General Physics
Physics 101
Test #3 – Fall 2018
Friday 11/16/18
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.

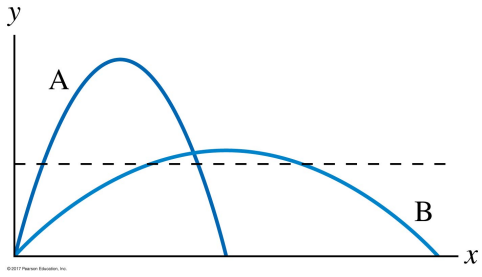
Signature:_____

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:

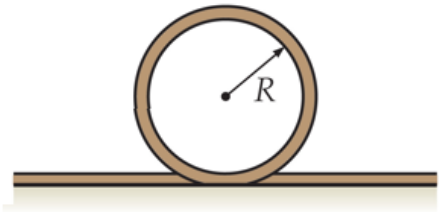


1. Two identical projectiles are fired with the same speed but at different angles. Neglecting air resistance, how do the speeds at the dashed line on the diagram compare?

(a) The speed of A is greater than B
(b) The speed of A is the same as B
(c) The speed of A is less than B
(d) Need more information

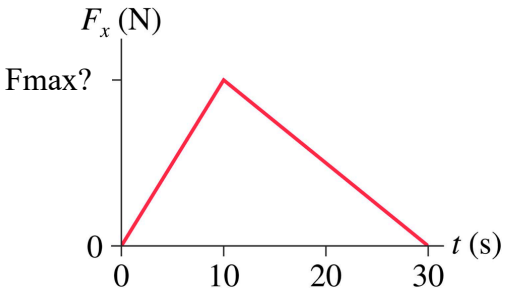
2. Dan (50 kg) is gliding on his 5.0 kg skateboard at 4.0 m/s. He suddenly jumps backward off the skateboard, kicking it forward at 8.0 m/s. How fast is Dan going as his feet hit the ground?

(a) 3.6 m/s
(b) 5.2 m/s
(c) 3.3 m/s
(d) 36 m/s



3. A 1.00 kg ball approaches a loop-da-loop with a radius of 0.500 m. If at the top of the loop the normal force on the ball equals twice the gravitational force, what is the magnitude of the centripetal force?

(a) 9.80 N
(b) 19.6 N
(c) 29.4 N
(d) -9.80 N



4. Far in space, where gravity is negligible, a 425 kg rocket traveling at 75 m/s fires its engines and experiences a 1.5×10^4 Ns impulse. The graphs shows the force the rocket experiences as a function of a time. Assume the mass of the ship is constant. Calculate the maximum thrust force.

(a) 1000 N
(b) 2.0×10^3 N
(c) 5.0×10^2 N
(d) 1.0 kN

5. If you lift a light block (m=1.0 kg) from the floor to a 2.0 m high shelf with a constant acceleration of 1.0 m/s^2, what is the total work done on the block?

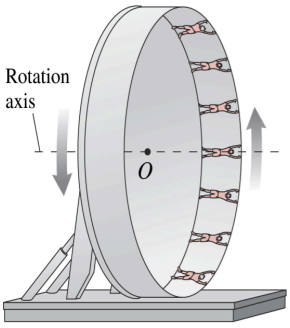
(a) 1.0 N
(b) 9.8 Nm
(c) 20 J
(d) 2.0 Nm

6. A 1 kg ball spins in a circle with a speed of 2 rad/s on a long string. If a moment later, the centripetal force has doubled but the radius has halved what is the new angular speed of the ball?

(a) 2 m/s
(b) 4 rad/s
(c) 8 rad/s
(d) $\sqrt{2}$ rad/s

7. A 6.0 kg ball traveling at 2.0 m/s collides elastically with a 3.0 kg ball that is traveling at 1.0 m/s. What is the velocity of the 3.0 kg ball after the collision?

(a) 1.3 m/s
(b) 0.67 m/s
(c) 2.0 m/s
(d) 2.3 m/s



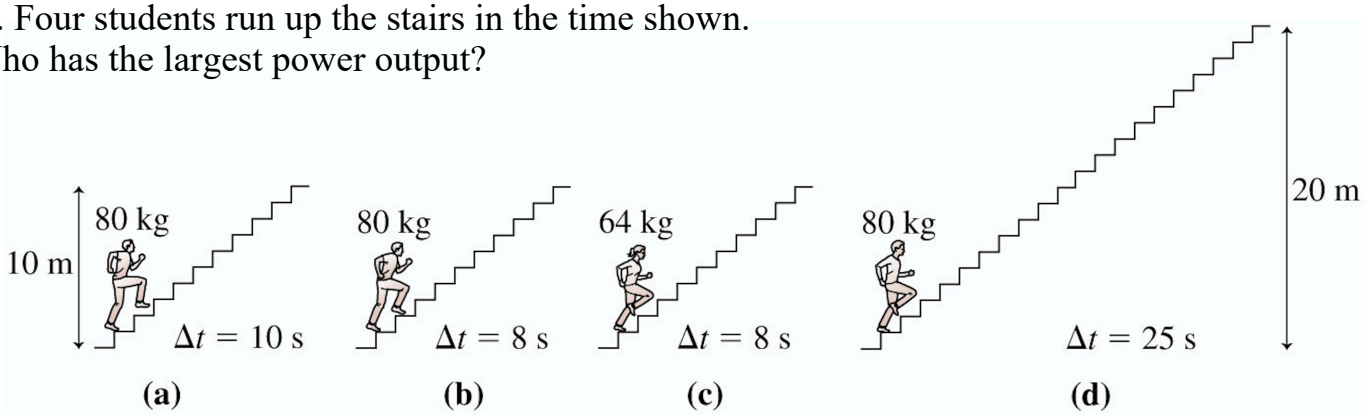
8. In an amusement park ride called "The Roundup", passengers stand inside a 16-m diameter rotating ring. After the ring has acquired sufficient speed, it tilts into a vertical plane. What is the longest rotation period of the wheel that will prevent a 55 kg rider from falling off at the top?

