

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

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

October 12, 2000

Time: 90 minutes

NAME: \_\_\_\_\_ STUDENT NO.: \_\_\_\_\_  
(Last)                      **Please Print**                      (Given)

LECTURE SECTION (please circle):

01      Dr. R.E. Pywell  
02      B. Zulkoskey  
03      Dr. A.H. Manson  
97      M. Gibson  
C41     A. Duffy  
C15     A. Duffy

**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.

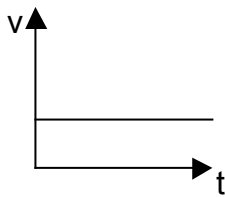
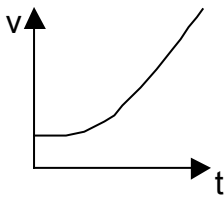
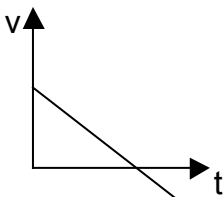
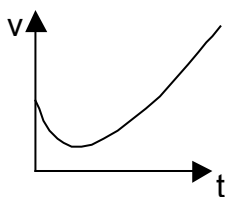
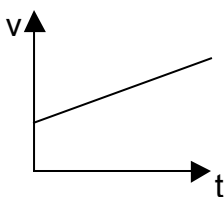
***PLEASE DO NOT WRITE ANYTHING ON THIS TABLE***

QUESTION NUMBER	MAXIMUM MARKS	MARKS OBTAINED
Part A	10	
Part B	10	
C1	5	
C2	5	
C3	5	
TOTAL	35	

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.** In the following equations the units of the quantities are  $a$  ( $\text{m/s}^2$ ),  $v$  ( $\text{m/s}$ ),  $v_0$  ( $\text{m/s}$ ),  $t$  ( $\text{s}$ ),  $x$  ( $\text{m}$ ). Which one of the following equations is *dimensionally incorrect*?
- (A)  $v - at = v_0$     (B)  $a^2t^2 = ax$     (C)  $at = x$     (D)  $x = v^2/a$     (E)  $x/t = (v_0 + v)$
- A2.** A rock is thrown directly upward. Neglecting the effects of air resistance, what is the instantaneous acceleration of the rock at the highest point in its flight?
- (A) It is zero.    (B) It is less than  $g$  downward.    (C) It is greater than  $g$  downward.  
(D) It is  $g$  downward.    (E) It is less than  $g$  upward.
- A3.** A flowerpot falls off the edge of a fifth-floor window. Just as it passes the third-floor window, someone drops a glass of water from that window. Which one of the following statements is true? (Neglect air resistance.)
- (A) The flowerpot hits the ground first with a higher speed than the glass has when it hits the ground.  
(B) The flowerpot hits the ground at the same time as the glass, but the speed of the flowerpot is greater than that of the glass.  
(C) The flowerpot and the glass hit the ground at the same time and with the same speed.  
(D) The glass hits the ground before the flowerpot, but the glass has a lower speed when it hits than the flowerpot when it hits.  
(E) The flowerpot hits the ground at the same time as the glass, but the speed of the glass is greater than the speed of the flowerpot.
- A4.** Which one of the following velocity versus time graphs represents an object moving along the  $x$ -axis with a constant non-zero positive acceleration?
- (A)  (B)  (C) 
- (D)  (E) 
- A5.** Vector **A** has horizontal and vertical components of 1.5 m and 2.0 m respectively. Vector **B** has horizontal and vertical components of -1.5 m and -2.0 m respectively. The vector  $\mathbf{C} = \mathbf{A} + \mathbf{B}$  has magnitude
- (A) zero    (B) 7.0 m    (C) 4.0 m    (D) 3.0 m    (E) 2.5 m

