

**UNIVERSITY OF SASKATCHEWAN**  
**Department of Physics and Engineering Physics**

**Physics 111.6**  
**MIDTERM TEST #1**

October 14, 2004

Time: 90 minutes

NAME: \_\_\_\_\_  
(Last)                      **Please Print**                      (Given)

STUDENT NO.: \_\_\_\_\_

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

continued on page 2 ...

**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) 2.31            (B) 231            (C) 23.1            (D)  $2.3 \times 10^2$             (E) 0.0231

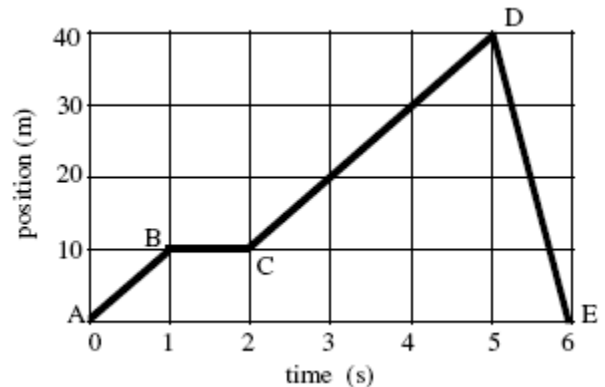
- A2. Given the dimensions of the symbols as shown in the table, which one of the following options correctly gives the dimensions of  $\sqrt{\frac{Fx}{m}}$  ?

$x$	[L]
$F$	$[M][L]/[T]^2$
$m$	[M]

- (A) [L]/[T]            (B)  $[L]^2/[T]^2$             (C)  $[L]^2/[T]$             (D)  $[L]/[T]^2$             (E)  $[M][L]/[T]$

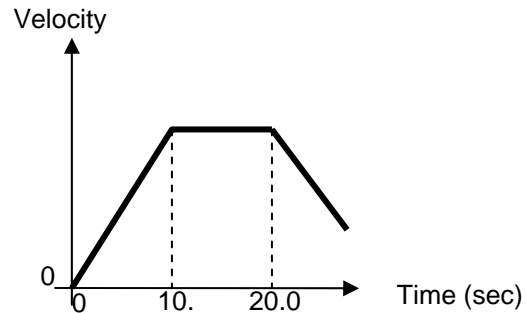
- A3. In which one of the following situations does the object have a negative acceleration?  
 (A) The object is moving in the positive direction and its speed is increasing.  
 (B) The object is moving in the negative direction and its speed is decreasing.  
 (C) The object is moving in the positive direction and its speed is decreasing.  
 (D) The object is moving in the negative direction at constant speed.  
 (E) The object is moving in the positive direction at constant speed.

- A4. An object is moving along a straight line. The graph shows the object's position from the starting point as a function of time. In which segment(s) of the graph does the object have the highest speed?  
 (A) AB  
 (B) BC  
 (C) CD  
 (D) AB and CD  
 (E) DE



- A5. A baseball is hit so that it travels along a parabolic arc before it strikes the ground. Which one of the following statements **must** be true? Ignore any effects due to air resistance.  
 (A) The acceleration of the ball decreases as the ball moves upward.  
 (B) The velocity of the ball is zero when the ball is at the highest point in the arc.  
 (C) The acceleration of the ball is zero when the ball is at the highest point in the arc.  
 (D) The horizontal component of the velocity of the ball is the same throughout the ball's flight.  
 (E) The velocity of the ball is a maximum when the ball is at the highest point in the arc.

A6. Examine the velocity-time graph at right. Which one of the statements below is **NOT** correct?



- (A) The tangent to the velocity-time curve gives the instantaneous acceleration.
- (B) The acceleration is constant between  $t = 0$  s and  $t = 10.0$  s.
- (C) The object is stationary between  $t = 10.0$  s and  $t = 20.0$  s.
- (D) The velocity of the object decreases after  $t = 20.0$  s.
- (E) The acceleration is negative after  $t = 20.0$  s.

A7. A bicyclist is riding at a constant speed along a straight-line path. The rider throws a ball straight up to a height a few meters above her head. Ignoring air resistance, where will the ball land?

- (A) behind the rider
- (B) in front of the rider
- (C) in the same hand that threw the ball
- (D) The landing spot cannot be determined without knowing the speed of the rider.
- (E) The landing spot cannot be determined without knowing the maximum height of the ball.

A8. The only force experienced by each of two objects in deep space is the mutual gravitational force of attraction between them. Let the mass and acceleration of object 1 be denoted by  $m_1$  and  $a_1$  and the mass and acceleration of object 2 be denoted by  $m_2$  and  $a_2$ . Which one of the following is correct for the ratio of their accelerations,  $\frac{a_1}{a_2}$  ?

- (A)  $\frac{a_1}{a_2} = \frac{m_1}{m_2}$     (B)  $\frac{a_1}{a_2} = \frac{m_2}{m_1}$     (C)  $\frac{a_1}{a_2} = 1$     (D)  $\frac{a_1}{a_2} = \left(\frac{m_2}{m_1}\right)^2$     (E)  $\frac{a_1}{a_2} = \sqrt{\frac{m_1}{m_2}}$

A9. A rock is thrown straight up from the earth's surface. Which one of the following statements concerning the net force acting on the rock at the top of its path is **true**? Ignore any effects due to air resistance.

