Name: «Name_»	Signature:
Surname: «Surname_»	Student ID Number: «Student_ID»

PHYS 101 General Physics I – Midterm 2

May 9, 2015 Saturday 09:00 -10:50

Please read!

- Count to make sure that there are 5 pages in the question booklet
- Check your name and surname on front page, and student ID number on each page, and sign each page.
- This examination is conducted with closed books and notes.
- Put all your personal belongings underneath your seat and make sure that pages of books or notebooks are not open.
- Absolutely no talking or exchanging anything (like rulers, erasers) during the exam.
- You must show all your work to get credit; you will not be given any points unless you show the details of your work (this applies even if your final answer is correct!).
- Write neatly and clearly; unreadable answers will not be given any credit.
- If you need more writing space, use the backs of the question pages and put down the appropriate pointer marks.
- Make sure that you include units in your results.
- Make sure that you label the axis and have units in your plots.
- You are not allowed to use calculators during this exam.

P101_Index: «Index»

1	2	3	4	5	Total

Exam Room: «Exam_Room»	P101_Index: «Index»
Student ID Number: «Student_ID»	**Signature:**

1-(25 points) As shown in figure, a **varying horizontal force F** is pushing the object very slowly with constant speed from α **= 0 to** $\pi/2$ on a rough cylindrical surface **with a kinetic friction coefficient of** μ**=0.1**. Through the process, the object remains in equilibrium.

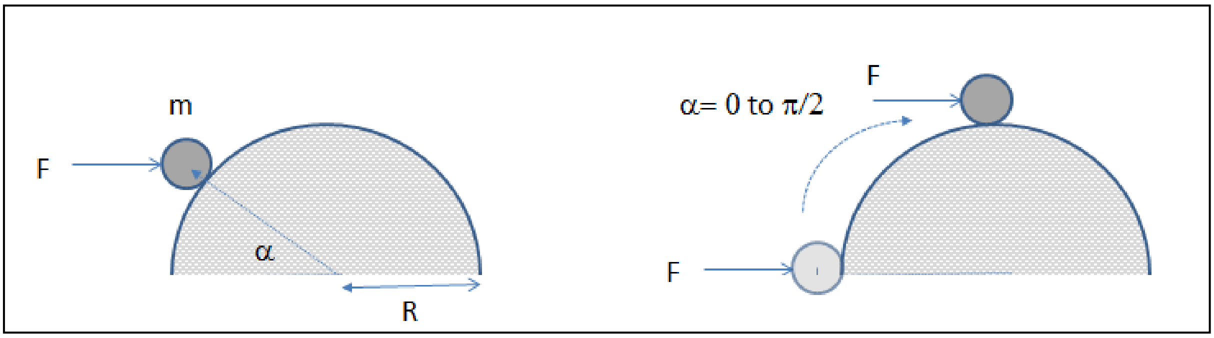
a) Calculate **F** and friction force (**f**) as a function of angle α

b) What is the total work done by the force **F**?

d) What is the total work done by the friction force **f**?

c) What is the total work done by the gravitational force?

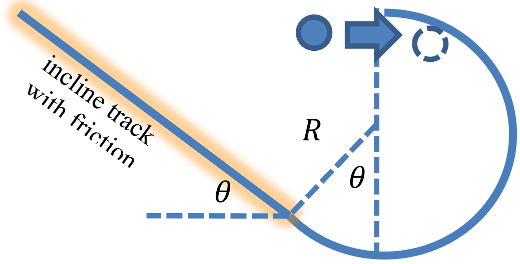
d) What is the total work done by the normal force **N**?



Solution continues on the back side of the page **Yes** □ **No** □

Exam Room: «Exam_Room»	P101_Index: «Index»
Student ID Number: «Student_ID»	**Signature:**

2-(25 points) A particle of mass m is launched horizontally at the top point in a vertical circular track of radius R as shown in the figure. The circular track is frictionless and the arc angle is $\pi + \theta$. The circular arc is connected to an inclined track which has a kinetic friction constant μ_k. Gravitational acceleration is g.



