CSUC Spring Term 2020 Physics 204A <u>Portfolio Problem for Week 9:</u>
<u>Due Monday, March 30 by Noon on our class Blackboard site:</u> 202-PHYS204A-05-4569

Dear Class: This is the second midterm you would have taken! It is also, now, your first (and Week9) Portfolio Problem. This is an open book and unlimited time exercise – but now I'm looking for thorough understanding and creative solutions! Completeness and depth count!

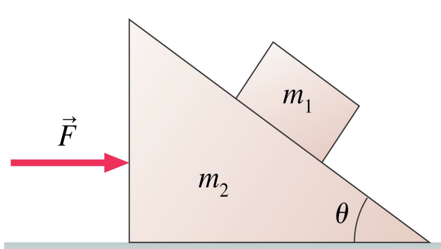
1) **a)** State Newton's laws clearly (in words and/or symbols) <u>and in order</u>.
b) A 2 kg mass moves in the x-y plane with a velocity vector given by
$\mathbf{v} = (a - bt^2, ct)$. { a, b, c are constants where a = 2.4 m/s , b = 1.6 m/s^3 , c= 4 m/s^2}
What must be the force on the mass at $t = 2$ *seconds ?*

2) A wedge of mass m_2 is pushed along the floor by a horizontal force F while a mass m_1 sits on its sloping face but slips neither up nor down. If all surfaces are frictionless, what must F be ?
a) *draw a complete free body diagram for the upper block* m_1.
b) *draw a complete free body diagram for the wedge* m_2.
c) *find the acceleration of the blocks.*
d) *find the force F.*

3) A 50kg steel file-cabinet is in the back of a dump truck. There is a coefficient of static friction $\mu_s = 0.8$ and a coefficient of kinetic friction $\mu_k = 0.6$ between the cabinet and the truck bed. The truck bed is now tilted to 20° and the cabinet <u>hasn't slipped yet</u>.
a) *Draw a free body diagram for the cabinet.*
b) *What is the frictional force at this angle?*
c) *At what angle <u>does</u> the cabinet finally slip ?*
d) *Once the cabinet finally slips, … what will be its acceleration?*

4) A conical pendulum is formed by attaching a mass m =1.5kg to a string of length L =3m and then allowing the mass to move in a horizontal circle of radius r = .4m as shown below.
a) What is the tension in the string?
b) What is the ball's angular speed?
c) What would be the minimum (nonzero!) angular speed <u>possible</u> if we were now to change the radius of circular motion and allow the radius r to become smaller but remain non-zero ?

5) Two blocks are connected by an ideal string that runs over an ideal frictionless pulley as shown below. The coefficient of kinetic friction between each pair of surfaces is $\mu_k = 0.25$.
a) *Draw a free body diagram for each block.*
b) *Find the acceleration of the lower block.*
c) *Find the tension in the connecting string.*

2)


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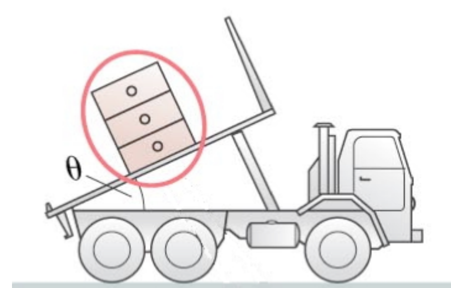

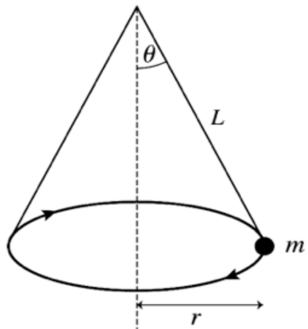

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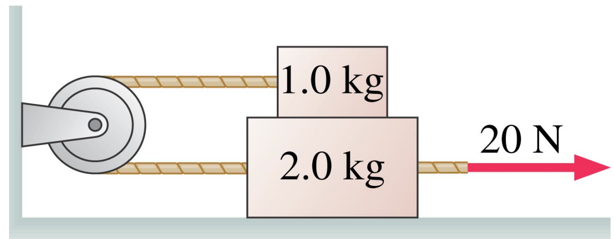

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