Prince Sultan University

Department of Mathematics & Physics

PHY 105- General Physics 1

Final Exam

First Semester, Term 171

Tuesday 9/January/2018

Examination Time : 180 minutes

Name: .....

Student I.D. .....

Circle your Section

279	282	285	654
8 – 9:15	9 – 9:50	1 – 2:15	10 – 10:50
Dr. Muaffaq Nofal	Dr. Muaffaq Nofal	Dr. Muaffaq Nofal	Dr. Hazim abu Farsakh

Use the magnitude of the acceleration of gravity = 9.8 m/s^2

Important Instructions:

1. You can use a scientific calculator that does not have programming or graphing capabilities.

*2. You may **NOT** borrow a **calculator** from anyone.*

*3. Do not use **RED pen**.*

*4. This is a closed books and notes exam. Do **NOT** use notes or textbooks.*

*5. There should be **NO** talking during the examination.*

*6. Your will be **expelled** immediately from the exam if your mobile phone is seen or heard.*

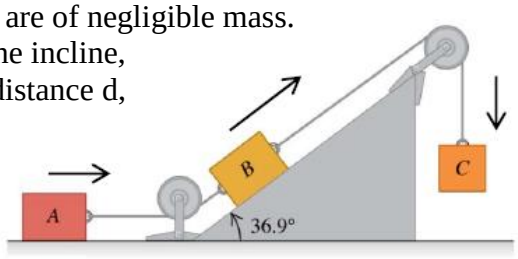
*7. Any signs of **cheating** may cause you being expelled from the exam.*

*8. This examination has **3 parts**. **Part 1** has **8 multiple choice questions**, each question worth **1 point**. **Part 2** has **8 multiple choice questions**, each question worth **2 points. Part3** has **4 workout problems** each problem worth **4 points**.*

Make sure your paper has all the questions and problems.

Part 1: 8 Multiple Choice Questions (1 mark each)

1) Three blocks are connected as shown. The ropes and pulleys are of negligible mass. When released, block C moves downward, block B moves up the incline, and block A moves to the right. After each block has moved a distance d, the force of gravity has done



a) Positive work on A, B, and C.
b) Zero work on A, positive work on B, negative work on C.
c) Zero work on A, negative work on B, positive work on C.
d) Positive work on A, negative work on B, positive work on C.

2) The same constant force F acts for the same time period on three different balls of different masses $m_1 > m_2 > m_3$. Which one of the following statements is correct?
a) The impulse given to m_1 is the largest b) The impulse given to m_2 is the largest
c) The impulse given to m_3 is the largest d) All impulses are the same.

3) Ahmed throws a stone horizontally from the top of a building. At the same instant Khalid releases a similar stone from rest at the same height. Which of the following statements is correct?
a) Ahmed's stone reaches the ground first
b) Khalid's stone reaches the ground first
c) Both stones reach the ground at the same time
d) Both stones have the same initial velocity

4) Which of the following is TRUE concerning the completely elastic collision?
a) Momentum is conserved but kinetic energy is not conserved.
b) Momentum is not conserved but kinetic energy is conserved.
c) Both momentum and kinetic energy are not conserved.
d) Both momentum and kinetic energy are conserved.

5) A bullet is fired with initial speed of 150 m/s at an angle of 60^o above the ground. What is the horizontal component of its velocity after 8 seconds from being fired (neglect air resistance).
a) 3.4 m/s b) 75 m/s c) 130 m/s d) 51.6 m/s

6) A stone is thrown vertically upward from the ground with an initial velocity of 35 m/s. If air resistance is neglected, what is its velocity just before it hits the ground again?
a) -35 m/s b) 35 m/s c) -9.8 m/s d) 0 m/s

7) In the absence of external forces, a moving object will
a) move with constant velocity. b) slow down and eventually come to a stop.
c) move faster and faster. d) stop immediately. .

8) An object is hanging by a string from the ceiling of an elevator. The elevator is moving up at constant speed. What is the tension in the string?
a) zero. b) exactly equals the weight of the object.
c) greater than the weight of the object. d) less than the weight of the object.

Part 2: 8 Multiple Choice Questions (2 marks each)

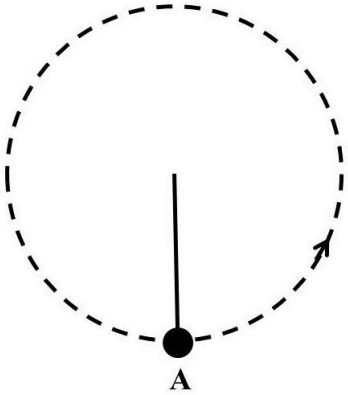
1) A 2 kg mass initially moving with a velocity $v_i = 3\hat{x} + 2\hat{y}$ m/s is acted upon by a force $F = 4\hat{x} - 10\hat{y}$ N for 5 seconds. What is the velocity of the mass at the end of that time?

