General Physics
Physics 101
Test #2 – Spring 2022
Friday 3/2/22
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.

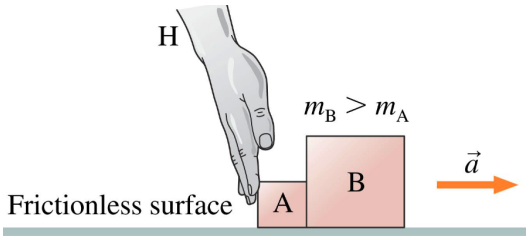
Signature:_____

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:



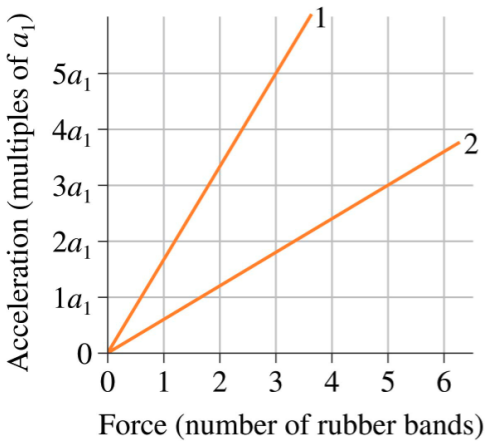
1. Two blocks with masses m_A=5.0 kg and m_B=10.0 kg are pushed on a frictionless surface. If the force of A on B is 20 N, what the acceleration of the system?

(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.

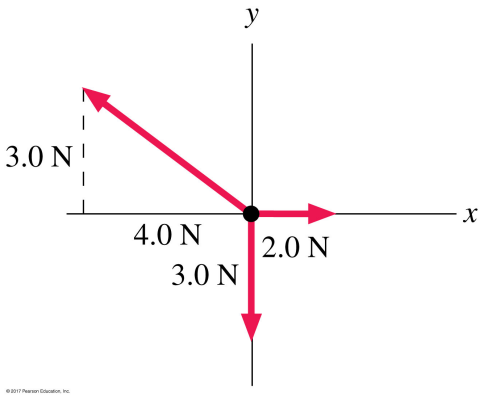
2. A wheel is rotating with a clockwise angular velocity of 6.0 rad/s, it experiences a counter-clockwise angular acceleration of 2.0 rad/s^2 for 2.0 s. What is the final angular velocity of the wheel?

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

3. The figure shows acceleration versus force graphs for two objects pulled by rubber bands.
What is the mass ratio of m_2 to m_1?

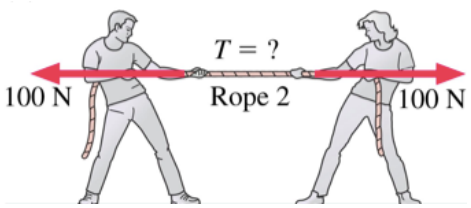


(a) 9/25
(b) 25/9
(c) 5/3
(d) 15/15



4. The forces shown act on a 2.0 kg object. What is the magnitude of the acceleration?

(a) 6.0 m/s
(b) 1.0 m/s^2
(c) 0.50 N/kg
(d) 2.0 m/s^2



5. Two people are playing tug-of-war, and are presently at a stand-still. What is the tension in the rope? Ignore the mass of the rope, and assume it is equally stretched.

(a) 200 N
(b) 100 N
(c) -200 N
(d) 0 N

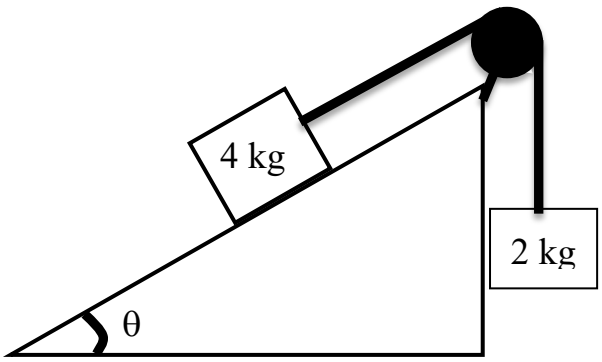
6. A standard clock, like the one hanging on the wall in our classroom, is running out of batteries. As the second hand slows to a stop what are the signs of ω and α?

(a) ω is positive and α is positive.
(b) ω is positive and α is negative.
(c) ω is negative and α is positive.
(d) ω is negative and α is negative.

