PRINCE SULTAN UNIVERSITY
جامعة الأمير سلطان

Department General Sciences

Physics 1 (PHY105)
Final Exam.

Second Semester, Term 162
Date: Tuesday. May. 23, 2017

Student Name:		
ID number:		
Section number or time:	Section 431/9AM	Section 435/8AM
Instructor's name:	Dr. Asif Zaidi	

Important instructions:

1. Examination time: 3 hours.
2. Write your name before starting with the questions.
3. Switch off your mobile phone and put any books and notes away.
4. Check that you have 9 pages in total, including this cover page and a scratch paper. DO NOT REMOVE SCRACH PAPER.
5. You may use a calculator but you may *not* borrow one.

Good Luck!

Mark	
Part1	
Part2	
Part3	----------
Q1	
Q2	
Q3	
Q4	
Total	

Part (1): 10 multiple choice questions, 1point each.
Circle the letter of the most correct answer using a pen. **Use $g = 9.80\ m/s^2$.**

Q (1)

Consider following physical quantities, which one is a vector?

A) Time. B) Speed. C) Mass. D) Impulse.

Q (2)

"The acceleration of a body is directly proportional to the net force acting on it and inversely proportional to its mass." This statement is:

A) Newton's First Law of motion
B) Newton's second Law of motion
C) Newton's third Law of motion
D) None of these

Q (3)

A ball is dropped from 4.9 m above the ground. How long does it take to reach the ground?

A) 0.1 sec. B) 1 sec. C) 4.9 sec. D) 9.8 sec.

Q (4)

A ball is set in motion in free space at a speed of 10 m/s:

A) The ball will stop after some time.

B) The ball will accelerate with time.

C) The ball will continue to move with initial speed for forever.

D) None of the above is true.

Q (5)

For every physical process in the universe if system is isolated:

A) Total momentum is always conserved.

B) Momentum is never conserved.

C) Momentum is conserved in some processes only.

D) In case if momentum is not conserved kinetic energy is conserved.

Q (6)

A 2000 kg car can accelerate from rest to 108 km/h in 4 seconds. The power of its engine is:

A) 100 kW. B) 150 kW. C) 225 kW. D) 250 kW.

Q (7)

A mass of 10 kg slides down on a frictionless incline plane inclined at an angle of 60°. Its acceleration is given by:

A) 3.0 m/s^2. B) 4.9 m/s^2. C) 9.8 m/s^2. D) 8.49 m/s^2.

Q (8)

The apparent weight of a 60 kg man in an elevator with upward acceleration of 2.2 m/s^2 is:

A) 266 N B) 400 N C) 450 N D) 720 N

Q (9)

A box of mass 5 kg is pushed along x- axis with a force of 50 N. If frictional force on the box is 30 N, acceleration of the box is:

A) 4 m/s^2 B) 6 m/s^2 C) 15.3 m/s^2 D) 20 m/s^2

Q (10)

To open a revolving door a tangential force is applied at a distance of 0.94 m. If the minimum torque required to open the door is 3.1 N.m, what force must be applied?

A) 1 N B) 3.3 N C) 4.3 N D) 5.6 N

Part (2): 5 multiple choice questions, 2 points each.

Q (1)

A body moves such that its initial position vector is $\overrightarrow{r_i} = 2\hat{x} - 3\hat{y}$ and the final position after 2 seconds is given by position vector $\overrightarrow{r_f} = 4\hat{x} + 3\hat{y}$. What is the speed of this body?

(A) 0.1 m/s B) 1 m/s C) 3.16 m/s D) 12.64 m/s

Q (2)

A 5 kg block is attached to a horizontal spring with spring constant 400 N/m. The block rests on a frictionless surface. If this block is pulled out to 5 cm and released, the speed of the block when it reaches equilibrium position is:

A) 0.15 B) 0.45 m/s C) 0.65 m/s D) 0.85 m/s

Q (3)

A student of mass 72 kg wins a prize in a game and he jumps up with joy. If the jump results in an upward speed of 2.1 m/s, what is the average force floor exerts on student if his contact time with floor is 0.36 seconds?