a) $v_f = 15\hat{x} + 10\hat{y}$ m/s
b) $v_f = 13\hat{x} - 23\hat{y}$ m/s
c) $v_f = 23\hat{x} - 48\hat{y}$ m/s
d) $v_f = 23\hat{x} - 13\hat{y}$ m/s

2) A spring is hanged vertically from the ceiling of the room. When a mass of 13 kg is attached to the lower end of the spring, the spring is stretched by 7 cm. What is the spring constant of that spring?

a) 1820 N/m b) 18.2 N/m c) 185.7 N/m d) 1.86 N/m

3) A 0.2 kg ball is attached to the end of a 50 cm long string and is rotated in a vertical circle. What is the speed of the ball at point A; the exact bottom of the path given that the tension in the string at that point is 14 N.



a) 6.32 m/s

b) 5.92 m/s

c) 3.41 m/s

d) 5.49 m/s

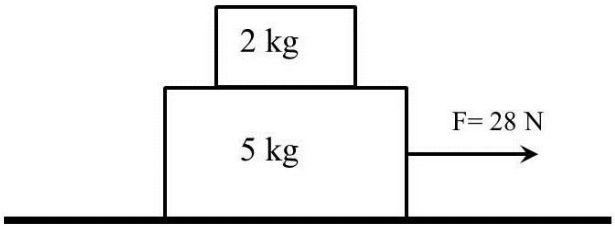
4) A 2 kg block is placed on top of another block of mass 5 kg. The system moves on a frictionless horizontal surface under the action of a force F = 28 N applied to the lower block. Find the minimum coefficient of static friction between the two blocks such that the upper block does not slide off.

a) 0.41

b) 0.20

c) 0.50

d) 2.45



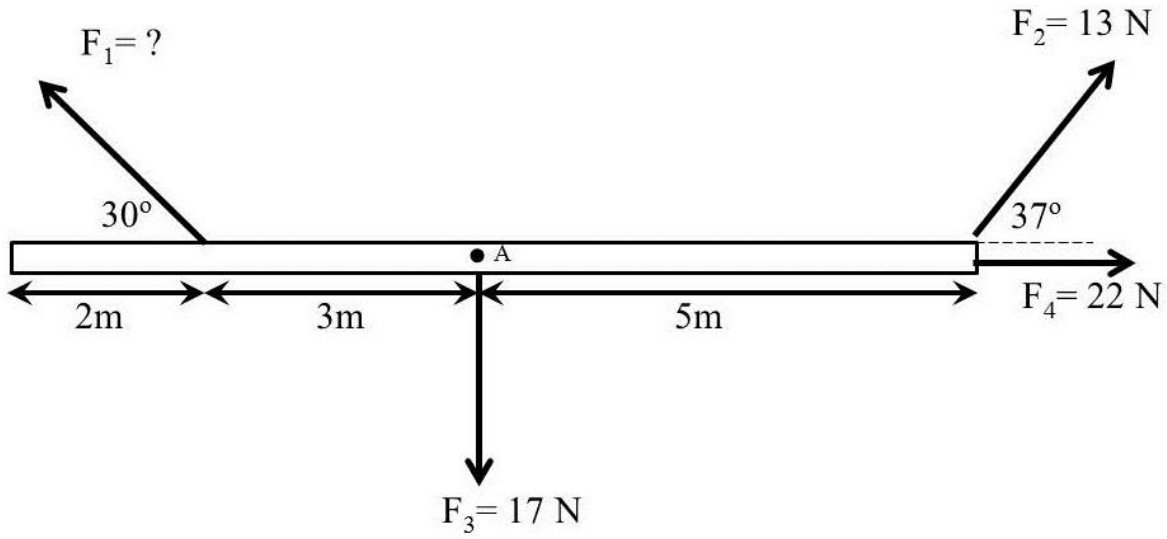
5) A 0.3 kg freely falling ball hits the ground with speed 30 m/s and bounces up at a speed of 22 m/s. If the ball was in contact with the ground for 0.2 seconds, what was the average force from the ground on the ball?

a) 3.12 N b) 15.6 N c) 78 N d) 156 N

6) A ball of mass m_1= 12 kg is moving at 6 m/s towards another ball of mass m_2= 5 kg that is initially at rest. If the balls undergo a head on perfectly elastic collision, what are the velocities of the balls after the collision? Assume no friction.

a) v_{1f} = 8.47 m/s, v_{2f} = 2.47 m/s. b) v_{1f} = 2.47 m/s, v_{2f} = 8.47 m/s.
c) v_{1f} = -8.47 m/s, v_{2f} = 2.47 m/s. d) v_{1f} = -2.47 m/s, v_{2f} = 8.47 m/s.

