Prince Sultan University

Department of Mathematics & Physics

PHY 105- General Physics1

Final Exam

First Semester, Term 151

Tuesday January/5/2016

Examination Time : 120 minutes

Name (Please Print) . . . . . .

Student I.D. . . . . .

Section . . . . . .

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 **4 parts**. **Part 1** has **10 multiple choice** questions, each question worth **1 point**. **Part 2** has **10 multiple choice** questions, each question worth **2 poinst**. **Part 3** has **two** workout problems each problem worth **3 points**. **Part 4** has **two** workout problems each problem worth **4 points.***

	Possible Score	**Student's Total Score**
Part 1 Questions	**10**	
Part 2 Questions	**20**	
P. # 1	**3**	
P. # 2	**3**	
P. # 3	**4**	
P. # 4	**4**	
Total	**44**	**/40**

Part 1: 10 Multiple Choice Questions (1 mark each)

1) The average velocity and the instantaneous velocity of an object will be the same if

a) the object's acceleration is positive. b) the object's acceleration is negative.

c) the object's acceleration is zero. d) They are never the same.

2) A heavy rock and a light rock in free fall (no air resistance) have the same acceleration. The reason the heavy rock doesn't have a greater acceleration is that

a) the force due to gravity is the same on each.

b) the air resistance is always zero in free fall.

c) the ratio of force to mass is the same for both.

d) None of these.

3) An object is hanging by a string from the ceiling of an elevator. The elevator is moving with downward constant acceleration. The tension in the string is:

a) zero

b) less than the weight of the object

c) exactly equals the weight of the object

d) greater than the weight of the object

4) In the absence of external forces, a moving object will

a) stop immediately. b) slow down and eventually come to a stop.

c) move faster and faster. d) move with constant velocity.

5) No work is done by gravity on a bowling ball that rolls along a bowling alley because

a) no force acts on the ball.

b) no distance is covered by the ball.

c) no potential energy is being converted to kinetic energy.

d) the gravitational force on the ball is at right angles to the ball's direction of motion.

6) Consider two carts, of masses *m* and 2*m*, at rest on an air track. If you push first one cart for 3 seconds and then the other for the same length of time, exerting equal force on each, the momentum of the light cart compared to the heavy cart is

a) four times b) twice c) equal d) one-half

7) Which of the following is TRUE concerning the completely inelastic 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 conserved

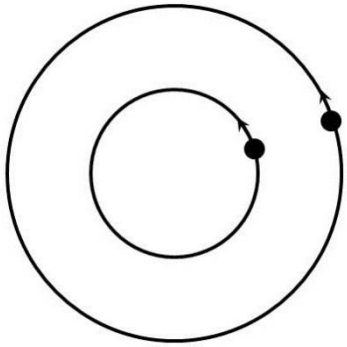
d) Both momentum and kinetic energy are not conserved

8) If an object is moving in a circular motion at constant speed then,

a) its centripetal acceleration is zero b) its tangential acceleration is zero

c) its total acceleration is zero d) anything is possible

9) Two objects are moving in a circular motion at two different circles as shown. If the two objects have the same angular speed, then



a) they must have the same angular acceleration.

b) they must have two different angular accelerations.

c) they must have the same linear speed.

d) they must have two different linear speeds.

10) Which of the following is **NOT TRUE** about torque?

a) the SI unit of torque is (Newton×second)

b) Torque is the effectiveness of a force in rotating an object about some axis

c) The value of the torque depends on the chosen axis of rotation.

d) Torque is a vector quantity.

Part 2: 10 Multiple Choice Questions (2 mark each)

1) The velocity of an object is increased uniformly from 5 m/s to 11 m/s within a distance of 16 m. The acceleration of the object is:

a) 25 m/s^2 b) 0.7 m/s^2 c) 2.9 m/s^2 d) 3 m/s^2

2) A freely falling object is dropped from rest from a height of 60 m above the ground. What is its velocity when it reaches a height of 15 m?

a) 69.3 m/s b) 29.7 m/s c) 49.5 m/s d) 89.1 m/s

3) Two forces $\vec{F}_1 = (35\hat{x} + 17\hat{y})\ N$ and $\vec{F}_2 = (-3\hat{x} + 7\hat{y})\ N$ are acting on a 4 kg object, what is the resulting acceleration of the block?

a) $\vec{a} = (4\hat{x} + 8\hat{y})\ m/s^2$. b) $\vec{a} = (8\hat{x} + 4\hat{y})\ m/s^2$.

c) $\vec{a} = (6\hat{x} + 8\hat{y})\ m/s^2$. d) $\vec{a} = (8\hat{x} + 6\hat{y})\ m/s^2$.

