UNIVERSITY OF SASKATCHEWAN
Department of Physics and Engineering Physics

Physics 111.6
MIDTERM TEST #1

October 13, 2005 | Time: 90 minutes

NAME: ____ STUDENT NO.: _____________
(Last) **Please Print** (Given)

LECTURE SECTION (please circle):

01 Dr. A. Robinson
02 B. Zulkoskey
03 Dr. K. McWilliams
C15 F. Dean

INSTRUCTIONS:

1. You should have a test paper, a formula sheet, and an OMR sheet. The test paper consists of 10 pages. **It is the responsibility of the student to check that the test paper is complete**.
2. Enter your name and STUDENT NUMBER on the OMR sheet.
3. The test paper, the formula sheet and the OMR sheet must all be submitted.
4. The test paper will be returned. The formula sheet and the OMR sheet will NOT be returned.

PLEASE DO NOT WRITE ANYTHING ON THIS TABLE

QUESTION NO.	MAXIMUM MARKS	MARKS OBTAINED
Part A	10	
Part B	10	
C1	5	
C2	5	
C3	5	
TOTAL	35	

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PART A

FOR EACH OF THE FOLLOWING QUESTIONS IN PART A, ENTER THE MOST APPROPRIATE RESPONSE ON THE OMR SHEET.

A1. Which one of the following numbers is ***NOT*** expressed to 3 significant figures?

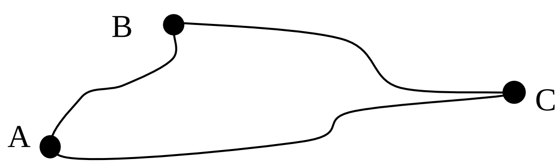
(A) 4.56 (B) 4.56×10^{-6} (C) 0.045 (D) 45.6 (E) 456

A2. Given the dimensions of the symbols as shown in the table, which one of the following options correctly gives the dimensions of $E = \frac{1}{2}mv^2$?

m	[M]
v	$[L][T]^{-1}$

(A) $[M][L]^2[T]^2$ (B) $[M][L]^2[T]^{-2}$ (C) $[M][L][T]^{-4}$ (D) $[M]^2[L]^{-2}[T]^{-2}$ (E) $[M][L]^{-2}[T]^{-3}$

A3. An object starts at position A, moves to position B on the path shown, then to position C and finally back to position A (see diagram). Which option correctly describes the motion of the object after it has moved back to position A?



(A) The displacement is not zero, but the distance travelled is zero.
(B) The distance travelled is the same as the displacement and both are zero.
(C) The distance travelled is the same as the displacement and both are not zero.
(D) The displacement is zero, but the distance travelled is not zero.
(E) The displacement is greater than the distance travelled.

A4. A ball is kicked at an angle of 30° above the horizontal ground. Which one of the following statements concerning the motion of the ball at the top of its trajectory is correct?

(A) The velocity is directed opposite to the acceleration.
(B) The velocity and acceleration of the ball are both zero.
(C) The velocity of the ball is directed parallel to the acceleration.
(D) The velocity and acceleration are perpendicular to each other.
(E) The velocity and acceleration have their maximum magnitudes.

A5. A soccer player is practicing her kicks over level ground. She gives the ball the same initial speed each time, but at different launch angles. Let θ represent the launch angle as measured above the level ground. For kick 1, $\theta_1 = 30°$ and for kick 2, $\theta_2 = 60°$. In the absence of air resistance, which one of the following statements is correct?

(A) The ball is in the air for the same period of time for both kicks.
(B) The ball is in the air for a longer period of time for kick 1 than for kick 2.
(C) The ball is in the air for a longer period of time for kick 2 than for kick 1.
(D) The ball reaches a greater vertical height for kick 1 than for kick 2.
(E) The ball reaches the same vertical height for both kicks.

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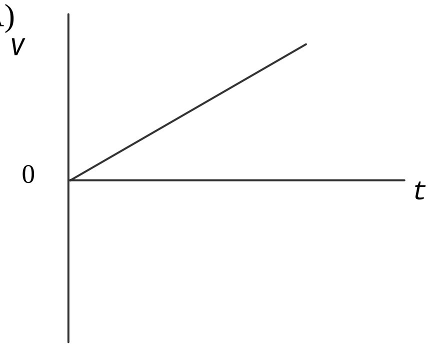
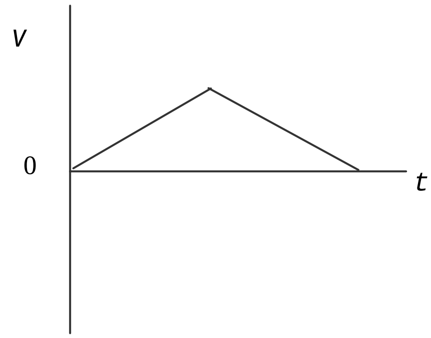
A6. Which one of the following graphs best depicts velocity versus time for a ball that is thrown vertically upward. (Ignore air resistance and assume that UP has been chosen as the positive direction.)

