International University - VNUHCM
Department of Physics

Final Examination

Date: 11/01/2022; Duration: 120 minutes

Group 3

Open book; **Online**; Laptops, Calculators **are allowed**

SUBJECT: PHYSICS 1 (ID: PH013IU)	
Approval by Chair of Department of Physics Signature  Full name: Phan Bảo Ngọc	Lecturer: Signature  Full name: Đỗ Xuân Hội
Proctor 1 Signature Full name:	Proctor 2 Signature Full name:
STUDENT INFO	
Student name: **Student ID:**	

INSTRUCTIONS: the total of point is 100 (equivalent to 30% of the course)

1. *Purpose:*
   - Construct the basic knowledge of general Mechanics Physics (CLO1)
   - Solve problems in engineering environment by applying both theoretical and experimental techniques (CLO2)
   - Understand and acquire skills needed to use physical laws governing real process and to solve them in the engineering environment (CLO3)
   - Develop confidence and fluency in discussing physics in English (CLO4)
2. *Requirement:*
   - Read carefully each question and answer it
   - Write the answers and draw models CLEAN and TIDY

Student Name:……..…..……
Student ID:……

QUESTIONS

Q1. (20 marks) A 28-kg rock approaches the foot of a hill and go upward the hill at an angle α above the horizontal. The coefficients of static and kinetic friction between the hill and the rock are 0.75 and 0.20, respectively. The initial speed of the rock at the foot of a hill is 15 m/s and the maximum height above the foot of the hill reached by the rock is 9.3 m.

(a) Use energy conservation to find the value of the angle α.

(b) Will the rock remain at rest at its highest point, or will it slide back down the hill? If the rock does slide back down, find its speed when it returns to the bottom of the hill.

Q.2 (20 marks) Two balls A and B of mass 0.50 kg and 0.30 kg successively make an elastic collision. The ball A has an initial speed of 4.0 m/s and final speed of 2.0 m/s after the collision. The ball B is initially at rest. Find the speed of B after the collision and the angle between two velocity vectors after the collision.

Q.3 (10 marks) An object *M* of mass m = 0.200 kg is connected to a spring with force constant k = 5.00 N/m and moves on a frictionless horizontal plane. *M* is pulled so that the spring is stretched by 0.100 m and then released with no initial velocity. The displacement of *M* with respect to its equilibrium position is x.

(a) Draw the graphs showing the variation of potential energy and kinetic energy of the system with respect to x on the same figure. Find the velocity of *M* when its potential energy equals its kinetic energy.

(b) Use the graph showing the variation of potential energy to explain the change of the magnitude of the spring force applied on *M* when *M* is released and moves to its equilibrium position.

Q. 4 (20 marks) A solid, uniform cylinder with mass 8.25 kg and diameter 15.0 cm is spinning at 220 revolutions per minute on a thin, frictionless axle that passes along the cylinder axis. You design a friction brake to stop the cylinder by pressing the brake against the outer rim with a normal force of 7.47 N. The cylinder comes to rest after it has turned through 5.25 revolutions.

Find the angular acceleration of the cylinder and the coefficient of kinetic friction between the brake and the rim. Given the moment of inertia of the cylinder with respect to the axis of rotation: $\frac{1}{2}MR^2$.

Q. 5 (20 marks) A flat uniform disk has a radius of 2.00 m. The disk is initially rotating at 3.00 rad/s about a vertical axis through its center. Suddenly, a 70.0-kg person makes a soft landing on the disk at a point near the outer edge and the angular speed of the disk (and the person) becomes 1.38 rad/s. Given the moment of inertia of the cylinder with respect to the axis of rotation: $\frac{1}{2}MR^2$.

Find the mass of the disk. Assume that you can treat the person as a particle. Is this collision elastic? Explain.

Q. 6 (10 marks) A small ball of mass 500 g flying horizontally at 2.25 m/s suddenly collides to a stationary vertical bar at the point 25.0 cm below the top of the bar (Fig. 1). The bar is 0.750 m long, has a mass of 1.50 kg and can rotate about a fixed axis on the ground. After the collision, the ball drops slightly to the ground so that its speed can be ignored.

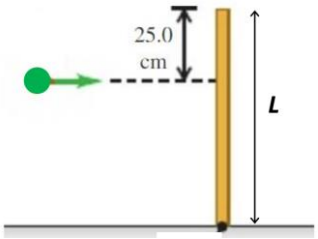

Fig. 1

What is the angular velocity of the bar just after it is hit by the ball, knowing that the moment of inertia of the bar with respect to the axis of rotation: $\frac{1}{3}ML^2$.

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