Prince Sultan University

Deanship of Educational Services
Department of Mathematics
and General Sciences

COURSE DETAILS:

Physics I	**PHY105**	**MAJOR EXAM II**
Semester:	Second Semester - Term 182	
Date:	Wednesday April 3, 2019	
Time Allowed:	60 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:

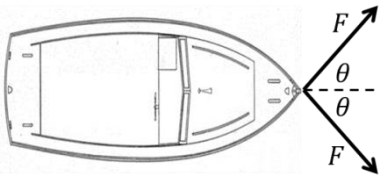
- You may use a scientific calculator that does not have programming or graphing capabilities. NO borrowing calculators.
- NO talking or looking around during the examination.
- NO mobile phones. If your mobile is seen or heard, your exam will be taken immediately.
- Show all your work when required 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 - Q1**	**Part 2 - Q2**			**Total**
Mark						
Full Mark	**9**	**3**	**3**			**15**

Part 1 (9 marks): Indicate the answer choice that best completes the statement or answers the question

Q1. Two equal forces of magnitude $F = 40$ N pull on a 150 kg boat as shown, where $\theta = 50°$. Assuming no frictional forces, what is the magnitude of the boat's acceleration?

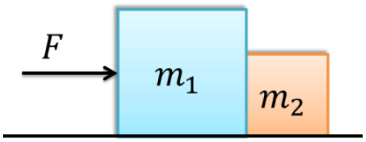


a) 0.34 m/s^2
b) 0.41 m/s^2
c) 0.20 m/s^2
d) 0.17 m/s^2

Q2. What is the apparent weight of a 72 kg astronaut in a rocket during takeoff, given that the rocket accelerates straight up with an acceleration of 30 m/s^2?

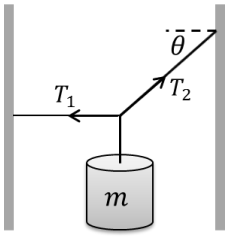
a) 1454.4 N
b) 2160 N
c) 7056 N
d) 2865.6 N

Q3. Two boxes rest on a smooth horizontal surface next to each other, as shown, where $m_1 = 5$ kg and $m_2 = 3$ kg. When m_1 is pushed with an unknown horizontal force F as shown the boxes accelerate at 1.5 m/s^2. How much is the contact force between the two boxes?



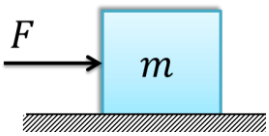
a) 15 N
b) 12 N
c) 9 N
d) 4.5 N

Q4. A mass m is suspended by cables as shown. If the angle $\theta = 35°$ and the tension $T_2 = 342$ N, what is the value of the mass m?



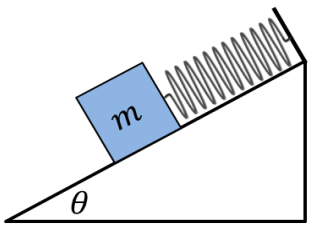
a) 28.6 kg
b) 20.0 kg
c) 280.2 kg
d) 34.7 kg

Q5. A 5 kg box is initially at rest on a rough horizontal surface as shown. Given that the coefficients of static and kinetic friction between the box and the surface are $\mu_s = 0.6$ and $\mu_k = 0.2$, respectively, how much friction force will act on the box when it is pushed horizontally with a force $F = 18$ N?



a) 18 N
b) 9.8 N
c) 29.4 N
d) 49 N

Q6. A 3 kg mass sits on smooth surface inclined at an angle of $\theta = 30°$ above horizontal and attached to a spring as shown. The mass is in equilibrium. Given the spring constant is 180 N/m, what is the extension in the spring?

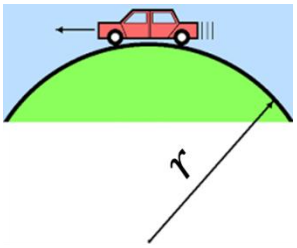


a) 16.33 cm
b) 40.41 cm
c) 8.17 cm
d) 14.15 cm

Q7. If the maximum speed a car can have on a horizontal circular path of radius 20 m without skidding is 12 m/s, what is the coefficient of static friction between the tires and the road?

a) 0.06
b) 0.52
c) 0.73
d) 0.81

Q8. A car moving at a constant speed of 15 m/s encounters a bump in the road that has a circular cross section with a radius of curvature of 30 m. What is the apparent weight of a 70 kg person in the car as the car passes over the top of the bump?



a) 161 N
b) 213 N
c) 525 N
d) 1211 N

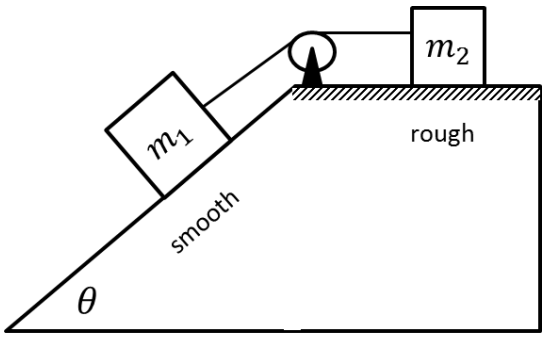
Q9. How much power is required to accelerate a 1800 kg car from rest to 90 km/h in 5 seconds?

a) 1458 kW
b) 162 kW
c) 45 kW
d) 112.5 kW

Part 2 (6 marks): Solve the following TWO problems in the provided space and *show your work in detail*.

Q1. In the figure, two masses $m_1 = 3$ kg, $m_2 = 1.75$ kg are attached by a string over an ideal pulley as shown. The inclined surface is at an angle of $\theta = 53°$ above the horizontal. The coefficient of kinetic friction between m_2 and the horizontal surface is 0.21, while the inclined surface is smooth. Calculate:

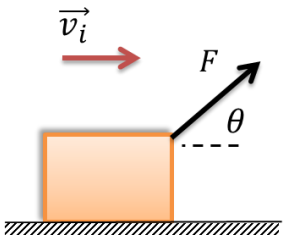
a) The acceleration of the system



b) The tension in the string.

Q2. A 15 kg box initially moving at 0.5 m/s on a horizontal rough surface is pulled by a 70 N force directed 30° above the horizontal. Given the coefficient of kinetic friction between the box and the surface is 0.2, and the pulling force continue to act as the box slides for 15 m. During this displacement determine:

a) The work done by the applied force



b) The work done by the friction force

c) The final speed of the box

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