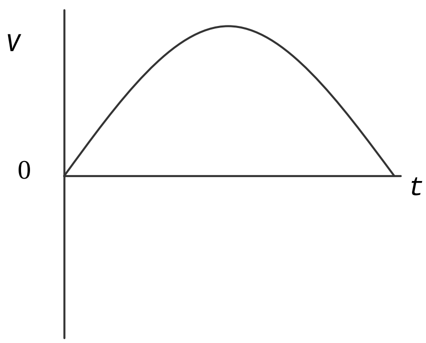
(A)



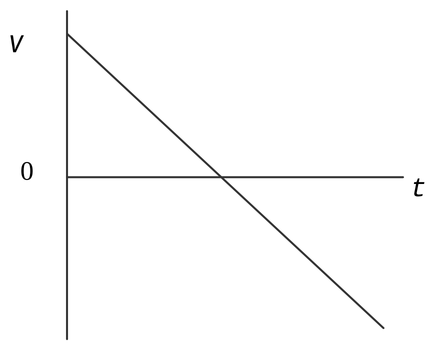
(B)



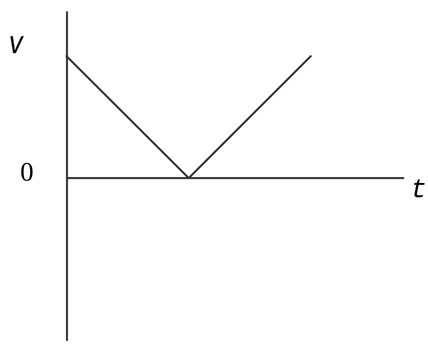
(C)



(D)



(E)



A7. Isobel Newton is conducting her famous elevator experiments. Isobel stands on a scale and reads the scale while ascending and descending in an elevator. Isobel weighs 600 N, but notices that the scale readings depend on the motion of the elevator. Which one of the following statements is correct?

(A) When the elevator is going up at a constant speed, the scale reads more than 600 N.
(B) When the elevator is going up and slows as it approaches the top of the building, the scale reads less than 600 N.
(C) When the elevator is going down and slows as it approaches the ground floor, the normal force that the scale exerts on Isobel decreases.
(D) When the elevator is moving downward at a constant speed, the magnitude of the normal force that the scale exerts on Isobel is less than 600 N.
(E) If the cable supporting the elevator were to break and the elevator were to fall, the scale would still read 600 N.

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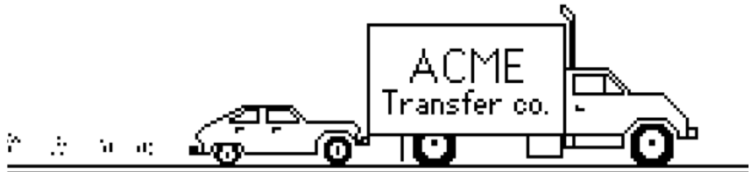
A8. A large truck breaks down on the highway and the driver of a small compact car stops to help. The small car pushes the truck back to town, as shown in the figure. Complete the following statement: "While the car is speeding up to cruising speed and pushing the truck…



(A) …the amount of force with which the car pushes on the truck is equal to that with which the truck pushes back on the car."
(B) …the amount of force with which the car pushes on the truck is smaller than that with which the truck pushes back on the car."
(C) …the amount of force with which the car pushes on the truck is greater than that with which the truck pushes back on the car."
(D) …the car's engine is running so the car pushes against the truck, but the truck's engine is not running so the truck cannot push back against the car. The truck is simply pushed forward because it is in the way of the car."
(E) …neither the car nor the truck can exert any force on each other. The truck is pushed forward simply because it is in the way of the car."

A9. An object of mass m is sitting at rest on a horizontal surface. The maximum static frictional force between the object and the surface is f_s^{max}. If a horizontal force of F is applied to the object in the positive direction, and $F < f_s^{max}$, then the acceleration of the object is

(A) 0. (B) $\frac{F - f_s^{max}}{m}$. (C) $\frac{F + f_s^{max}}{m}$. (D) $\frac{f_s^{max} - F}{m}$.