A) 150 N $\hat{y}$ B) 200 N $\hat{y}$ C) 390 N $\hat{y}$ D) 420 N $\hat{y}$

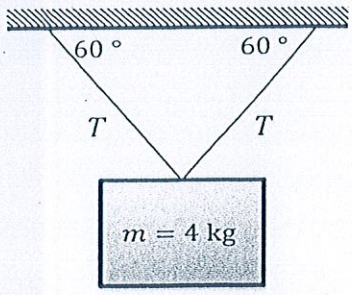
Q (4)

A ball of mass 0.5 kg is attached at the end of a string of length 1.5 m. The ball is rotated over head in a horizontal circle. The string breaks if tension exceeds 50 N. What is the maximum angular speed the ball can have before string breaks?

A) 1.66 rad/s. B) 4.8 rad/s. C) 8.17 rad/s. D) 10.4 rad/s.

Q (5)

A picture is hanging with two strings as see diagram. Tension in each string is:



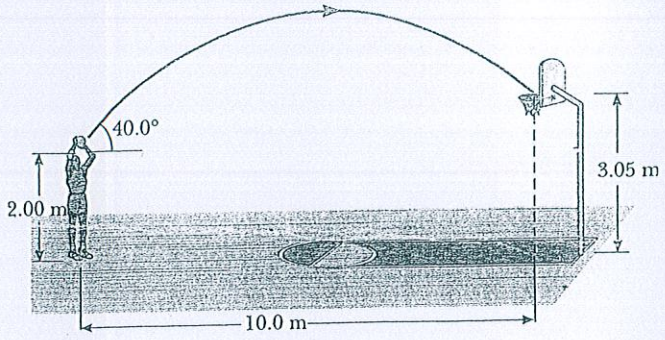
A) 4 N B) 22.6 N C) 35.3 N D) 46 N

Part 3: Solve the following **four** problems in the provided space.
Show all your work and include the appropriate units. **Use $g = 9.8$ m/s^2.**

Q 1. (5 marks)

A basketball player who is 2 m tall is standing on the floor 10 m from the basket, as in figure. If he shoots the ball at a 40° angle with the horizontal and the basket height is 3.05 m.

(a) At what initial speed must he throw the ball so that it goes through the net exactly?

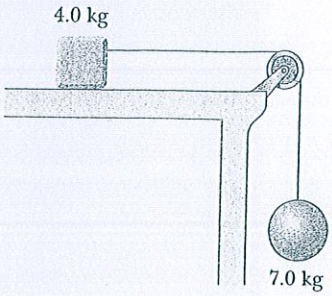


(b) What is the velocity vector and the speed of the ball as it passes through the ring?

Q 2. (5 marks)

A ball m_2 = 7 kg and a mass m_1 = 4 kg are connected by a massless string (See diagram). The coefficient of kinetic friction between 4 kg mass and the surface is 0.3. When released the ball moves downwards.

(a) Draw a free body diagram of all forces on both cube and the ball. Indicate axis you choose on the given diagram.



(b) What is the acceleration of the ball and cube?

(c) What is the tension in the string?

Q 3 (5 marks)

The driver of 1000 kg car traveling at 126 km/h applies his brakes to avoid hitting a second car in front of him. After the brakes are applied a constant kinetic friction force of magnitude 8000 N acts on the car.

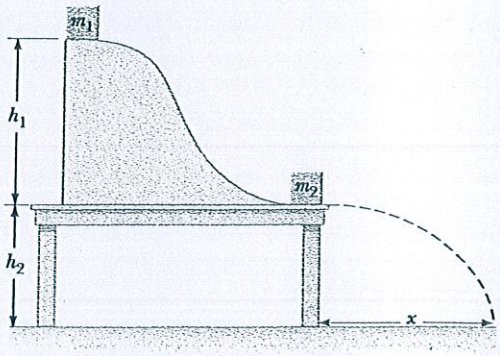
(a) At what minimum distance should the brakes be applied to avoid hitting the car in front?

(b) If the distance between two cars is initially 30 m, at what speed would the collision occur?

Q 4 (5 marks)

A block with mass m_1 = 1 kg is released from rest on a frictionless track at a distance h_1 = 2.5 m above the top of a table. It then collides elastically with a block having same mass m_2 = 1 kg that is at rest on the table.

(a) What is the velocity of mass m_1 just before collision?



(b) What is the velocity of m_2 just after collision?

(c) What is the horizontal distance "x" where block m_2 hits the ground if measured from the end of the table? When height of table is h_2 = 2 m.

(d) How high above the track does the m_1 = 1 kg block move up after collision?

Scratch sheet. DO NOT REMOVE.