Department of Physics

PHY1321/31 A/B
2 MIDTERM TEST
November 21, 2015
Duration: 100 min

uOttawa
L'Université canadienne
Canada's university

Student ID: _____

STUDENT'S NAME: _____

I WANT FOLLOWING PROBLEMS FROM PART II TO BE MARKED: _____

This is 100 minutes long , closed-book evaluation.

I am also aware that I should have only one copy of this questionnaire, and that by the end of this test I will have to return it to the proctor with all other materials provided during the test (SCANTRON AND EXAM BOOKLET).

Failing to return this document results in obtaining 0 for the whole test.

Failing to properly fill the scantron will result in 0 for the part 1 of the test.

By signing below you acknowledge that you are aware of the above conditions and will comply with them

Student Signature :_____ DATE :_____

Cellular phones, unauthorized electronic devices or course notes) are not allowed during this exam. Phones and devices must be turned off and put away in your bag. Do not keep them in your possession, such as in your pockets. If caught with such a device or document, the following may occur: you will be asked to leave immediately the exam, academic fraud allegations will be filed which may result in you obtaining a 0 (zero) for the exam.

By signing below, you acknowledge that you have ensured that you are complying with the above statement.

Student Signature :_____ DATE :_____

PART I .ver A

IN THE SCANTRON SHEETS ENTER THE ANSWERS TO THE FOLLOWING 7 QUESTIONS.

(6 BEST ANSWERS COUNT FOR THE 48% OF THIS TEST MARK

1. The position of a particle moving along the *x* axis is given by $x = \left(21 + 22t - 6.0t^2\right)\text{m}$, where *t* is in s. What is the average velocity during the time interval *t* = 1.0 s to $t = 3.0$ s?

a) –6.0 m/s **b)** –4.0 m/s **c)** –2.0 m/s **d)** –8.0 m/s **e)** 8.0 m/s

2. A bullet is fired through a board, 14.0 cm thick, with its line of motion perpendicular to the face of the board. If it enters with a speed of 450 m/s and emerges with a speed of 220 m/s, what is the bullet's acceleration as it passes through the board?

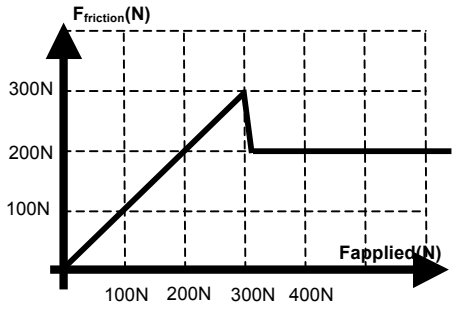
a) –500 km/s^2 **b)** –550 km/s^2 **c)** –360 km/s^2 **d)** –520 km/s^2 **e)** –275 km/s^2

3. If the only forces acting on a 2.0-kg mass are F_1 = (3i – 8j) N and F_2 = (5i + 3j) N, what is the magnitude of the acceleration of the particle?

a) 1.5 m/s^2 b) 6.5 m/s^2 c) 4.7 m/s^2 d) 9.4 m/s^2
e) 7.2 m/s^2

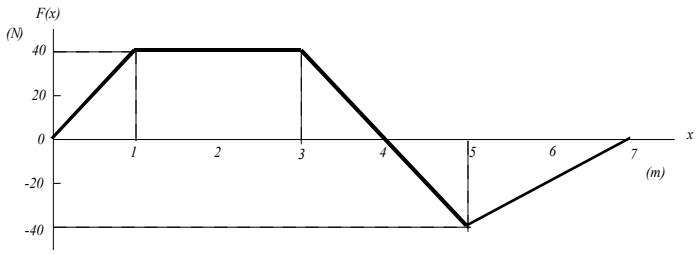
4 Given is the diagram describing the magnitude of the friction on a body of mass 100kg. When the applied force equals to 200N, the friction force is:

a) 100N b)200N c)300N d)980N
e) Impossible to determine



5 An object moves from $x = 0$ m to $x = 7$ m subject to the force shown in the diagram. How much work in J is done on the object by the force when the object moves from x=3m to x=4m

a. –40 b.–20 c. 0 d.20 e. 40



6. A 0.20-km wide river has a uniform flow speed of 3.0 m/s toward the east. A boat with a speed of 8.0 m/s relative to the water leaves the south bank and heads in such a way that it crosses to a point directly north of its departure point. How long does it take the boat to cross the river?

a) 29 s **b)** 23 s **c)** 25 s **d)** 27 s **e)** 17 s

7. A race car (m=500kg) moving with a constant speed of 60 m/s completes one lap around a circular track in 50 s. What is the magnitude of the acceleration of the race car? What is the work done by the radial force on the car during one half of the full turn?

