EXAM-2 – v1

PHYS 201 (Spring 2015), 03/09/15

Name:

Lab-Sect. no.:

Signature:

In taking this exam you confirm to adhere to the Aggie Honor Code:
"An Aggie does not lie, cheat, steal or tolerate those who do."

Duration: 50 minutes
Show all your work for full/partial credit!
Include the correct units in your final answers for full credit!
Unless otherwise stated, quote your results in SI units!

1.) *Multiple Choice* *(18 pts.)*

For each statement below, circle the correct answer (TRUE or FALSE, no reasoning required).

(a) If a car takes a turn on a road without sliding, the static friction force between tires and road acts as a centripetal force.
TRUE FALSE

(b) Work is a vector quantity.
TRUE FALSE

(c) The tension force is a conservative force.
TRUE FALSE

(d) If a negative net work is done on an object, the object's speed is decreasing.
TRUE FALSE

(e) In a 2-dimensional collision without external forces, the x- and y-component of the total momentum are conserved separately.
TRUE FALSE

(f) If no external forces act on a 2-body system, its center-of-mass velocity does not change.
TRUE FALSE

No.	Points
1	
2	
3	
4	
5	
Sum	

2.) *Satellite Motion* *(20 pts.)*

Assume the Moon (mass M_M=$7.35 \cdot 10^{22} kg$) to be in a circular orbit around Earth (mass M_E=$6 \cdot 10^{24} kg$) at a radius of $384000 km$.

(a) Calculate the gravitational force and associated acceleration exerted by the Earth on the Moon.

(b) Calculate the period of the Moon's revolution around Earth (in days).

3.) *Vertical Circular Motion and Energy Conservation* *(22 pts.)*
Consider a frictionless roller coaster with a decline followed by a loop-the-loop (radius $4\,m$), as sketched below.

(a) What is the minimal speed required for the car at the top of the loop, in order not to fall off the track? (*hint: the normal force is zero in this case*)

(b) Starting from rest, how high above the ground should the car start out on the initial decline to just make it through the loop without falling off the track?

4.) *Nonconservative Work* *(20 pts.)*

A box is sliding on a horizontal surface for $25\,m$, causing its speed to decrease from initially $15\,m/s$ to $6\,m/s$.

(a) Calculate the kinetic friction coefficient between the box and the surface.

(b) How many additional meters does the box slide before coming to a stop?

5.) *Momentum Conservation* *(20 pts.)*

A massless spring of unknown spring constant is compressed by $22\,cm$ in between two carts of masses $m_1 = 40\,kg$ and $m_2 = 600\,kg$, both being originally at rest. The system is released and the two carts recede from each other on a horizontal surface, leaving the spring behind on the ground. Cart 1 reaches a final velcocity of $-18\,m/s$, in negative x-direction. Neglect friction.

(a) What is the final velocity of cart 2?

(b) What is the spring constant?