General Physics
Physics 101
Test #2 – Spring 2013
Friday 3/8/13
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:

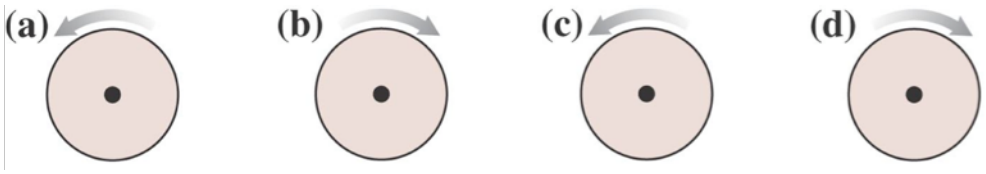
1. An explosion occurs and an object is split into two pieces one that has a larger mass than the other. During the explosion which block experiences a bigger magnitude of acceleration?

(a) They experience the same magnitude.
(b) The larger piece.
(c) The smaller piece.
(d) Need more information.

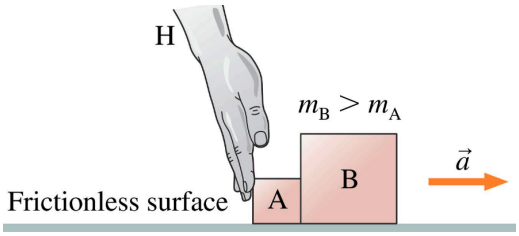
2. You push a 10 kg box across a room by applying a 5.0 N force, which is parallel to the floor. This force causes the box to move across the room with a constant velocity. What is the coefficient of kinetic friction between the floor and the box? Draw a picture if it helps.

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

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



(a) Slowing down
(b) Slowing down
(c) Speeding up
(d) Constant speed



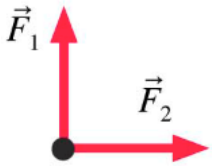
4. Two blocks with masses m_A=5.00 kg and m_B = 10.0 kg are pushed on a frictionless surface with a force of 15.0 N as shown. Determine the force (mag & dir) of mass B on mass A.

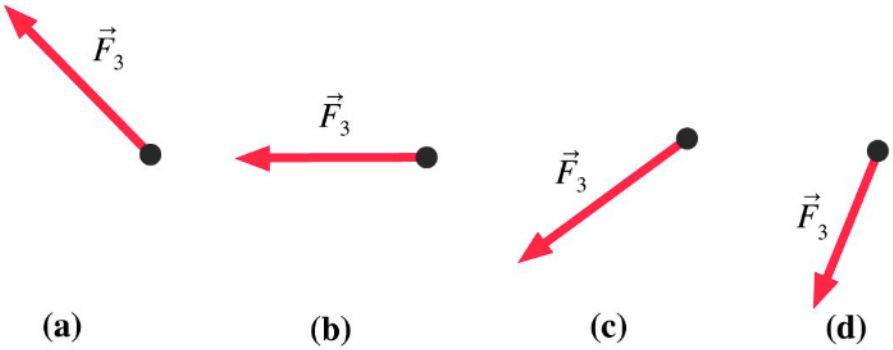
(a) 15.0 N
(b) -10.0 N
(c) – 5.00 N
(d) +5.00 N

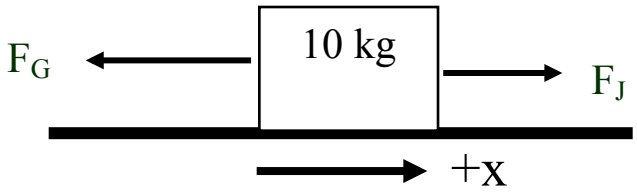
5. A wheel is rotating with a clockwise angular velocity of 6.0 rad/s, it experiences a counter-clockwise angular acceleration of 2.0 rad/s^2 for 2.0 s. What is the final angular velocity of the wheel?

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

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







7. George and Jill are getting a divorce and are fighting over a 10 kg trunk (as shown). George "knows everything", so he is pulling with a force of 5.0 N magnitude, and knows the trunk is accelerating at +1.0 m/s^2. What force must Jill be pulling with for this to be the case? Pretend friction doesn't exist.

