UNIVERSITY OF SASKATCHEWAN
Department of Physics and Engineering Physics

Physics 111.6
MIDTERM TEST #1

October 10, 2002 Time: 90 minutes

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

LECTURE SECTION (please circle):

01	R.E. Pywell
02	B. Zulkoskey
03	Y. Pahatouroglou
C15	F. Dean

INSTRUCTIONS:

1. You should have a test paper, a formula sheet, and an OMR sheet. The test paper consists of 9 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 NUMBER	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 options correctly expresses π (3.14159…) to 3 significant figures?

(A) 3.141
(B) 3.142
(C) 3.1416
(D) 3.15
(E) 3.14

A2. The time *T* required for one complete oscillation of a mass *m* on a spring of force constant *k* is

$$T = 2\pi\sqrt{\frac{m}{k}}\,.$$

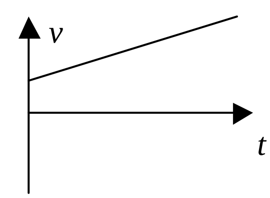
Given the following notation: [L] = length, [M] = mass, [T] = time, the dimensions of *k* are

(A) $[T]^2/[M]$ (B) $[M]/[T]^2$ (C) $[M]^{1/2}/[T]$ (D) $[M]/[T]$ (E) $[M]^2/[T]^2$

A3. Two children are standing on a bridge throwing stones into the water below. One child throws a stone vertically upward and the other child throws a stone vertically downward. After the stones have been released and before they hit the water, how do the accelerations of the two stones compare? Choose up to be the positive direction and ignore any effects due to air resistance.

(A) The stone thrown upward has an acceleration of $+g$ and the stone thrown downward has an acceleration of $-g$.
(B) Both stones have a downward acceleration and the magnitude of the acceleration of the stone thrown upward is greater than the magnitude of the acceleration of the stone thrown downward.
(C) Both stones have a downward acceleration and the magnitude of the acceleration of the stone thrown upward is less than the magnitude of the acceleration of the stone thrown downward.
(D) The acceleration of the stone thrown upward is zero at the top of its trajectory.
(E) Both stones have an acceleration of $-g$.

A4. The velocity versus time graph for an object undergoing straight-line motion is linear and has a positive intercept with the velocity axis. Which of the following statements is correct?



(A) The velocity of the object is constant and equal to the slope of the line.
(B) The acceleration of the object is constant and equal to the slope of the line.
(C) The acceleration of the object is constant and equal to the value of the intercept with the velocity axis.
(D) The velocity of the object is constant and equal to the value of the intercept with the velocity axis.
(E) The acceleration of the object is increasing linearly with time.

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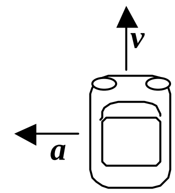
A5. A soccer ball is kicked at an angle of 45.0° with the horizontal over level ground. Ignore any effects due to air resistance. Which of the following statements is correct? At the top of the ball's trajectory

(A) the velocity and acceleration of the ball are parallel.
(B) the velocity and acceleration of the ball are oppositely directed.
(C) the velocity and acceleration of the ball are perpendicular.
(D) the velocity and acceleration of the ball are zero.
(E) the velocity and acceleration of the ball have maximum magnitude.

A6. The diagram shows a car, viewed from above, which is moving forward with the velocity, ***v***, as shown. The acceleration, ***a***, of the car is also shown. Which of the following is an accurate statement concerning this situation.



(A) This shows a car that is speeding up.
(B) This shows a car that is slowing down.
(C) This shows a car that is turning to the right.
(D) This shows a car that is turning to the left.
(E) This shows an impossible situation since velocity and acceleration are always parallel vectors.

A7. When the rocket engines of a starship are suddenly turned off while traveling in empty space, far from the gravitational effects of any star or planet, the starship will

(A) stop immediately.
(B) slow down and then stop.
(C) start moving in the opposite direction.
(D) move with constant velocity.
(E) continue moving with constant acceleration.

A8. The force that keeps you from sliding when walking on the sidewalk is

(A) air resistance. (B) kinetic friction.
(C) static friction. (D) the normal force.
(E) your weight.

A9. A 10 kg mass and a 5 kg mass are acted on by the same magnitude net force (which remains constant) for the same period of time. Both masses are at rest before the force is applied. The 10 kg mass moves a distance of x_1 and the 5 kg mass moves a distance x_2 during this time period because of this force. What is the relationship between x_1 and x_2?

(A) $x_1 = x_2$
(B) $x_1 = \frac{1}{2} x_2$
(C) $x_1 = 2 x_2$
(D) $x_1 = \frac{1}{4} x_2$
(E) $x_1 = 4 x_2$

A10. An object, of mass *m*, is suspended by a string from the roof of an elevator car. The elevator is moving upward with a constant speed. Which statement best describes the magnitude of the tension in the string?