(a) 5.7 s
(b) 8.0 s
(c) 2.0 s
(d) 11 s

9. A 0.2 kg plastic cart and a 20 kg lead cart both roll without friction on a horizonal surface. Equal forces are used to push both carts forward a distance of 1 m, starting from rest. After traveling 1m, is the kinetic energy of the plastic cart…

(a) Greater than the kinetic energy of the lead cart
(b) Less than the kinetic energy of the lead cart
(c) Equal to the kinetic energy of the lead cart
(d) Need more information

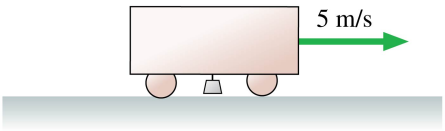
10. Four students run up the stairs in the time shown.
Who has the largest power output?



11. A 1000 kg safe is 2.0 m above a heavy-duty spring when the rope holding the safe breaks. The safe hits the spring and compresses it by 50 cm. What is the spring constant of the spring?

(a) 156800 Nm
(b) 2.0×10^4 N/m
(c) 2.0×10^5 N/m
(d) 1.6×10^5 N/m

12. A cart is rolling at 5 m/s. A heavy lead weight is suspended by a thread beneath the cart. Suddenly the thread breaks and the weight falls. Immediately afterward, the speed of the cart is…



(a) Still 5 m/s
(b) More than 5 m/s
(c) Less than 5 m/s
(d) Not possible to determine with the information given.

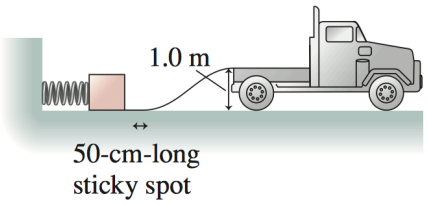
Part II. Short answer problems (12 pts each)

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 freight company uses a compressed spring to shoot 2.0 kg packages up a 1.0-m-high frictionless ramp into a truck, as shown. The spring constant is 500 N/m and the spring is compressed 30 cm.

(a) What is the speed of the package when it reaches the truck? Assume no friction.

A careless worker spills his soda on the ramp. This creates a 50-cm-horizontal-long sticky spot with a coefficient of kinetic of 0.30. The next 2.0 kg package is launched under the same conditions as the first.

(b) What is the work done by friction of the sticky spot?

(c) What is the total mechanical energy of the package after it leaves the sticky spot?

(d) Explain whether or not the package makes it to the truck. Use a calculation and/or theory to justify your answer.

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

A 1.0 kg ball connected to a 0.50 m long string is spun in a vertical plane with constant speed of 10 m/s.
(a) Where it the string most likely to break (where is the tension the greatest)? Explain your answer in words and with a force diagram (or two).

(b) What is the net force on the ball at the top of the motion.
Be sure to indicate in words the direction along with your answer

(c) Calculate the tension at the top.

(d) If the ball begins to slow and the net force on the ball is 100 N, what is the angular speed of the ball?

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

A 20 g ball traveling at 3.0 m/s to the east collides elastically with a 10 g ball that is initially at rest.

(a) What is the velocity of the 20 g ball post collision?

The 20g ball now traveling with the velocity from (a) collides and sticks to a 30 g sticky ball traveling at with components of 3.0 m/s north and 4.0 m/s west (5.0 m/s magnitude).

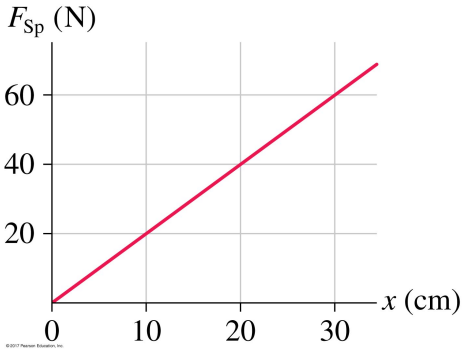
(b) What is the combined velocity in the North/South "y" direction post collision?

(c) What is the combined momentum in the East/West "x" direction post collision?

(d) In the collision considered in b&c are momentum and/or kinetic energy conserved? Explain your answer using words, and be sure to address both momentum and kinetic energy.

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

A 50 g rock is placed in a slingshot and the rubber band is stretched. The magnitude of the force of the rubber band on the rock is shown. The rubber band is stretched 30 cm and then released.



(a) What is the spring constant of the rubber band?

(b) What is the speed of the rock as it leaves the rubber band?

(c) If the rock was launched from a 20 m high cliff, what is the impact speed as it hits the ground below?

(d) As the rock strikes the ground, which experiences a bigger magnitude of impulse the ground or the rock? Justify using words and theory.