Name________________________ ID__________________________ Section_________________

Closed book exam - Calculators are allowed.

Only the official formula sheet downloaded from the course web page can be used. You are allowed to write notes on the back of the formula sheet.

Use the scantron forms (pencil only!) for the multiple choice problems. Circle the ansers on the examination sheet as well, and return it together with the scantron form. Use the back of these page, or attache your own pages with solutions for the problems which require calcuations.

The multiple-choice problems are 1 point each. Work out problems are 4 points each. Passing of the exam requires at least 50% of the maximum number of points.

Clearly print your last name and indicate your section number on both the scantron form and the examination sheet. Also indicate your name and ID on each of the two sheets with work-out problems since they will be graded separately. Failure to do any of these will result in a penalty of 2 points.

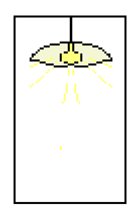
Problem 1: Please mark the version of the exam you are taking

A) YOU ARE TAKING VERSION A
B)
C)
D)
E)

Problem 2: Find the mass of an object whose initial speed of 4 m/s is reduced to zero with a constant 4 N force in 2 seconds.
B) 0.5 kg
B) 2 kg
C) 4 kg
D) 8 kg
E) 16 kg

Problem 3: Two forces acting on an object of mass 5.0 kg give rise to an acceleration $\mathbf{a} = (2.0\ \mathrm{m/s^2})\mathbf{i} + (3.0\ \mathrm{m/s^2})\mathbf{j}$. One of the forces is $\mathbf{F_1} = (10\ \mathrm{N})\mathbf{i} - (4\ \mathrm{N})\mathbf{j}$. The other must be
A) $\mathbf{F_2} = (10\ \mathrm{N})\mathbf{i} + (15\ \mathrm{N})\mathbf{j}$
B) $\mathbf{F_2} = (20\ \mathrm{N})\mathbf{i} + (11\ \mathrm{N})\mathbf{j}$
C) $\mathbf{F_2} = (10\ \mathrm{N})\mathbf{i}$
D) $\mathbf{F_2} = (12\ \mathrm{N})\mathbf{i} - (1\ \mathrm{N})\mathbf{j}$
E) $\mathbf{F_2} = (19\ \mathrm{N})\mathbf{j}$

Problem 4: A 5 kg lamp is suspended by a string from the ceiling inside an elevator moving up with decreasing speed. If the magnitude of the elevator's acceleration is 3 m/s^2, what is the tension in the string?



A) 64 N
B) 49 N
C) 34 N
D) 15 N
E) 60 N

Problem 5: A 10 kg block is dragged along a horizontal frictionless surface with a 100 N force that makes an angle of 25° with the horizontal. The normal force exerted by the surface on the block is

Name________________________ ID__________________________ Section_________________

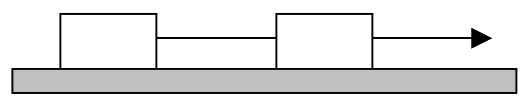
A) 98 N
B) 140 N
C) 7.4 N
D) 56 N
E) 2 N

Problem 6: A block initially moving at 4 m/s upwards on an incline comes to rest after traveling 5 m up the incline. What is the angle between the incline and the horizontal in degrees?

A) 9.4
B) 81
C) 45
D) 53
E) 6.7

Problem 7: The tension in the string on the right of the right block is 36 N. Each block has a mass of 2 kg. The surface is frictionless. What is the tension in the string between the blocks?

A) 9 N
B) 36 N
C) 18 N
D) 12 N
E) 27 N

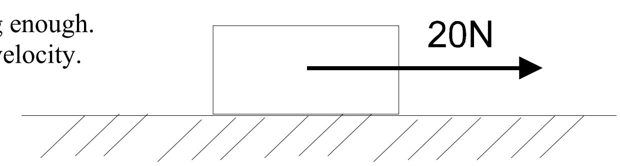


Problem 8: A 2000kg car slides on the ice and stops in 20m due to the frictional force between the car and the ice. If the initial speed of the car is 5 m/s, the coefficient of kinetic friction between the ice and car is:

A) 0.
B) 0.064
C) 0.013
D) 1.0
E) 9.8

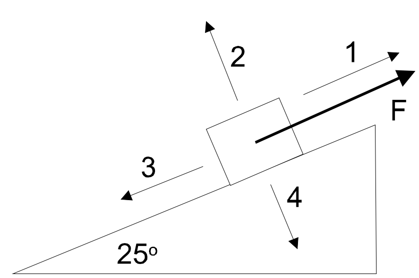
Problem 9: A block of mass 5kg is pulled along a horizontal floor by a force of 20N as shown in the figure. The coefficient of static friction is 0.4. The coefficient of dynamic friction is 0.2. the magnitude of the acceleration of the block is

A) The block does not accelerate. The 20N force is not strong enough.
B) The acceleration is zero, but the block moves at constant velocity.
C) 2.04 m/s^2
D) 0.24 m/s^2
E) 9.8 m/s^2



Problem 10: As shown in the Figure below, a sled is pulled up a snow covered hill by a force F. The angle of the slope is 25 degrees. The weight of the sled is 100N. Which of the labeled arrows below indicate the DIRECTION of the frictional force?

A) Arrow 1
B) Arrow 2
C) Arrow 3
D) Arrow 4
E) None of the above

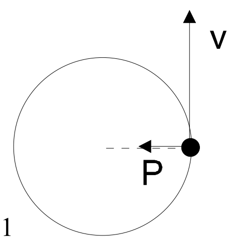


Name________________________ ID__________________________ Section_________________

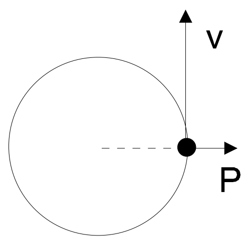
Problem 11: Referring to the sled problem above, the coefficient of static friction is 0.25 and the coefficient of kinetic friction is 0.15. What value of F is required such that the sled moves at a constant velocity?

A) 56 N
B) 65 N
C) 42 N
D) 91 N
E) 100 N

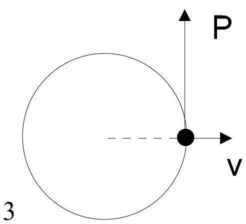
Problem 12: A ball a mass 0.5kg is tied to a string. The ball is swung in a circle (in the absence of gravity) in a circle of radius 2m. For the diagrams below, which correctly shows the relative directions of the centripetal force (P) acting on the ball and the velocity (v) of the ball.



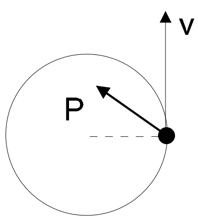
A) Figure 1



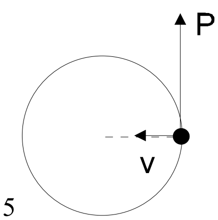
B) Figure 2



C) Figure 3



D) Figure 4



E) Figure 5

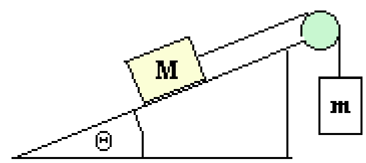
Problem 13: Referring to the problem above with the ball moving in circular motion, if the time for the ball to complete one revolution is 0.5 seconds, the magnitude of the centripetal acceleration is

A) 9.8 m/s^2
B) 4 m/s^2
C) 25 m/s^2
D) 157 m/s^2
E) 316 m/s^2

Name________________________ ID__________________________ Section_________________

WORKOUT PROBLEM 1: [1 point for each part]

For the diagram shown, assume that the pulley is massless and frictionless, the incline is frictionless, the string is massless, M = 4.0 kg and $\Theta = 43^o$. Starting from rest, the mass M moves downhill with a speed that is increasing at a rate of 2.0 m/s^2.



a) Draw the free-body-diagram of each of the objects.

b) Write components of Newton's 2nd Law of Motion for each of the masses using symbols only (M, m, Θ, g etc.)

c) Solve the equations in part b using the data supplied and find the tension in the string T and the mass m.

d) What value of m would have given an uphill motion of M with constant speed ?

Name________________________ ID__________________________ Section_________________

WORKOUT PROBLEM 2:

(a) **[3 points]** A 2000 kg race car is rounding a level curve at a speed of 50m/s. If the coefficient of static friction between the road and the tires is 0.5, what is the minimum radius of the curve for which the car can round the curve without skidding?

(b) **[1 point]** If the curve is banked rather than flat, does the minimum radius at which the car can turn without skidding at 50m/s increase or decrease compared to the case of a flat curve? **IN ORDER TO RECEIVE CREDIT, YOU MUST JUSTIFY YOUR ANSWER using a diagram and a *brief* explanation.**