(A) It is equal to *mg*. (B) It is less than *mg*.
(C) It is greater than *mg*. (D) It is zero.
(E) It is impossible to tell without knowing the speed of the elevator.

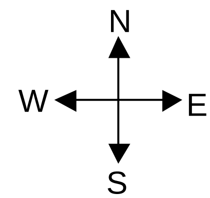
continued on page 4 ...

PART B

FOR EACH OF THE FOLLOWING PROBLEMS, B1 TO B5, ON PAGES 4 TO 6, WORK OUT THE SOLUTION IN THE SPACE PROVIDED AND ENTER YOUR ANSWERS ON PAGE 6.

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

B1. A treasure map directs you to start at a palm tree and walk due north for 10.0 m. You are then to turn east and walk 15.0 m, then turn south and walk 5.00 m. Calculate your final distance from the palm tree.



B2. A sprinter starts from rest and accelerates at 1.90 m/s^2 for 2.25 s. For the remainder of the 10.0 s race, the sprinter's acceleration is zero. Calculate the speed of the sprinter 4.50 s after the start of the race.

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B3. A certain projectile is launched with an initial speed v_o. At its highest point its speed is 0.370 v_o. Calculate the launch angle above the horizontal.

B4. A barrel of a gun is aimed horizontally, directly at the centre of a target. When the gun is fired the bullet hits the target at a distance of 2.58 cm below the centre of the target. How long does it take for the bullet to travel from the gun to the target (ignoring air resistance)?

continued on page 6 ...

B5. What is the acceleration due to gravity on the surface of the Moon?
Mass of the Moon, $M_M = 7.35 \times 10^{22}$ kg. Radius of the Moon, $R_M = 1.74 \times 10^{6}$ m.

ANSWERS FOR PART B

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

THE ANSWERS MUST CONTAIN <u>THREE SIGNIFICANT FIGURES</u> AND THE UNITS MUST BE GIVEN.

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

B1 $\boxed{}$

B2 $\boxed{}$

B3 $\boxed{}$

B4 $\boxed{}$

B5 $\boxed{}$

continued on page 7 ...

PART C

IN EACH OF THE PART C QUESTIONS ON THE FOLLOWING PAGES, 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.

SHOW YOUR WORK – NO CREDIT WILL BE GIVEN FOR ANSWERS ONLY. EQUATIONS NOT PROVIDED ON THE FORMULAE SHEET MUST BE DERIVED.

USE THE BACK OF THE PREVIOUS PAGE FOR YOUR ROUGH WORK.

C1. A volcano shoots out blobs of molten lava, called lava bombs, from ground level. A geologist observing the eruption uses a stopwatch to time the flight of a particular lava bomb that is projected straight upward. The time for the bomb to rise and fall back to the ground is 4.75 s. Ignore any effects due to air resistance.

(a) Calculate the initial speed of the lava bomb.

(b) Calculate the maximum height of the lava bomb above the ground.

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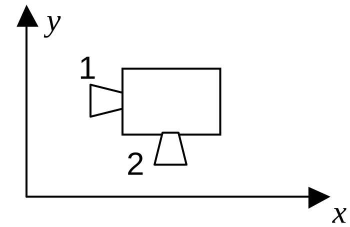
 Student No.: ______________________

C2. A spacecraft, in gravity free space, is initially moving in the $+x$ direction with speed 20.0 m/s. There are two rockets on the spacecraft. Rocket 1 can give the spacecraft an acceleration of 4.00 m/s^2 in the $+x$ direction and rocket 2 can give the spacecraft an acceleration of 6.50 m/s^2 in the $+y$ direction.



(a) Rocket 1 is turned on for 6.00 s. Calculate the speed of the spacecraft when rocket 1 shuts off.

(b) Calculate the distance moved by the spacecraft in this 6.00 s time period.

(c) Immediately after rocket 1 shuts off, rocket 2 is turned on for a time of 12.0 s. Calculate the magnitude of the displacement of the spacecraft in the 18.0 s time interval from when rocket 1 was turned on to when rocket 2 was shut off.

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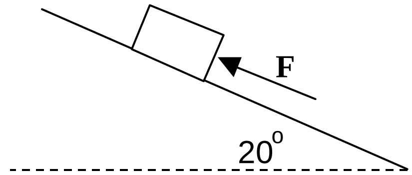
C3. A box, of mass 45.0 kg, is on a loading ramp that is at an angle of 20.0° to the horizontal. There is friction between the box and the ramp. A worker pushes on the box with a force **F**, with magnitude 20.0 N, that is parallel to the ramp as shown. The force **F** is the minimum force needed to keep the box from sliding down the ramp.



(a) Draw a free body diagram of the forces on the box.

(b) Calculate the magnitude of the static friction force on the box and indicate in which direction the static friction force points, up or down the ramp.

(c) Calculate the coefficient of static friction between the box and the ramp.

END OF EXAMINATION