(a) 10 N
(b) 15 N
(c) 5.0 N
(d) -10 N

8. A wooden block of 2.0 kg slides up a wooden ramp angled at 20º 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.

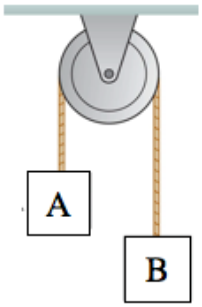
(a) 10 N
(b) 2.5 N
(c) 3.0 N
(d) 16 N

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

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

10. 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) $\sqrt{2}v$



11. You brought your Atwood's machine with you to planet X, and measure an acceleration for the system of 6.0 m/s^2. What is the acceleration due to gravity on Planet X? m_A = 2.0 kg and m_B = 4.0 kg

(a) 18 m/s^2
(b) 12 m/s^2
(c) 2.0 m/s^2
(d) 36 m/s^2

12. An object is held in place by friction on an inclined surface. The angle of incline is increased until the object starts moving. If the surface is kept at the angle, the object

(a) slows down.
(b) moves at uniform speed.
(c) speeds up.
(d) none of the above

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)**

Astronauts use a centrifuge to simulate the acceleration of a rocket launch. The centrifuge has a top speed of one rotation every 1.3 seconds in the counter-clockwise direction and the astronaut is strapped into a seat 6.0 m from the axis of rotation.

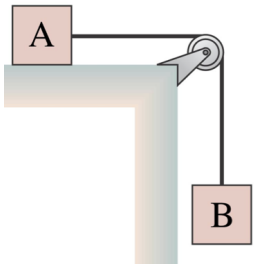
(a) When at top speed, explain whether the astronaut's tangential acceleration is +, - or zero. Be sure to justify your answer with words and possibly equations.

(b) What is the centripetal acceleration of the astronaut when she is at top speed? Be sure to explicitly state the direction of the acceleration.

(c) To stop the centrifuge takes 30 seconds. What angular acceleration does the astronaut experience during the stopping motion?

(d) Through what angle does the astronaut turn through as she comes to rest?

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



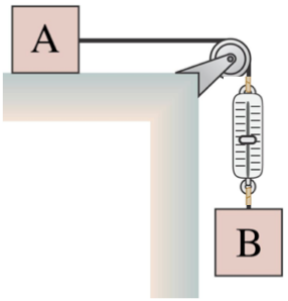
Two blocks $m_A = 3.0$ kg and $m_B = 2.0$ kg are released from rest. Block A rests on a frictionless table-top, the string is massless and equally stretched, and the massless pulley has no friction.

(a) Calculate the net acceleration for the system.

(b) Calculate the tension in the string.

(c) Using a photo-gate you measure the velocity of block A to be 0.50 m/s, 100 ms after this measurement, how fast is the block moving?

(d) You reset the system, and install a spring scale that reads in kg. What is the reading on the scale, if you hold block A to keep the system in static equilibrium. Be sure to justify your answer with words and possibly an equation. No calculations are required.



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

You press your 1.0 kg physics book against a vertical wall with a force that has components of $(10.0N\hat{i} + 2.5N\hat{j})$. You press just hard enough that the book is motionless. You may not ignore friction.

(a) Draw a force diagram showing all forces acting on the picture.
Be sure to include/state the net force and label each force appropriately.

(b) What is the magnitude and direction of the friction force acting between the book and the wall? An equation showing the sum of all forces is required with your numerical answer.

(c) What is the normal force (mag + dir) between the book and the wall?

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

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

To fulfill his dream of being an astronaut, we bought our pet gerbil, "Mr Scribbles", a toy rocket and allowed him to go to space (total mass of Mr. Scribbles and the rocket is 2.5 kg). The engine on the rocket, when fired exerts a constant thrust on the rocket. It takes the rocket and Mr. Scribbles 2.5 seconds to travel 20 m vertically above the launch point. Note: Mr. Scribbles was not hurt in this experiment.

(a) What is the net acceleration of the system while the rocket is fired?

(b) Determine the thrust force from the rocket?

(c) If Mr. Scribbles has a mass of 500 g, what net force does he experience while the rocket is fired?

(d) The rocket runs out of fuel, and it continues to travel upwards. Explain whether the normal force experienced by Mr. Scribbles is greater than or less than the force of gravity acting upon him. Please explain your answer with words and possibly a diagram.