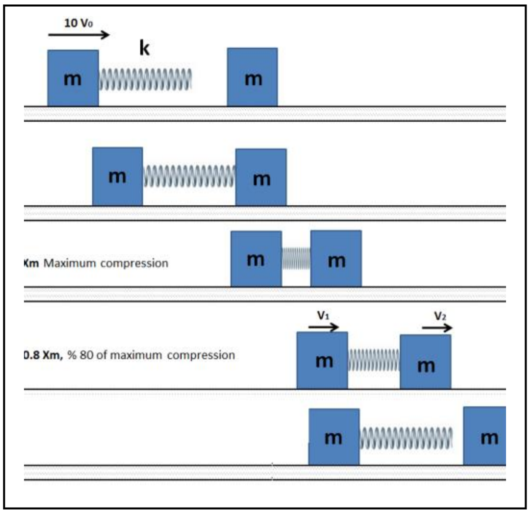
a) What must be the minimum launch speed of the particle so that it can follow the circular track?

b) For the minimum speed, how high does the particle go from the beginning level of the inclined track? (If you did not solve part(a), you can still work on part (b), by defining the minimum speed as a parameter, v_0, in your solution).

Solution continues on the back side of the page **Yes** □ **No** □

Exam Room: «Exam_Room»	P101_Index: «Index»
Student ID Number: «Student_ID»	Signature:

3-(25 points) A block of mass **m** with a light spring attached is moving to the right with a speed of $\mathbf{10V_0}$ on a frictionless surface. As shown in Figure, the first block collides to a second block of mass **m** which is initially at rest. The spring constant is **k.**



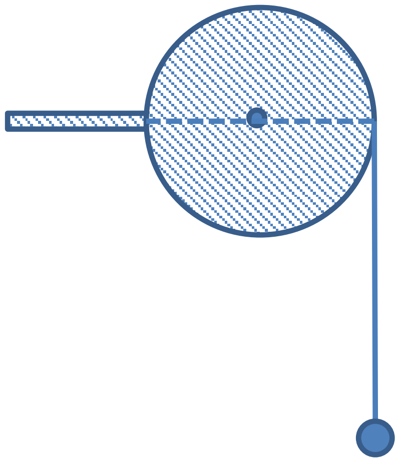
a) Find the velocities of the two blocks when the spring reaches maximum compression (**Xm**).

b) Calculate the maximum compression of the spring (**Xm**).

c) Find the velocities of the blocks (V1 and V2) when the spring reaches **%80** of the maximum compression (**0.8 Xm**).

d) Find the velocities of the blocks (V'1 and V'2 after the blocks are separated as in the last figure.

 Solution continues on the back side of the page **Yes** □ **No** □



4-(25 points) A uniform disk of mass $\boldsymbol{m}$, radius $\boldsymbol{R}$ can rotate about its center axis, perpendicular to the page. A rod of mass $\boldsymbol{2m}$ length $\boldsymbol{R}$ is fixed from one end to the rim of the disk and a small ball of mass $\boldsymbol{m}$ is attached to a light rope which is threaded around the disk. The rope can move without slipping on the disk surface. The system is released from the position shown in the figure, when the rod is parallel to the horizontal diameter of the disk. Note that the ball moves up. ($I_{disk-cm} = \frac{mR^2}{2}$.)

a) Calculate the moment of inertia of the rod with respect to the center axis of the disk (You may use the formula for the moment of inertia through the rod center directly in your calculation).

b) Calculate the angular speed of the disk, when the disk has rotated by $\frac{\pi}{2}$ from its initial position.

c) Calculate the linear velocity and the radial acceleration of the rod's center of mass, when the disk has rotated rotated by $\frac{\pi}{2}$ from its initial position.

 Solution continues on the back side of the page **Yes** □ **No** □