4) A bowling ball rolls off of a 1.25 meter tall horizontal table. It hits the ground 1.75 meters from the base of the table. What was the launch speed?

a) 2.7 m/s b) 8.1 m/s c) 3.5 m/s d) 1.6 m/s

5) A 1.5 kg ball moving at 16 m/s hits a wall and bounces back with a speed of 9 m/s. If the ball was in contact with the wall for 0.3 s, what is the average force from the wall on the ball?

a) 35 N b) 75 N c) 125 N d) 37.5 N

6) Two balls of mass 2 kg and 8 kg move towards each other and undergo a head on collision. Assume that the collision between them is perfectly elastic. If the initial velocities of the balls are 12 m/s and -5 m/s respectively, what are the velocities of the balls after the collision? Assume no friction.

a) -15.2 m/s and 1.8 m/s respectively b) 15.2 m/s and -1.8 m/s respectively

c) 4 m/s and -16 m/s respectively d) -4 m/s and 16 m/s respectively

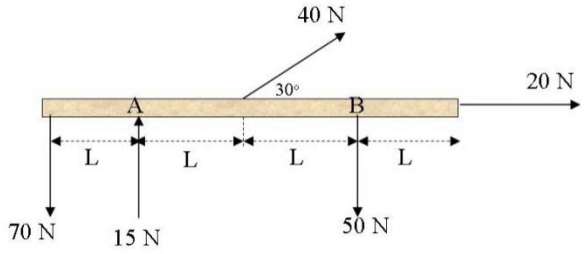
7) A particle is traveling in a circle of radius r = 2.5 m with an angular velocity of 8 rad/s. What is the centripetal acceleration of the particle?

a) 3.2 m/s^2 b) 20 m/s^2 c) 25.6 m/s^2 d) 160 m/s^2

8) A 0.2 kg stone is attached to the end of a 80 cm long string and is rotated in a vertical circle. If the speed of the stone at the bottom point is 3 m/s, What is the tension in the string at this point?

a) 0.4 N b) 4.2 N c) 2.4 N d) 3.7 N

9) In the figure shown, if L = 2 m, what is the net torque about point A?



a) 20 N.m clockwise b) 40 N.m clockwise

c) 60 N.m clockwise d) 80 N.m clockwise

10) A force of $\vec{F} = 15\hat{x} - 12\hat{y}\ N$ is applied at the point (2m,8m). What is the torque generated by this force at the point (9m,5m)?

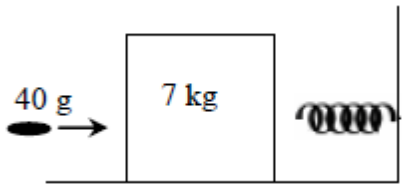
a) 39 N.m clockwise b) 39 N.m counterclockwise

c) 129 N.m clockwise d) 129 N.m counterclockwise

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

Question 1(3 marks):

A block of mass 7 kg is placed on a frictionless surface beside a massless spring of spring constant k = 2800 N/m as shown in the figure. A bullet of mass 40g is fired toward the block with speed of 500 m/s. The bullet enters the block and leaves it from the other side with speed of 150 m/s.

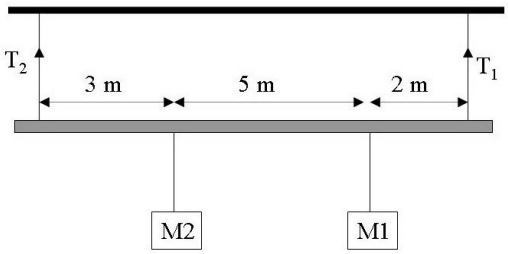


a) Find the speed of the block directly after the bullet leaves it.

b) Find the maximum compression distance of the spring.

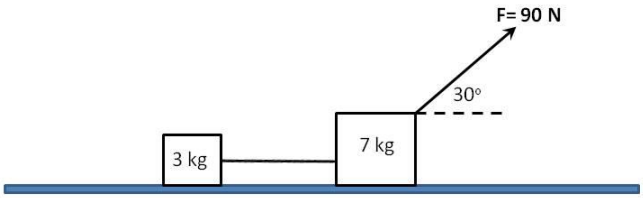
Question 2(3 marks):

A 10 m long bar is hanged from the ceiling by two ropes while two masses are connected to it as shown in the figure. If M_1= 2 kg and M_2 =7 kg, calculate the tension in both ropes neglecting the mass of the bar?



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

Question 3 (4 marks): A force of 90 N directed at 30^o above horizontal pulls two boxes of masses 3 kg and 7 kg connected by a string along a rough horizontal surface. The coefficient of kinetic friction between the surface and each box is 0.6



a) Draw the free body diagram for each object

b) Calculate the acceleration of the system

b) Calculate the tension in the connecting string

Question 4 (4 marks):

A particle was initially traveling with an angular speed of 9 rad/s in a circular path of radius r = 2.5 m. The particle then begins to slow down with an angular acceleration of -1.8 rad/s^2.

a) What is the angular speed of the particle after 3 seconds?

b) What is the angular displacement of the particle after 3 seconds in revolutions?

c) What is the centripetal acceleration of the particle after 3 seconds?

d) What is the total acceleration of the particle after 3 seconds?

Good Luck