UNIVERSITY OF SASKATCHEWAN

Department of Physics and Engineering Physics

Physics 111.6
MIDTERM TEST #1

October 11, 2001 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
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	

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. The Base SI units are defined as

(A) distance, velocity, acceleration.
(B) distance, weight, time.
(C) length, distance, metre
(D) metre, kilogram, second.
(E) time, tide, temperature.

A2. For a vector to be equal to zero, which one of the following statements must be true?

(A) The vector must point into the page.
(B) Each component of the vector must be zero.
(C) Each component of the vector must be equal in magnitude and direction to the others.
(D) One component must be positive and the other must be negative.
(E) Both option (A) and option (D) above are correct.

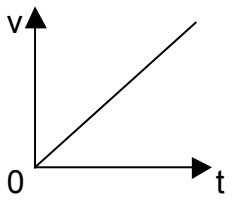
A3. Which one of the following has the smallest mass?

(A) A mass of 1.4 μg. (B) A mass of 2.8 ng. (C) A mass of 3.4 mg.
(D) A mass of 4.6 g. (E) A mass of 5.2 kg.

A4. A student adds two displacement vectors of magnitudes 8.0 km and 6.0 km. Which one of the following statements is true concerning the magnitude of the resultant displacement?

(A) It must be 10.0 km. (B) It must be 14.0 km. (C) It must be 2.0 km.
(D) It could equal zero, depending on how the vectors are orientated.
(E) It could be anywhere between 2.0 km and 14.0 km depending on how the vectors are orientated.

A5. A ball is thrown vertically upward. In the absence of air resistance, which one of the following best represents the velocity versus time graph of the ball from the moment of release until it returns to the point from which it was thrown (up has been chosen as the positive direction)?

(A)


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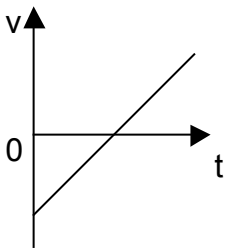
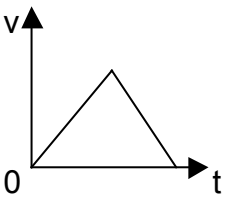


(C)


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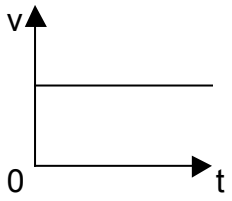

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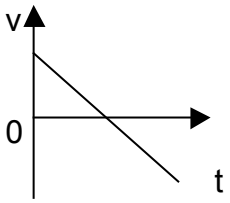

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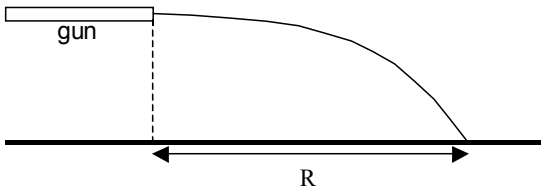
A6. A football is kicked at an angle θ with respect to the horizontal. Which one of the following statements best describes the acceleration of the ball during its flight if air resistance is neglected?

(A) The acceleration is zero at all times.
(B) The magnitude of the acceleration is 9.8 m/s^2 at all times.
(C) The acceleration is zero when the football reaches the highest point in its trajectory.
(D) The acceleration is positive as the football rises, and is negative as the football falls.
(E) The acceleration is largest when the football is high above the ground and lowest when it is near the ground.

A7. A spring-loaded gun is aimed horizontally and is used to launch identical balls with *different* initial speeds. The gun is at a fixed position above the horizontal floor. The balls are fired one at a time and the effects of air resistance can be neglected. If the speed of the second projectile fired is twice the speed of the first projectile fired, how is the horizontal range (denoted R in the figure) affected?



(A) The range for both projectiles will be the same.
(B) The range of the second projectile will be half as much as that of the first projectile.
(C) The range of the second projectile will be twice as large as that of the first projectile.
(D) The range of the second projectile will be $\sqrt{2}$ times larger than that of the first projectile.
(E) The range of the second projectile will be smaller than that of the first projectile by a factor of $\sqrt{2}$.

A8. An object is moving at constant velocity. Which one of the following statements is correct?

