Prince Sultan University
Department of Mathematics and General Sciences

Physics I (PHY105)
Final Exam

First Semester, Term 121
Date: Saturday 12/1/2013

Name:	
ID number:	
Section number and time:	
Instructor's name:	

Important instructions:

1. Examination time: 120 minutes.
2. Write your name now before starting with the questions.
3. Switch off your mobile phone and put any books and notes away.
4. Check that you have 7 pages in total, including this cover page and a blank page.
5. You may use a calculator but you may *not* borrow a calculator from anyone.

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	marks
Part 1	
Part 2	
TOTAL	/35

Part 1: *Twenty* multiple choice questions, 1.5 marks each.
Circle the letter of the closest answer. Use $\boldsymbol{g}$ **= 10 m/s^2** (g = acceleration of gravity).

Q1. Which of the following quantities has the dimensions of speed?

a) $\frac{1}{2} a\, t^2$ b) $\sqrt{at}$ c) $(2x/a)^{1/2}$ d) $(2ax)^{1/2}$

Q2. How many significant figures are in -2.70×10^3?

a) 3 b) 6 c) 2 d) 1

Q3. A rock was thrown straight upward at 50 m/s. Ignoring air resistance, how long it takes the rock return to its launching point?

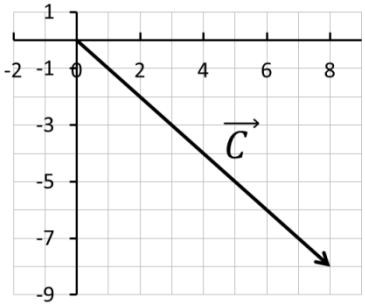
a) 2.5 s b) 5 s c) 10 s d) 50 s

Q4. Ahmad runs 60 m in 10 seconds in a straight line, stops, and then walks back to the starting point in 60 seconds. Ahmad's average *velocity* for the complete round trip is:

a) 0 m/s b) 3.5 m/s c) 7 m/s d) 1.7 m/s

Q5. Which of the following describes the vector $\overrightarrow{C}$ shown in the figure?

a) $\overrightarrow{C} = 8\,\hat{x} + 8\,\hat{y}$
b) $\overrightarrow{C} = 8\,\hat{x} - 8\,\hat{y}$
c) $\overrightarrow{C} = -8\,\hat{x} - 8\,\hat{y}$
d) $\overrightarrow{C} = 5.7\,\hat{x} - 5.7\,\hat{y}$



Q6. Two forces $\overrightarrow{F_1} = 3\hat{x} - 2\hat{y}$ N and $\overrightarrow{F_2} = 4\hat{x} - 5\hat{y}$ N affect a 2 kg object. What is the magnitude of the net force acting on the object?

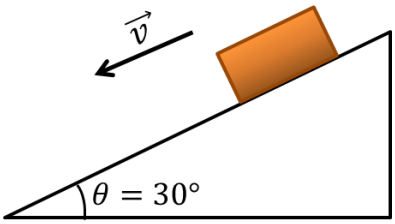
a) 0 N b) 9.9 N c) 7 N d) 14 N

Q7. A 40 kg box is pushed across a rough level floor using a constant force of 110 N. The box slides with a constant acceleration of 1.5 m/s^2. What is the magnitude of the friction force acting on the box?

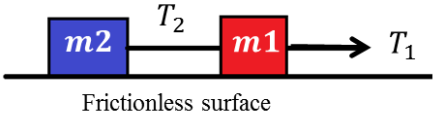
a) 0 N b) 60 N c) 50 N d) 110 N

Q8. A 5 kg object is sliding down a rough surface inclined at 30° with the horizontal. Given that the friction force has a magnitude of 5 N, what is the acceleration of the object?

a) 5 m/s^2 b) 4 m/s^2
c) 0 m/s^2 d) 50 m/s^2

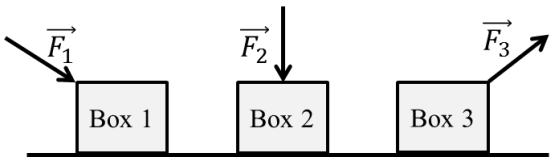


Q9. Two objects $m1 = 2$ kg and $m2 = 4$ kg on a frictionless horizontal surface are connected by a string. The object $m1$ is pulled using the force $T1 = 48$ N as shown. What is the tension $T2$ in the string?



