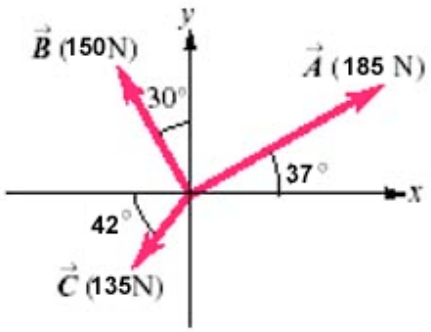
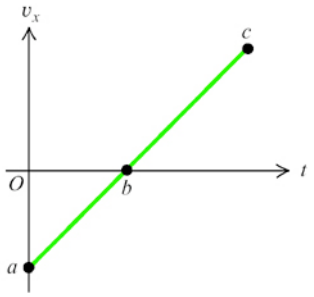
Physics 180A Name _____
Final Test - 120 Points

1. Three horizontal ropes are attached to a boulder and produce the pulls shown in the figure. Find the magnitude and direction of the resulltant pull. (5 points)



Answer box

2. A wildebeest is running in a straight line, which we shall call the axis, with the positive direction to the right. The figure below shows this animal's velocity as a function of time. Which of the following statements about the animal's motion must be true? (5 points)



A. It is moving to the right between a and c.
B. It is moving to the left between a and b and to the right between b and c.
C. Its acceleration is increasing.
D. Its speed is decreasing from a to b and increasing from b to c.

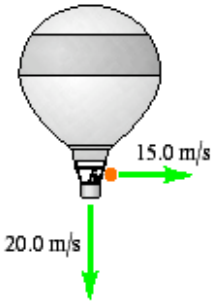
3. A brick is released with no initial speed from the roof of a building and strikes the ground in 2.20 s, encountering no appreciable air drag. How tall, in meters, is the building? How fast is the brick moving just before it reaches the ground? (10 points)

Answer box

4. A cannonball is fired toward a vertical building 384 m away with an initial velocity of 120 m/s at 36.9° above the horizontal. The ball will hit the building in (5 points)

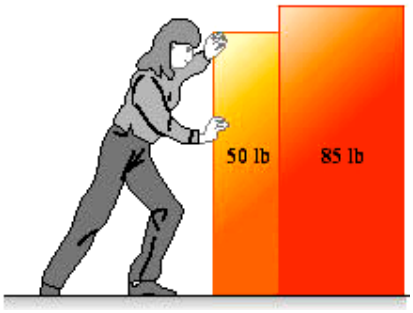
a. 4.00s b. 5.00 s c. more than 5.00s d. less than 4.00 s

5. A balloon carrying a basket is descending at a constant velocity of 20.0 m/s. A person in the basket throws a stone with an initial velocity of 15.0 m/s horizontally perpendicular to the path of the descending balloon, and 4.00 s later this person sees the rock strike the ground. How high was the balloon when the rock was thrown out? How far horizontally does the rock travel before it hits the ground? (10 points)

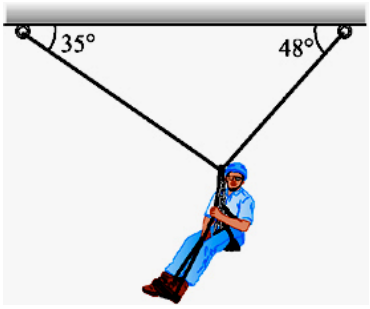


Answer box

6. A hospital orderly pushes horizontally on two boxes of equipment on a rough horizontal floor, as shown in the figure. Draw a FreeBody Diagram for both boxes. (5 points)

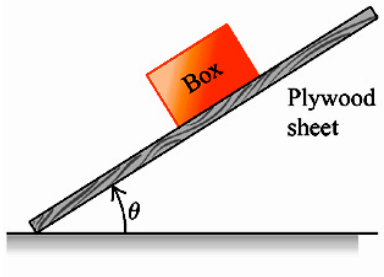


7. In a rescue, the 82.0 kg police officer is suspended by two cables, as shown in the figure below. Find the tension in the left cable. Find the tension in the right cable. (10 points)



Answer box

8. One straightforward way to measure the coefficients of friction between a box and a wooden surface is illustrated in the figure. The sheet of wood can be raised by pivoting it about one edge. It is first raised to an angle θ_1 (which is measured) for which the box just begins to slide downward. The sheet is then immediately lowered to an angle θ_2 (which is also measured) for which the box slides with constant speed down the sheet. Apply Newton's second law to the box in both cases to find the coefficients of kinetic and static friction between it and the wooden sheet in terms of the measured angles θ_1 and θ_2 . Find the coefficient of static friction. Find the coefficient of kinetic friction. (10 points)



Answer box

9. A frictional force F provides the centripetal force as a car goes around an unbanked curve of radius R at speed v. Later, the car encounters a similar curve, except of radius 2R, and the driver continues around this curve at the same speed v. In order to make this second curve, the frictional force on the car must be equal to (5 points)

a. 1/4F b. 1/2F c. F d. 2F

10. A 15.0 kg stone and a 150 kg stone are released from rest at the same height above the ground. There is no appreciable air drag. (5 points)

a. Both stones will reach the ground at the same time.
b. Both stones will have the same speed when they reach the ground.
c. Both stones will have the same acceleration as they fall.
d. Both stones have the same initial gravitational potential energy.
e. Both stones will have the same kinetic energy when they reach the ground.

11. A 56.0 kg stunt pilot who has been diving her airplane vertically pulls out of the dive by changing her course to a circle in a vertical plane. If the plane's speed at the lowest point of the circle is 156 m, what should the minimum radius of the circle be in order for the acceleration at this point not to exceed 4.50 g? What is the apparent weight of the pilot at the lowest point of the pullout? (10 points)

Answer box

12. A loaded 465 kg toboggan is traveling on smooth horizontal snow at 6.10 m/s when it suddenly comes to a rough region. The region is 6.10 m long and reduces the toboggan's speed by 1.10 m/s. What average friction force did the rough region exert on the toboggan? By what percent did the rough region reduce the toboggan's kinetic energy and speed? (10 points)

Answer box

Diagram 10 points **Reason 10 Points** **Solution 10 Points**

A hotair balloonist, rising vertically with a constant speed of 5.75 m/s, releases a sandbag at the instant the balloon is 45.0 m above the ground. After it is released, the sandbag encounters no appreciable air drag. A. Compute the position (height above the ground) of the sandbag at 0.275 s after its release. B. Compute the position of the sandbag 1.03 s after its release. C. Compute the component of the velocity of the sandbag at 0.275 s after its release. D. Compute the component of the velocity of the sandbag at 1.03 s after its release. E. How many seconds after its release will the bag strike the ground? F. How fast is it moving as it strikes the ground? G. What is the greatest height above the ground that the sandbag reaches? Box your answers, please.