7) In the shown figure, If the net torque about point A is zero, what is the value of the unknown force F_1?



a) 52 N b) 6.5 N c) 26 N d) 13 N

8) If the density of oil is 10.5 g/inch^3, what is the density of oil in unit of kg/m^3? Given (1 kg = 1000 g and 1 m = 39.37 inch)

a) 1281 kg/m^3 b) 640.7 kg/m^3 c) 0.41 kg/m^3 d) 0.17 kg/m^3

Part 3: Solve the following four problems in the space provided in between showing all your steps (4 marks each)

Problem 1: A bullet of mass 50 g is fired at a speed of 300 m/s towards a 700 g wooden block that rests on a rough horizontal surface. The bullet is stuck inside the block and they both move as one object over the rough horizontal surface until they come to rest again after travelling 30 m.

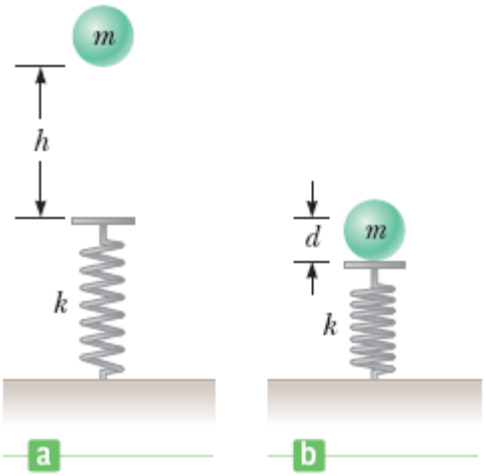
a) (1.5 marks) Calculate the speed of the combined object directly after the bullet is stuck inside the block.

b) (1 mark) Calculate the lost kinetic energy in this collision.

c) (1.5 marks) Calculate the coefficient of kinetic friction between the wooden block and the rough surface.

Problem 2: A sphere of mass 7 kg is dropped from rest from a height of h = 2.8 m above the top of a spring of spring constant 1180 N/m mounted vertically on the floor as shown.

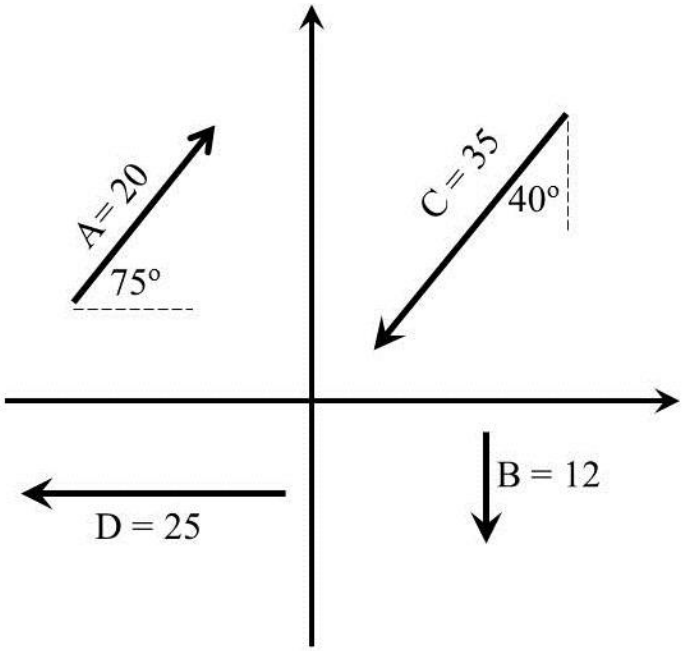
a) (2 marks) Calculate the speed of the sphere when it hits the top of the spring?



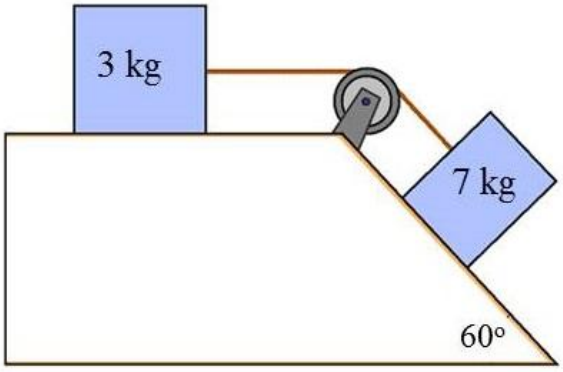
b) (2 marks) Calculate the maximum compression in the spring?

Problem 3:

If $\vec{E} = \vec{A} - \vec{B} + 2\vec{C} - \vec{D}$ where $\vec{A}$, $\vec{B}$, $\vec{C}$ and $\vec{D}$ are the four vectors shown in the graph. Use the algebraic method to calculate the magnitude and direction of vector $\vec{E}$



Problem 4: If the surface on which the blocks in the shown figure are moving is frictionless, calculate the acceleration of the system and the tension in the connecting string.



Scratch paper