(E) impossible to determine with the information provided.

A10. Which one of the following statements is **true**?

(A) If an object is in equilibrium, there may be individual forces acting on it, but the vector sum of these forces must be zero.
(B) If an object is in equilibrium, there cannot be any individual forces acting on it.
(C) If an object is in equilibrium, the individual forces acting on it must be mutually perpendicular.
(D) An object can be in equilibrium and still have a non-zero acceleration.
(E) If an object is in equilibrium, it **must** be at rest.

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PART B

FOR EACH OF THE FOLLOWING PROBLEMS, WORK OUT THE SOLUTION IN THE SPACE PROVIDED AND ENTER YOUR ANSWERS ON PAGE 7.

ONLY THE ANSWERS WILL BE MARKED. THE SOLUTIONS WILL NOT BE MARKED.

B1. A couple decides to walk around a circular lake of radius 1.25 km. They walk ¾ of the way around the lake and stop. Calculate the magnitude of the couple's displacement from their starting point.

B2. A car is travelling with a speed of 8.72 m/s in a direction east of north. The component of velocity in the easterly direction is 3.29 m/s. Calculate the magnitude of the component of velocity in the northerly direction.

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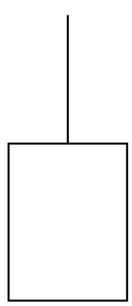
B3. A ball is thrown with an initial speed of 25.8 m/s at an angle of 36.2° above the horizontal. Neglecting air resistance, calculate the time for the ball to travel a horizontal distance of 4.27 m.

B4. There is a tension of 6.49×10^3 N in the cable attached to an elevator car of mass 536 kg. Calculate the magnitude of the acceleration of the elevator car.



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B5. Calculate the weight of an object of mass 1.00 kg when it is at a distance of 8.00×10^4 m above the **<u>surface</u>** of the Earth.

ANSWERS FOR PART B

ENTER THE ANSWERS FOR THE PART B PROBLEMS IN THE BOXES BELOW.

THE ANSWERS MUST CONTAIN THREE SIGNIFICANT FIGURES AND THE UNITS MUST BE GIVEN.

ONLY THE ANSWERS WILL BE MARKED. THE SOLUTIONS WILL NOT BE MARKED.

B1	
B2	
B3	
B4	
B5	

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PART C

IN EACH OF THE FOLLOWING QUESTIONS, GIVE THE COMPLETE SOLUTION AND ENTER THE FINAL ANSWER IN THE BOX PROVIDED.

THE ANSWERS MUST CONTAIN THREE SIGNIFICANT FIGURES AND THE UNITS MUST BE GIVEN.

NO CREDIT WILL BE GIVEN FOR ANSWERS ONLY. EQUATIONS NOT PROVIDED ON THE FORMULA SHEET MUST BE DERIVED.

C1. The fastest known land animal, the cheetah, can accelerate from rest to a maximum speed of 26.7 m/s in 4.00 seconds.

(a) Calculate the magnitude of the acceleration of the cheetah. Assume that the acceleration is constant.

(b) After accelerating, the cheetah can maintain its maximum speed for a further 30.0 seconds. Draw a well-labelled graph of speed versus time showing both the acceleration phase and the constant speed phase.

(c) Assuming that the cheetah runs in a straight line, calculate the distance covered during the 34.0 s interval.

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C2. A projectile is lauched with a speed v_o at an angle of θ_o above the horizontal. Ignore any effects due to air resistance. Let g represent the magnitude of the acceleration due to gravity.

(a) Derive an expression for the maximum height, y_{max}, reached by the projectile in terms of v_o, θ_o and g.

y_{max} =

(b) Derive an expression for the horizontal displacement, x, travelled by the projectile as it moves from the launch point to maximum height in terms of v_o, θ_o and g.

x =

(c) Determine the value of the launch angle such that the displacement x, referred to in part (b), has the same magnitude as the maximum height, y_{max}. Express your answer to three significant figures.

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C3. Sir Isaac Newton is pushing a 52.6 kg crate of apples across the horizontal floor by applying a force of 481 N at an angle of 23.6° **below** the horizontal. The coefficient of kinetic friction between the crate and the floor is 0.352.

(a) Draw a well-labelled diagram clearly showing all the forces acting on the crate, and your choice of coordinate system.

(b) Calculate the force of kinetic friction acting on the crate.

(c) Calculate the magnitude of the acceleration of the crate.

END OF EXAMINATION