10 N
- (b) 2.5 N
- (c) 3.0 N
- (d) 16 N

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.

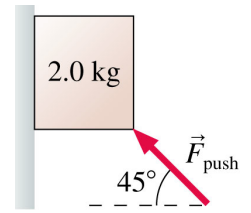
Please show all of your work, including equations without numbers.

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)

The 2.0 kg block shown slides down a vertical plaster wall at constant speed, while you push on it with 20 N at an angle of 45° as shown.



(a) Draw a force diagram for this situation, identifying all forces acting on the object. Also identify the net force.

(b) Calculate the magnitude of the normal force.

(c) Calculate the magnitude of the friction force.

(d) Calculate the coefficient of friction and explicitly state whether it is static or kinetic.

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

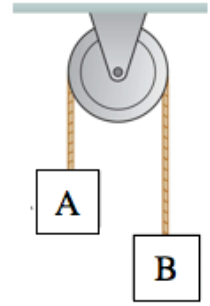
A boy jumps onto a small merry-go-round (m.g.r.) that has a diameter of 4.00 m and spins counter-clockwise in circles for 20s before coming to rest. He lands (and stays) at a distance of 1.75 m from the central axis of rotation of the m.g.r., and initially the angular velocity of the boy/m.g.r. system is 2.00 rad/s.

(a) What was the angular acceleration of the boy/m.g.r. system?

(b) What angle did he travel during his journey?

(c) Explain what happens to the boy's centripetal acceleration as he goes through his journey. Use theory and/or equations along with words in your answer.

(d) What arc length did the outer-edge of the m.g.r. travel during the motion?



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

If we had lab exams, I'd make you do an Atwood's machine experiment on your own. As we do not, we'll look at the following system where mass B is known to be 10.0 kg. When you release the system, mass B falls to the floor 1.5 m away in 1.5 seconds.

(a) What is the acceleration of mass B as it travels towards the floor?

(b) What is the tension in the string (assumed to be massless and evenly stretched)

(c) What is the mass of "A"?

(d) As mass B comes crashing to the floor, it makes a horrible dent in the floor, but has no noticeable damage on it from the impact. In this case, is the magnitude of the force from the floor on the mass greater than, equal to or smaller than the force from the mass on the floor? Explain/Justify.

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

An elevator has a long steel cable attached to its top and the other end of the cable is attached to a motor. It takes the elevator 1.0 second to reach its operational speed of 2.0 m/s from rest.

(a) If the elevator has a mass of 1,000 kg, what is the tension in the cable holding the elevator when it is at rest?

(b) What is the acceleration of the elevator if it is moving downward?

(c) What is the tension in the cable holding the elevator when it is accelerating downward?

If (hypothetically) the cable on the elevator would release from its motor the elevator and cable would experience free fall. Let's hope this is left as a thought exercise.

(d) What is the tension in the cable? Use words and possibly equations in your answer.