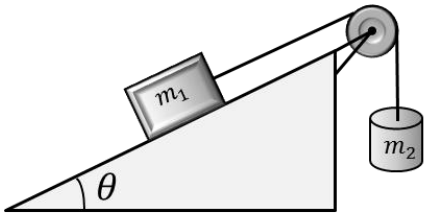
a) 48 N b) 24 N c) 96 N d) 32 N

Q10. Three forces are acting on three *identical* boxes on a horizontal surface, as shown. The three forces are equal in magnitude ($F_1 = F_2 = F_3$). Rank the boxes in order of *increasing* magnitude of the normal force.



a) Box3, Box1, Box2 b) Box1, Box3, Box2
c) Box2, Box3, Box1 d) The normal force is the same in all the cases

Q11. The mass m_1 is placed on an inclined frictionless surface and attached to m_2 using a rope and an ideal pulley, as shown in the figure. The system remains at rest when $m_2 = 20$ kg and $\theta = 30°$. What is the value of m_1?



a) 23.1 kg b) 20.0 kg
c) 40.0 kg d) 30.0 kg

Q12. For a freely falling object (ignoring air resistance), which of the following quantities is conserved:

a) Momentum b) Mechanical energy
c) Potential energy d) Kinetic energy

Q13. A 200 g ball falls vertically downward. It hits the ground with a speed of 2.0 m/s and bounces straight upward with a speed of 1.5 m/s. The magnitude of the change in the ball's momentum is:

a) 0.3 N.s b) 0.7 N.s c) 0.4 N.s d) 0.1 N.s

Q14. What average force is required by a goalkeeper to stop a 400 g ball moving at 30 m/s in 0.04 seconds?

a) 300 N a) 0.48 N b) 12 N c) 180 N

Q15. An 80 kg ice skater moving at 4 m/s meets a 60 kg skater at rest. If the two skaters stick together, their speed just after the collision is about:

a) 3.0 m/s b) 4.0 m/s c) 1.7 m/s d) 2.3 m/s

Q16. A 1200 kg cannon fires a ball whose mass is 70 kg horizontally with a speed of 50 m/s relative to the Earth. The speed at which the cannon recoils is:

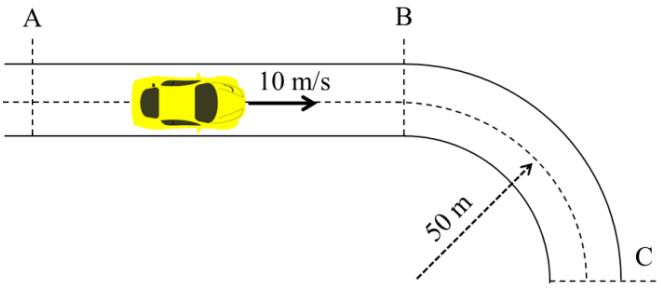
a) 857 m/s b) 47 m/s c) 2.9 m/s d) 12.1 m/s

Q17. The driver of a 2200 kg truck notices that the truck slows from 20 m/s to 15 m/s as it travellers a distance of 130 m along a level ground (horizontal). How large a force opposes the motion?

a) 1481 N b) 385000 N c) 5500 N d) 212 N

Q18. A 1200 kg car travels along a straight 480 m portion of highway (from A to B as indicated on the figure) at a constant speed of 12 m/s. What is the total work done on the car as it travels from A to B?

a) 14400 J
b) 57600 J
c) 86400 J
d) 0 J



Q19. Referring to the previous question, at B the car encounters a curve of radius 50 m as indicated. It follows the road from B to C traveling at a constant speed of 12 m/s. what is the magnitude of the static friction force between the tires and the road as the car travels along the curve from B to C?

a) 2.88 N b) 3456 N c) 288 N d) 8.64×10^6 N

Q20. A 1.5 kg block sliding on a horizontal frictionless surface at 3 m/s encounters a spring with a spring constant of 450 N/m. The maximum compression in the spring (when the block comes momentarily to rest) is:

a) 52 cm b) 1.0 cm c) 0.17 cm d) 17 cm

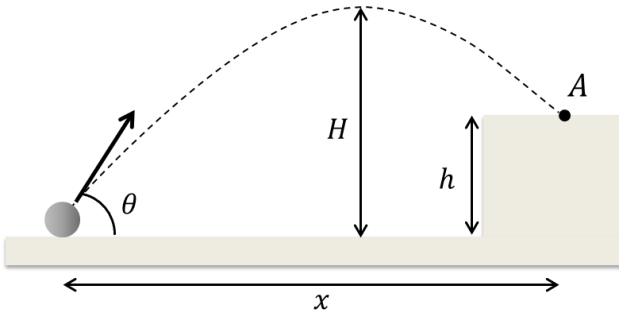
End of part 1

Part 2: Solve the following two problems in the provided space.
Show ALL the steps in your solution and include the appropriate ***units*** in the ***answer space***.
Use $\boldsymbol{g = 10\ m/s^2}$ (g = acceleration of gravity).

Q1. *(4 points)* A 70 kg cyclist riding his 15 kg bike at 10 m/s encounters a 12 m high hill. He arrives at the top of the hill with a speed of 2 m/s. If the work done by him was 9120 J, calculate the work done by frictional forces.

Answer: _____

Q2. *(3 points)* A ball kicked toward a cliff of height h with an initial speed of 30 m/s at an angle of $\theta = 60°$ above the horizontal, as shown in the figure. 5 seconds later, the ball strikes at point A on the cliff.



a) What is the horizontal distance between the launching point and point A (x in the figure)?

Answer: _____

b) What is the height h of the cliff?

Answer: _____

c) What is the maximum height H reached by the ball?

Answer: _____

End of part 2

BLANK SHEET. NO SOLUTIONS OR ANSWERS WILL BE CONSIDERED ON THIS SHEET