Physics 218 – Exam II

Fall 2016 (all sections) **October 26$^{\text{th}}$, 2016**

Please fill out the information and read the instructions below, but **do not open the exam** until told to do so.

Rules of the exam:

1. You have 90 minutes (1.5 hrs) to complete the exam.
2. Formulae are provided to you with the exam on a separate sheet. Make sure you have one before the exam starts. You may *not* use any other formula sheet.
3. Check to see that there are 8 numbered (four double-sided) pages in addition to the scantron-like cover page. **Do not remove any pages**.
4. If you run out of space for a given problem, pages 4 and 7 are blank and may be used for extra space. Be sure to indicate *at the problem under consideration* that the extra space is being utilized so the graders know to look at it!
5. You may use any type of handheld calculator. However, you **must** show your work. If you don't show *how* you integrated or *how* you took the derivative or *how* you solved a quadratic of system of equations, etc., you will **not** get credit.
6. Cell phone use during the exam is strictly prohibited. Please turn off all ringers as calls during an exam can be quite distracting.
7. Be sure to put a box around your final answer(s) and clearly indicate your work. Credit can be given **only** if your work is legible, clearly explained, and labelled.
8. All of the questions require you show your work and reasoning.
9. Have your TAMU ID ready when submitting your exam to the proctor.

Fill out the information below and sign to indicate your understanding of the above rules

Name: ______________________ UIN: ______________________
(printed *legibly*)

Signature: ______________________ Section Number: ______________

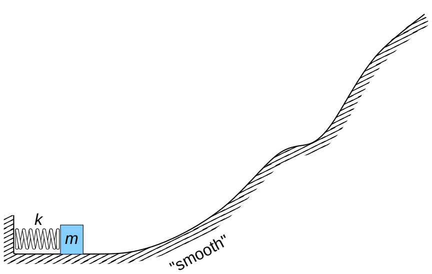
Instructor: (circle one) Akimov Eusebi Mahapatra Melconian Rapp Rogachev Webb

Short Answers:

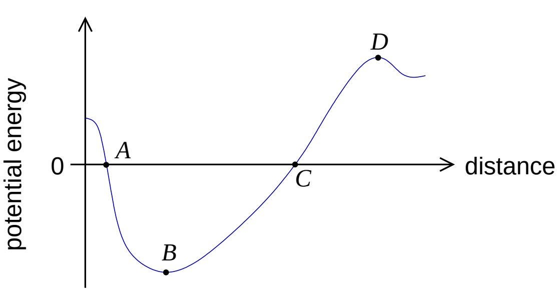
A) A 200-kg space craft crashed into the surface of a comet, hitting the surface with a velocity of 300 km/hr. If the crater formed by the crash is 50.0 cm deep and you assume that the force of the comet on the space craft was constant during the crash, what was the magnitude of this force?

B) A block of mass m sits on the surface of a "rough" incline. The angle that this incline makes with the horizontal is increased slowly and continuously. If the block begins to slide when the angle reaches 30°, draw a free body diagram for the block at this point and find the coefficient of static friction between the block and the incline.

C) A box of mass m is pressed against (but is not attached to) an ideal spring of force constant k and negligible mass, compressing the spring a distance x. After it is released, the box slides up a frictionless incline as shown in the figure and eventually stops at a height h above the original release point. If we repeat this experiment but instead compress the spring twice as far, how high will the box go up the hill in this case? Give your answer in terms of the constants given: k, h, m, x and g (not all may be necessary).

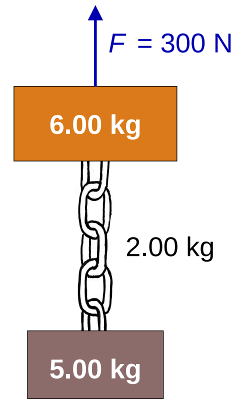


D) The plot in the figure shows the potential energy of a particle due to the force exerted on it by another particle as a function of distance. At which of the points labelled in the figure is the magnitude of the force on the particle the greatest? Clearly explain your choice.



LO	S	U
14.1		
22.1		
24.1		
29.1		
30.1		
33.1		
36.1		
41.1		
43.1		
44.1		

Prob 1 Two blocks hang vertically and are connected by a heavy uniform chain. The masses of the blocks and chain are shown in the figure below. An upward force of 300 N is applied to the top block.



