Prince Sultan University

Deanship of Educational Services
Department of Mathematics
and General Sciences

COURSE DETAILS:

Physics I	**PHY105**	**FINAL EXAM**
Semester:	Second Semester - Term 182	
Date:	Monday April 29, 2019	
Time Allowed:	180 minutes	

STUDENT DETAILS:

Student Name:	
Student ID Number:	
Section:	Circle section number: 142 148 145
Instructor's Name:	Circle the name: Dr. Hazem Abu-Farsakh Dr. Muaffaq Nofal

INSTRUCTIONS:

- You may use a scientific calculator that does not have programming or graphing capabilities. NO borrowing calculators.
- NO talking or looking around during the examination.
- NO mobile phones. If your mobile is seen or heard, your exam will be taken immediately.
- Show all your work when required and be organized.
- You may use the back of the pages for extra space, but be sure to indicate that on the page with the problem.
- Assume the magnitude of the acceleration of gravity on Earth $\boldsymbol{g = 9.8\ \mathrm{m/s^2}}$

GRADING:

	Part 1	**Part 2**	**Part 3**			**Total**
Mark						
Full Mark	10	18	12			**40**

Part 1 (10 marks): 10 multiple choice questions (1 mark each)
Indicate the answer choice that best completes the statement or answers the question

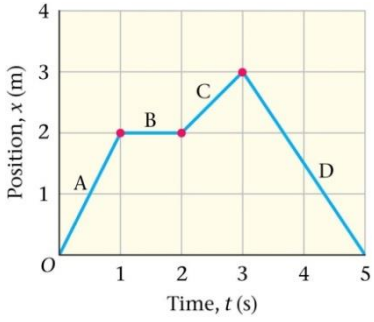
Q1. Which of the following has dimensions of distance?
a) $2at$
b) a/t^2
c) v^2/a
d) $\sqrt{2av}$

Q2. A car moves with a speed of 65 mi/h. What is its speed in m/s? (1 mile = 1.61 km)
a) 145.3 m/s
b) 29.1 m/s
c) 376.7 m/s
d) 11.2 m/s

Q3. A car starts from rest to accelerate at a constant rate of 2 m/s^2 in a straight line for 3 seconds and then continues to move at constant velocity for another 3 seconds. What is its average velocity during the 6 seconds?
a) 4.5 m/s
b) 9 m/s
c) 18 m/s
d) 27 m/s

Q4. A bag is dropped from a hot air balloon moving vertically upwards at 2 m/s. It takes the bag 3 seconds to reach the ground. Neglecting air resistance, what was the height of the bag above the ground when it was dropped?
a) 50.1 m
b) 38.1 m
c) 44.1 m
d) 6 m

Q5. The figure shows position versus time for an object. Which of the following statements is correct?
a) The object moves at constant velocity during segment B
b) The object moves at constant velocity during segment D
c) The objects decelerates during segment B
d) The object speeds up during segment A



Q6. A car moving at 20 m/s towards East changes its velocity to 28 m/s towards South in 4 seconds. What is the magnitude of its average acceleration?
a) 8.6 m/s^2
b) 12 m/s^2
c) 3 m/s^2
d) 8 m/s^2

Q7. What is the direction angle of the vector $\vec{r} = -3\,\hat{x} + 4\,\hat{y}$?

a) 53.1°
b) 143.1°
c) 306.9°
d) 126.9°

Q8. The total work done on an object is *always*:

a) conserved
b) equal to the change in its potential energy
c) equal to the change in its mechanical energy
d) equal to the change in its kinetic energy

Q9. The change in the gravitational potential energy of an object ΔU is *always* equal to:

a) negative the change in its kinetic energy
b) negative the work done by non-conservative forces
c) negative the work done by gravity
d) None of the above

Q10. A 1400 kg car is to increase its speed from 10 m/s to 25 m/s in 5 seconds. Howe much engine power is required?

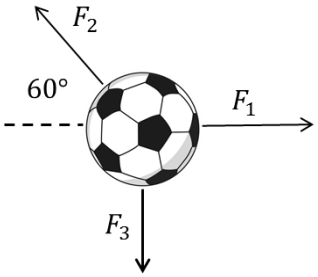
a) 73.5 kW
b) 4.2 kW
c) 63 kW
d) 105 kW

Part 2 (18 marks): 9 multiple choice questions (2 marks each)
Indicate the answer choice that best completes the statement or answers the question

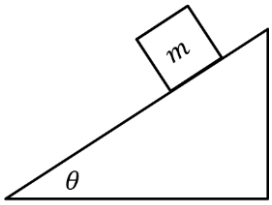
Q1. A ball is kicked from the ground at 20 m/s at an angle of 60° above horizontal. Neglecting air resistance, what is the maximum height reached by the ball?
a) 20.4 m
b) 5.1 m
c) 4.1 m
d) 15.3 m

Q2. You throw a stone horizontally from a height of 1.5 m with an initial speed of 10 m/s. Neglecting air resistance, what horizontal distance it covers before it reaches the ground?
a) 15 m
b) 4.03 m
c) 5.53 m
d) 7.03 m