- A6.** A brick is dropped from rest and a rock is thrown horizontally. Both objects are released from the top of a vertical cliff at the same instant. Compare the time it takes each object to reach the level ground at the base of the cliff. (Neglect air resistance.)
- (A) The brick reaches the ground first.
  - (B) The rock reaches the ground first.
  - (C) Which object reaches the ground first depends on the speed with which the rock is thrown. If the rock is thrown faster than a certain value the brick will reach the ground first.
  - (D) Which object reaches the ground first depends on the speed with which the rock is thrown. If the rock is thrown faster than a certain value the rock will reach the ground first.
  - (E) Both objects reach the ground at the same time.
- A7.** An object is moving in the Eastward direction at constant velocity. A net force directed Northward acts on the object for 5.0 s. At the end of the 5.0 s period, the net force drops to zero. Which one of the following statements is **necessarily** true?
- (A) The object will be moving Eastward when the force drops to zero.
  - (B) The final velocity of the object will be directed North of East.
  - (C) The change in the velocity of the object will be directed North of West.
  - (D) The direction of the object's acceleration depends on how fast the object was initially moving.
  - (E) The magnitude of the object's acceleration depends on how fast the object was initially moving.
- A8.** The weight of an object of mass  $m$  is  $W$  when the object is on the Earth's surface. The object is now taken to a height  $h$  above the Earth's surface where  $h$  equals the radius of the Earth. The Earth's gravitational force on the object is now
- (A) 0                      (B)  $W/2$                       (C)  $W/4$                       (D)  $2W$                       (E)  $4W$
- A9.** A painter holds a paint brush, of mass  $m$ , against the ceiling by applying a vertical force of magnitude  $F$ . The magnitude of the normal force of the ceiling on the brush is
- (A)  $F + m$                       (B)  $F - m$                       (C)  $F - mg$                       (D)  $F + mg$                       (E) 0
- A10.** A space-walking astronaut (with mass  $m$ ) and a spacecraft (with mass  $M > m$ ) are in deep space. The astronaut pushes on the spacecraft with a force of magnitude  $F$ . Which one of the following statements is correct?
- (A) The magnitude of the force of the astronaut on the spacecraft equals the magnitude of the force of the spacecraft on the astronaut.
  - (B) The magnitude of the force of the astronaut on the spacecraft is less than the magnitude of the force of the spacecraft on the astronaut.
  - (C) The magnitude of the force of the astronaut on the spacecraft is greater than the magnitude of the force of the spacecraft on the astronaut.
  - (D) The magnitude of the final velocity of the astronaut equals the magnitude of the final velocity of the spacecraft.
  - (E) The magnitude of the acceleration of the astronaut equals the magnitude of the acceleration of the spacecraft.

**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.**

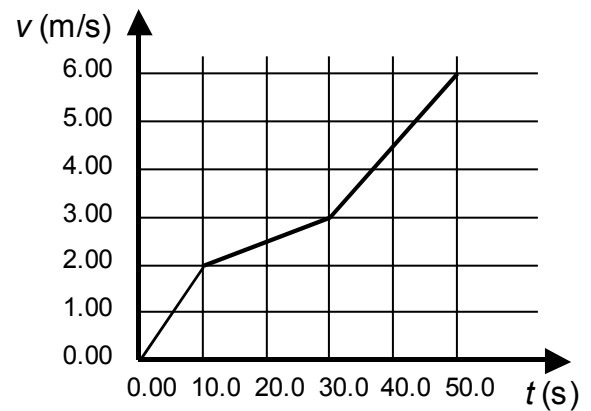
**B1.** A runner is moving at a velocity of 3.36 m/s. He accelerates at  $0.670 \text{ m/s}^2$  and soon reaches a velocity of 5.92 m/s. Calculate the time during which he was accelerating.

**B2.** A rock is dropped from rest from the top of a 65.0 m tall building. Calculate the speed of the rock just before it hits the ground. (Ignore air resistance.)

continued on page 5 ...

- B3.** A woman walks 2.00 km due East and then walks 4.00 km in the direction  $30.0^\circ$  North of East. Calculate the magnitude of her displacement from her starting point.

- B4.** The velocity of a car changes as shown in the figure. Calculate the average acceleration of the car in the time interval from  $t = 0$  to  $t = 50.0$  s.



continued on page 6 ...

- B5.** A cable causes an elevator car of mass  $1.20 \times 10^3$  kg to have an upward acceleration of  $1.50 \text{ m/s}^2$ . Calculate the tension in the cable. (Ignore frictional effects.)

**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**

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 rocket is launched vertically up from rest and accelerates upward at  $10.0 \text{ m/s}^2$  for 5.00 s during the rocket burn. After the burn ceases the rocket comes under the influence of gravity alone. (Ignore air resistance in this problem.)

(a) Calculate the height of the rocket when the burn ceases.

(b) Calculate the velocity of the rocket at the time when the burn ceases.

(c) Calculate the height of the rocket above the launch pad 12.0 s after lift-off.

- C2.** A football is kicked from the ground so that it travels through the air and lands on the horizontal level ground at a point that is a distance of 184 m from where it was kicked. The ball was in the air for a time of 7.60 s. Ignoring air resistance, calculate the initial velocity of the ball just after it was kicked. Express the direction of the velocity as the angle (in degrees) above the horizontal.

Magnitude:
Direction:



- C3.** An automobile's wheels are locked as it slides to a stop from an initial speed of 30.0 m/s. If the coefficient of kinetic friction between the tires and the road is 0.200 and the road is horizontal, calculate the time required for the car to stop.

***END OF EXAMINATION***