(A) There are no forces acting on the object.
(B) There cannot be any frictional forces acting on the object.
(C) Only the gravitational force acts on the object.
(D) The vector sum of all the forces acting on the object is zero.
(E) There is a non-zero net force on the object and it acts in the direction of the object's motion.

A9. A rock is thrown vertically upward from the Moon's surface. Which one of the following statements concerning the *net force* acting on the rock at the top of its path is true?

(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. A person of mass *m* is standing in an elevator car that has an upward acceleration of magnitude *a*. Which one of the following statements is correct?

(A) The elevator **must** be moving upward, and the apparent weight of the person is $m(g+a)$.
(B) The elevator **must** be moving upward, and the apparent weight of the person is $m(g-a)$.
(C) The elevator **must** be moving downward, and the apparent weight of the person is $m(g+a)$.
(D) The elevator **must** be moving downward, and the apparent weight of the person is $m(g-a)$.
(E) The elevator may be moving upward or downward, and the apparent weight of the person is $m(g+a)$.

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. The distance between stars is measured using a unit called the "Light Year". This unit is defined as the distance that light travels in one year. Given that the speed of light is 3.00×10^5 km/s, how far, in metres, does light travel in one year (365 days)?

B2. A hiker walks exactly half-way around the shoreline of a circular lake in a time of 1.50 hours. The diameter of the lake is 7.00 km. Calculate the magnitude of the hiker's average velocity for his hike. Express your answer in km/h.

continued on page 5 ...

B3. A cannon ball is fired with an initial velocity of 50.0 m/s at an angle of 65.0° above the horizontal. Calculate the maximum vertical height of the cannon ball above the cannon during its flight, neglecting air resistance.

B4. A 70.0-kg astronaut pushes to the left on a spacecraft with a force ***F*** in "gravity-free" space. The spacecraft has a total mass of 1.00×10^4 kg. During the push, the astronaut accelerates to the right with an acceleration of 0.360 m/s^2. Calculate the magnitude of the acceleration of the spacecraft.

continued on page 6 ...

B5. The gravitational force between two isolated identical spherical objects, whose centres are separated by a distance of 0.550 m, is measured to be 1.40×10^{-9} N. Calculate the mass of each object.

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 rock is thrown vertically upwards from the top of a cliff with an initial velocity of 11.9 m/s up. The rock hits the ground at the base of the cliff 3.81 s after it was thrown. Ignore air resistance.

(a) Calculate the height of the cliff.

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

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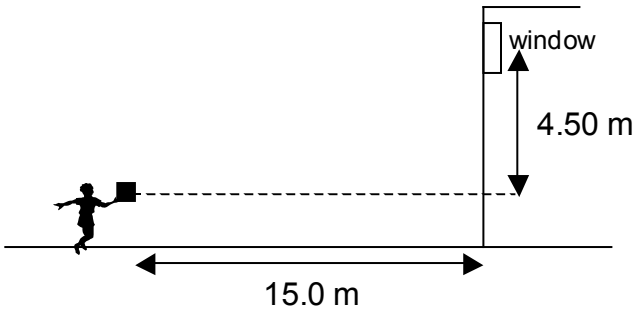
C2. A boy standing on the ground throws a package through an open window in a nearby building. At the time of release, the package is a horizontal distance of 15.0 m from the window and a vertical distance of 4.50 m below the window. The package is at its maximum height above the ground at the time it passes through the window. Ignore air resistance effects.



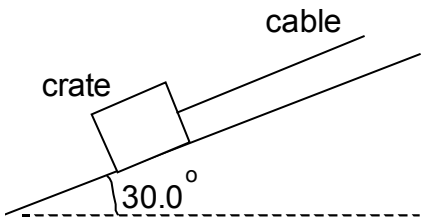
(a) On the diagram draw the trajectory of the package as it moves from the boy to the window.

(b) Calculate the time after the package was released that it passes through the window.

(c) Calculate the angle with the horizontal at which the package was thrown.

continued on page 9 ...

C3. A cable is used to drag an 80.0-kg crate up a ramp. The ramp is inclined at an angle of 30.0° with the horizontal and the coefficient of kinetic friction between the ramp and the crate is 0.245. Calculate the tension in the cable when the crate is being pulled at a constant velocity. (The cable is parallel to the ramp.)



END OF EXAMINATION