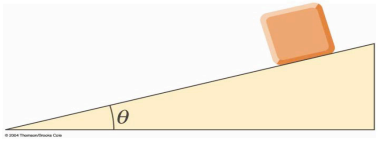
a) a=8.8 m/s^2; W=0 b) a=7.5 m/s^2; W=0 c) a=7.5 m/s^2; W=5.7MJ
d) a=7.5 m/s^2; W=2.8J e) a=5.3 m/s^2; W=5.7MJ

PART II:IN THE EXAMINATION BOOKLETS ENTER THE FULL SOLUTIONS TO 4 OUT OF 5 PROBLEMS BELOW.(Each Question is worth 13%, for total of 52%)

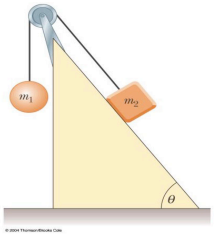
1 A ball is tossed from an upper-story window of a building. The ball is given an initial velocity of 8.00 m/s at an angle of 20.0° below the horizontal. It strikes the ground 3.00 s later.
(a) How far horizontally from the base of the building does the ball strike the ground? (4P)
(b) Find the height from which the ball was thrown. (4P)
(c) Find the magnitude and direction of the ball's velocity when it strikes the ground. (5P)

2 An automobile is moving at speed of 2.00 m/s along a circular road of radius 20 m.
A) Find the time it takes to make one full circle when the car is still moving at constant speed. (3P)
B) Find the car radial acceleration during this time. (3P)
Then its speed starts increasing at a rate of 0.600 m/s2 while it stays on the same road. When the instantaneous speed of the automobile is 4.00 m/s, find
(C) the tangential acceleration component (2P)
(D) the radial acceleration component, (2P)
(E) the magnitude and direction(with respect to horizontal) of the total acceleration. (3P)

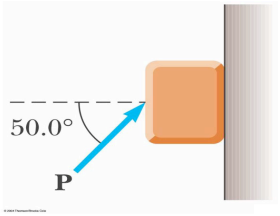
3 For each of the <u>equilibrium cases</u> below draw free body diagrams and write <u>down proper component equations for acting forces. (all surfaces exert friction!)</u>



a) 6P



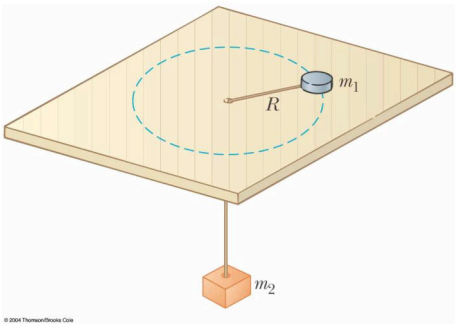
b) 3P



c) 4P

4 A cart of mass M= 500kg rolls up the 30 deg, (u_{kin} = 0.2) incline with the initial speed of 40 m/s at the bottom of the incline.
a) How far up the incline will the cart stop? (7P)
b) What is the work done on the cart by constant force of kinetic friction, (3P)
c) Work done by gravitational force (2P)
d) Work done by normal force (1P)

5. An air puck of mass m1 =1kg is tied to a string and allowed to revolve in a circle of radius R=0.5m on a frictionless horizontal table. The other end of the string passes through a hole in the center of the table, and a counterweight of mass m2= 0.5kg is tied to it. The suspended object remains in equilibrium while the puck on the tabletop revolves.



a) Draw free-body-diagram for each relevant body (3P)
b) Write relevant Newton's Equations for each body (3P)
c) What is the tension in the string? (2P)
d) What is the speed of the puck? (2P)
e) What is the work by the centripetal force done on the puck in one half of the full turn. (3P) (show your work!)