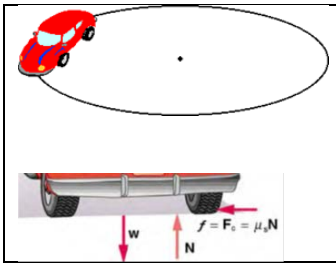
Physics 1100 (Eve Sec.) Exam#2B, Name_____, ID#_____, Score____100/100

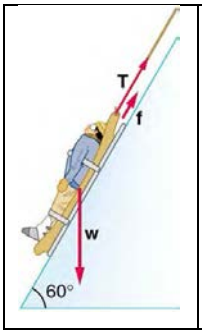
1. (**Uniform circular motion, 5/ea.**)



An 800-kg car with a linear speed of 20 m/s runs in a radius 400-meter unbanked curve, assuming the static friction force is the reason to keep the car from slipping away (see the diagram on the left).

(a) What is the magnitude of centripetal acceleration? Ans. _____1 m/s^2
(b) What is the required centripetal force acting on the car? Ans. _____800 N
(c) What is the angle between the centripetal force acting on the car and the velocity of the car? Ans._____90^o
(d) What is the required static coefficient [**use g = 10 m/s^2**]? Ans. _____0.1

2. (**Work, energy, 5/ea.**)

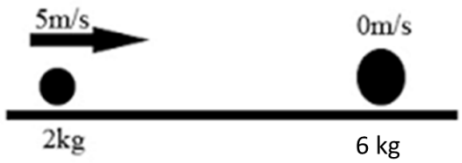


A ski-patrol lowers a rescue sled with victim, having a total mass of 100 kg, down a 60.0^o slope **at a constant speed**, as shown in **left.** The dynamic coefficient of friction between the sled and the snow is 0.1.

Please use g = 10 m/s^2

(a) How much work is done by friction as the sled moves 60 m along the hill? **Ans.**_____- 3000 J
(b) How much work is done by the tension, T, in the rope on the rescue sled in this distance? **Ans.**_____- 49200 J
(c) What is the work done by the gravitational force on the sled-victim system? **Ans.**_____52200 J
(d) What is the work done by the normal force exerted on the sled-victim system? **Ans.** _____0
(e) What is the total work done by all the forces acting on the sled-victim system? **Ans.**_____0
(f) What is the value of potential energy for the sled-victim system lost in this process? **Ans.**_____52200 J

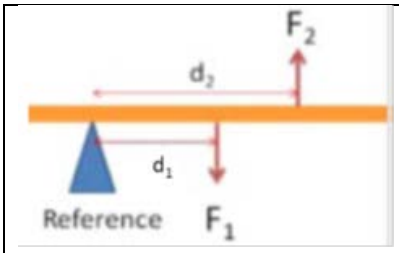
3. (**Momentum conservation, 1D collisions, 5/ea.**)



As shown in left, a ball with mass m1 = 2 kg is traveling towards another ball with mass m2 = 6 kg, initially at rest **on a frictionless surface**. Assumption: elastic collision.

(a) What is the momentum of m1 ball before collision? **Ans.**_____10 kg.m/s
(b) What is the total momentum of m1-m2 system before collision? Ans._____10 kg.m/s
(c) What is the velocity of ball m1 after collision? **Ans.** _____ - 2.5 m/s
(d) What is the velocity of ball m2 after collision? **Ans.**_____ 2.5 m/s
(e) What is the value of energy after collision for the m1-m2 system? **Ans.** __25 J

4. (**Torque and statics, 5/ea.**)



A rigid bar (ignore its own weight, consider it as 1D system) is being balanced horizontally by the forces of F1 and F2, located at the distance d1 and d2 away from the reference stand (point O) as shown in left, respectively.
For F2 = 200 N, d2 = 1 m, and d1 = 0.5 m,
Find:
a) the value of F1, Ans. _____400 N
b) the torque of F1 with the reference point O, Ans._____200 N.m
c) the torque of F2 with the reference point O, Ans._____- 200 N.m
d) the force on the bar exerted from the reference stand, Ans. _____ 200 N
e) the force on the stand exerted by the bar, Ans._____200 N

Note: **Equations given below are for your reference only.**

Uniform circular motion	$a_c = v^2/r$; $a_c = r\omega^2$	$F_c = ma_c$	$v = r\omega$
Work, energy	$w = Fd$	$KE = (1/2)mv^2$	$PK = mgh$
Momentum, collision	$p = mv$	Momentum conservation: $\Delta p = 0$	
Statics, torque	Condition-1: $F_{net} = 0$	Condition-2: $\tau_{net} = 0$	$\tau = Fr$