(a) Draw an individual free body diagram for each of the blocks and the chain, clearly identifying any action/reaction pairs.

(b) What is the acceleration of the system?

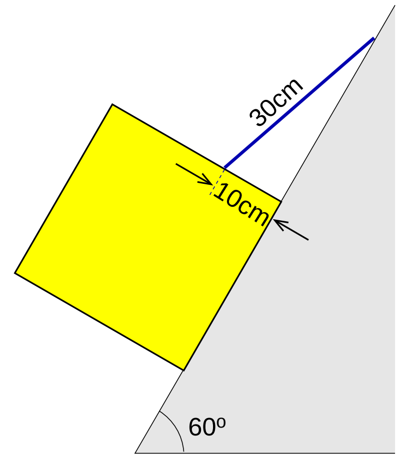
(c) What is the tension at the top of the heavy chain?

LO	S	U
23.1		
24.2		
25.1		
35.1		
3.1		
22.2		
34.1		
25.2		

Extra Space:

Prob 2 A solid uniform cube of mass M and sides of length L is supported against an inclined frictionless wall by a thin massless wire as shown in the figure. Answer parts (b) and (c) in terms of the weight, Mg, of the block.:

(a) Draw a free-body diagram for the block and make sure you include the relevant angles in your diagram.



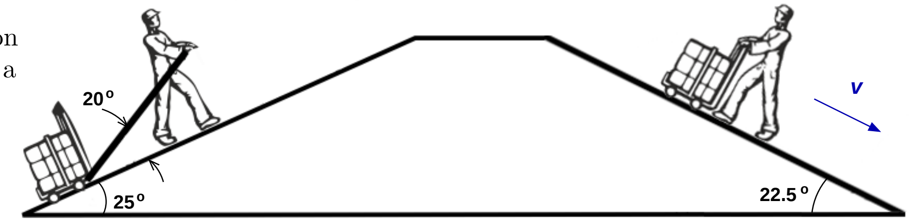
(b) Find the tension in the wire.

(c) How hard does the block push against the wall? Explain your reasoning.

LO	S	U
24.3		
25.3		
29.2		
35.2		
3.2		
22.3		
3.3		
23.2		

Prob 3 A worker pulls a loaded cart with a total mass of 50 kg uphill using a rope as shown below. He pulls the cart with a constant force of magnitude $P = 300$ N. The cart moves along the incline with negligible rolling friction. The worker then passes the top of the ramp and descends the other side at constant speed.

(a) What work was done by the worker on the cart as he pulled it up the ramp, a distance of 4.00 m along the incline? Do *not* use energy conservation; calculate the work based on the force and displacement.



(b) As the cart descends on the downward incline, in what direction, relative to the inclined surface, should the worker apply a force to slow down the cart most efficiently (with the least force)? Briefly explain your reasoning.

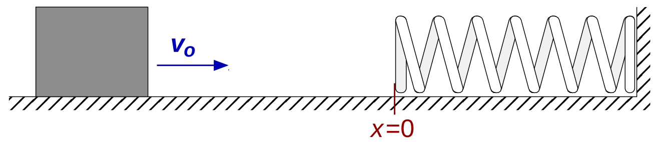
(c) What is the minimum weight of the worker, in pounds (lbs), required to keep the cart moving at constant speed, given the coefficient of the static friction between his boots and the slope is $\mu_s = 0.650$.

LO	S	U
37.1		
22.4		
3.4		
10.1		
22.5		

Extra Space:

Prob 4 A block of mass M is moving at a velocity v_0 along a horizontal frictionless surface toward an ideal massless spring that is attached to a wall. After the block collides with the spring, the spring is compressed a maximum distance of d. In terms of M, v_0, and d, (not all may be necessary) answer the following:

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



(b) What is the speed of the block when it has reached the point where the spring is compressed to only one-half of the maximum distance?

(c) Suppose that, once the block contacts the end of the spring, it experiences a frictional force on the horizontal surface. If the coefficient of kinetic friction between the block and the surface is μ_k, find the maximum compression of the spring in terms of M, v_0, d and μ_k.

LO	S	U
3.5		
42.1		
42.2		
5.1		
42.3		
43.2		