7. If a 1000 kg beam is lowered via a cable and the tension in the cable is 1.1 kN, what is the acceleration of the beam?

(a) -8.7 m/s^2
(b) 10.9 m/s^2
(c) -9.8 m/s^2
(d) 1.1 m/s

8. A 4.0 kg box is on a frictionless 20º ramp and is connected via a massless string over a massless, frictionless pulley to a hanging 2.0 kg weight. If you gently release the box, which way will it move on the ramp?



(a) Up
(b) Down
(c) It will not move
(d) Need more information

9. A spool has a thin, negligible-mass cable attached to it, which is pulled with an acceleration of 1.5 m/s^2. The diameter of the spool is 6.0 cm and it rotates on a frictionless bearing from rest. After 1.0 m of the cable has been unwound, what is the angular speed of the spool? Assume the cable is pulled at an angle that allows for the maximum speed to be obtained.

(a) 5.5 x 10^2 rad/s
(b) 28 rad/s
(c) 57 rad/s
(d) 5.0 rad/s

10. Which of the following statements is not true?

(a) When you punch through a wall with your fist, the force the fist exerts on the wall is the same as than the force the wall exerts on the fist.

(b) In uniform circular motion the acceleration is non-zero.

(c) The friction force does not always act in the opposite direction of motion.

(d) A box in the back of a car that doesn't slide when it stops is in equilibrium.

11. 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) $\sqrt{2}v$

12. A block is sliding up then 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 down the ramp

(c) When sliding up the ramp

(d) At the turn-around point

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)

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 may not ignore friction ($\mu_k = 0.25$, $\mu_s = 0.60$).

(a) What is the normal force (mag + dir) between the book and the wall? Please justify your calculation with words and/or equation(s).

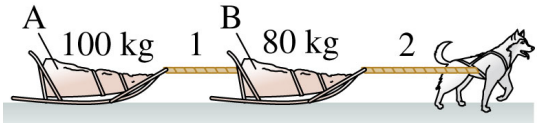
(b) What is the maximum static friction force between the book and wall?

(c) What static friction force is necessary to have the book remain motionless along the wall?

(d) Using your calculations, explain whether or not the book is standing still or sliding along the wall. Words are necessary in your response.

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

A sled dog drags sled A and B across the snow. The tension in rope 1 is 150 N and the acceleration of the system is 0.52 m/s^2.



(a) What is the magnitude of the friction force acting upon sled A?

(b) What is the coefficient of friction between the sled A and the snow?

(c) What is the net force acting upon sled B?

(d) Explain conceptually whether the tension in rope 1 or rope 2 is bigger using theory, force diagrams and/or sum of all forces. Words are necessary in your response, calculations are not.

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

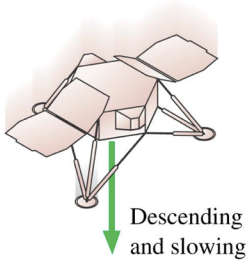
A computer hard disk 8.0 cm in diameter is initially at rest. A small dot is painted on the edge of the disk. The disk accelerates at 600 rad/s^2 for 0.50 s to achieve its steady operational speed.

(a) What is the speed of the dot when at operational speed?

(b) Through how many revolutions has the disk turned during the startup?

(c) Explain whether (or not) all points on the disk experience the same tangential acceleration while at operational speed. No calculations are necessary, but words and equations may be useful in your answer.

(d) What is the acceleration of the dot once at operational speed? A numerical answer is requested along with a word statement about the direction of the acceleration.



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

Mr. Scribbles (our heroic pet hamster) has been sent to Mars. He is attempting to land and is approaching the surface. The 50 kg lander is slowing its descent by firing its rocket motor, which exerts an upward thrust force of 236 N in magnitude on the lander. Ignore "air" resistance.

(a) If the lander's acceleration is 1.0 m/s^2, what is the magnitude of the acceleration due to Martian gravity?

(b) If Mr. Scribbles mass is 70 g, what normal force does he experience?

(c) The rocket runs out of fuel, and it continues to travel downwards. 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.

(d) Luckily, Mr. Scribbles deploys the Anti-Fall-Device^{TM}, causing the lander to safely come to rest on the surface of the planet over 10 m in 10 seconds. What is the net force (magnitude and direction) on the lander?