- (A) It is equal to the weight of the rock.
- (B) It is instantaneously equal to zero.
- (C) Its direction changes from up to down.
- (D) It is greater than the weight of the rock.
- (E) It is less than the weight of the rock, but greater than zero.

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.

**PART B**

**FOR EACH OF THE FOLLOWING PROBLEMS, 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 person on a camping trip goes on a hike. She leaves her cabin and walks east for two hours, covering a distance of 12.6 km. She then turns and walks for one-and-a-half hours on a heading of  $36.2^\circ$  North of East, covering a distance of 10.3 km before stopping for lunch. When she stops for lunch, how far east of the cabin is she?

B2. A sprinter accelerates uniformly from rest to a speed of 14.3 m/s in a time of 0.730 s. Calculate the magnitude of the sprinter's acceleration.

- B3. A train, pulling several freight cars, is found to have a velocity of  $5.23 \text{ m/s}$  as the front of the train passes an observation point  $P$ . The train is accelerating at  $0.247 \text{ m/s}^2$  in its direction of motion. The back of the train passes point  $P$  124 seconds after the front end. Calculate the length of the train.
- B4. A rock is kicked horizontally from the edge of a cliff at a speed of  $9.56 \text{ m/s}$ . The rock strikes the ground a horizontal distance of  $56.2 \text{ m}$  from the edge of the cliff. Ignoring air resistance, calculate the time that the rock is in the air.

- B5. An elevator car has a mass of 975 kg and is suspended from a cable. Calculate the magnitude of the tension in the cable when the elevator has an upward acceleration of  $1.25 \text{ m/s}^2$ .

**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

**PART C**

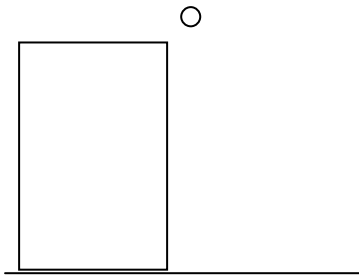
**IN EACH OF THE FOLLOWING QUESTIONS, GIVE THE COMPLETE SOLUTION AND ENTER THE FINAL ANSWER IN THE BOX PROVIDED.**

**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. A ball is thrown straight up by a person leaning over the edge of the roof of a building. The ball is initially at a height of 12.1 m above the ground and has a speed of 18.2 m/s at the instant that it leaves the person's hand. Ignore any effects due to air resistance.

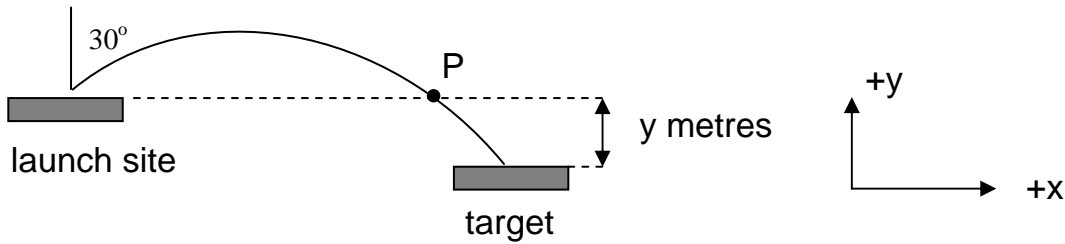
(a) Draw a well-labelled diagram showing the trajectory of the ball from hand to ground, the initial velocity, the acceleration, and your choice of coordinate system.



(b) Calculate the speed of the ball just before it hits the ground.

(c) Calculate the time of flight of the ball from hand to ground.

- C2. A model rocket is launched with an initial speed of 25.5 m/s, at an angle of  $30.0^\circ$  to the vertical. It lands on a target that is below the initial position (see diagram). The time of flight is 4.56 s. You may assume that air resistance is negligible.



- (a) Calculate the height difference between the launch site and the target.

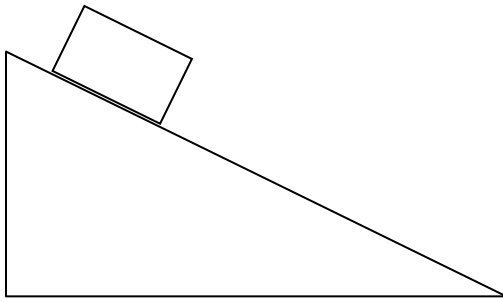
- (b) Calculate the horizontal distance between the launch site and the target.

- (c) Calculate the time for the rocket to reach its highest position after launch.



C3. In an airport baggage handling system, baggage is allowed to slide down a ramp that is inclined at an angle of  $\theta$  with the horizontal. Friction is present.

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



- (b) Given that the coefficient of kinetic friction between a piece of baggage and the ramp is  $\mu_k$ , derive an expression for the acceleration,  $a$ , of the piece of baggage of mass  $m$  as it slides down the ramp. If necessary, use the symbol  $g$  to represent the magnitude of the acceleration due to gravity.