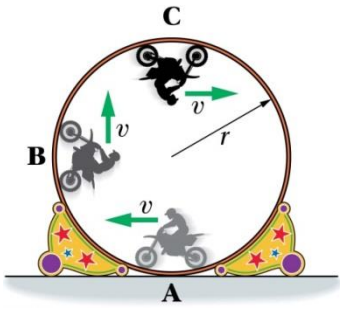
Q3. Three forces act on a ball as shown, where $F_1 = 8$ N, $F_2 = 16$ N. $F_3 = 5$ N. what is the magnitude of the net force acting on the ball?
a) 8.86 N
b) 5 N
c) 6.93 N
d) zero



Q4. In the figure, a block of 3 kg mass slides down a rough surface inclined at an angle $\theta = 40°$ above horizontal. If the coefficient of kinetic friction between the block and the surface is $\mu_k = 0.32$, what is the magnitude of the block's acceleration?
a) 6.3 m/s^2
b) 3.9 m/s^2
c) 2.4 m/s^2
d) 7.5 m/s^2



Q5. A 70 kg motorcyclist moves with a constant speed of $v = 15$ m/s on a vertical circular path of radius 3 m. How much normal force acts on the motorcyclist at the topmost point of his path (point C)?
a) 5936 N
b) 4564 N
c) 5250 N
d) 686 N



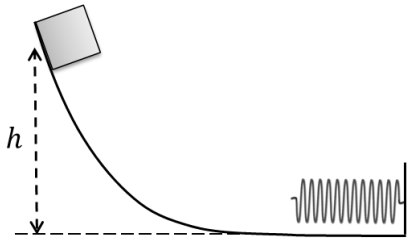
Q6. A 0.12 kg apple falls from rest from a height of 3.5 m above the ground. The apple hits the ground with a speed of 5.1 m/s. How much non-conservative work is done on the apple?
a) −1.56 J
b) −4.12 J
c) −5.68 J
d) −2.56 J

Q7. A 58 grams tennis ball moving horizontally at 30 m/s is hit by a racket. It bounces back with a speed of 35 m/s. What is the magnitude of the impulse delivered to the tennis ball?

a) 3.77 N.s
b) 0.29 N.s
c) 2.03 N.s
d) 1.74 N.s

Q8. A 0.15 kg block starts to slide from rest from a height of $h = 32$ cm down a frictionless surface to hit a spring on a horizontal surface, as shown. If the maximum compression of the spring is 3 cm, what is the spring constant k?

a) 15.7 N/m
b) 1250.4 N/m
c) 1045.3 N/m
d) 940.5 N/m



Q9. A 2 kg ball moving at 6 m/s hits a 4 kg ball initially at rest in a head on collision. If the collision is completely elastic, what will be the speed of the 2 kg ball after the collision?

a) 2 m/s in the same initial direction
b) 3 m/s in the same initial direction
c) 3 m/s opposite to the initial direction
d) 2 m/s opposite to the initial direction

Part 3 (12 marks):

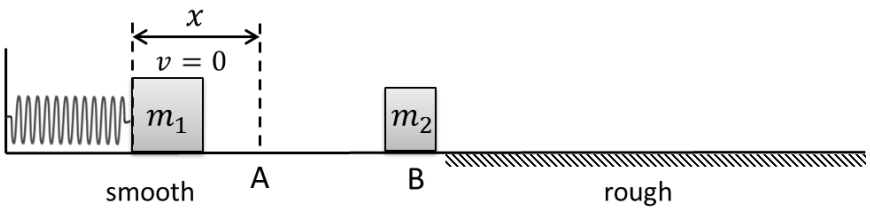
Solve the following three problems in the provided space and *show your work in detail*.

Q1. (4 marks) In the figure, two masses $m_1 = 5$ kg and $m_2 = 3$ kg, are connected by a string over an ideal pulley as shown. Neglecting frictional forces, determine:

a) The acceleration of the system

b) The tension in the string

Q2. (4 marks) A spring with a force constant of $k = 1200$ N/m is compressed by $x = 2\ cm$ using a block $m_1 = 3$ kg on a smooth horizontal surface. The block was then released from rest. After leaving the spring the block makes a head on collision with a second block $m_2 = 1.5$ kg initially at rest. The two blocks stick together and continue to slide on a rough surface until they come to stop. The coefficient of kinetic friction between the blocks and the rough surface is $\mu_k = 0.25$. Determine:

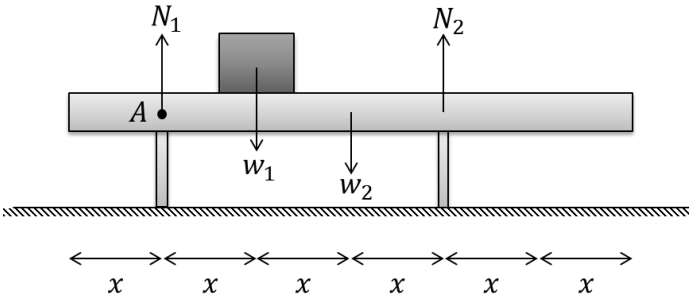


a) The speed of m_1 when it leaves the spring at point A

b) The speed of the two blocks just after the collision at point B

c) The distance the two blocks travel on the rough surface before they come to stop.

Q3. (4 marks) A block of mass $m_1 = 4$ kg is resting on a uniform plank of mass $m_2 = 8$ kg. The plank is supported by two pillars, as shown, where $x = 0.5$ m. The system is in equilibrium. Determine the magnitude of the two normal forces acting on the plank by the pillars (N_1 and N_2). Take the axis of rotation to be at the pillar on the left (point A).



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