

**PHY1505**

(474715)

May/June 2014

MECHANICS (PHYSICS)

Duration : 2 Hours

100 Marks

EXAMINERS :

FIRST :

PROF GJ RAMPHO

SECOND :

PROF BM MOTHUDI

Use of a non-programmable pocket calculator is permissible.

Closed book examination.

This examination question paper remains the property of the University of South Africa and may not be removed from the examination venue.

- This paper consists of 5 pages plus instructions for the completion of a mark reading sheet.
- This examination consists of two sections **SECTION A** and **SECTION B**.
- Answer **SECTION A** (Multiple Choice) on the mark reading sheet.
- Answer **SECTION B** (Written Solutions) on the examination answer book
- Mark allocation for each question is indicated in brackets to the right.
- The information given at the end of Section B may be used without proof.

SECTION A (Multiple Choice)

- ANSWER ALL QUESTIONS IN THIS SECTION IN A MARK READING SHEET
- Use an HB pencil
- Indicate the number corresponding to the most correct option ([1], [2], [3], [4] or [5])

1. Consider a vector $\vec{d} = 10\hat{i} + 10\hat{j} + 5\hat{k}$ The magnitude of this vector is

- (1) 0
- (2) 15
- (3) 20
- (4) 25
- (5) 225

(3)

[TURN OVER]

2. An object dropped from the window of a tall building hits the ground in 12.0 s. If its acceleration is 9.80 m/s^2 , the height of the window above the ground is:
- (1) 29.4 m
 - (2) 58.8 m
 - (3) 118 m
 - (4) 353 m
 - (5) 706 m
- (3)
3. A brick is sliding on a horizontal surface. Which of the following will increase the magnitude of the frictional force on the brick?
- (1) Putting a second brick on top.
 - (2) Decreasing the surface area of contact.
 - (3) Increasing the surface area of contact.
 - (4) Decreasing the mass of the brick.
 - (5) Making the surface area of contact more smooth.
- (3)
4. Which of the following quantities is NOT a vector?
- (1) Mass
 - (2) Displacement
 - (3) Weight
 - (4) Acceleration
 - (5) Force
- (3)
5. A stone is tied to a 0.50-m string and whirled at a constant speed of 4.0 m/s in a vertical circle. Its acceleration at the top of the circle is:
- (1) 9.8 m/s^2 , up
 - (2) 9.8 m/s^2 , down
 - (3) 8.0 m/s^2 , down
 - (4) 32 m/s^2 , up
 - (5) 32 m/s^2 , down
- (3)
6. An object of mass 1 g is whirled in a horizontal circle of radius 0.5 m at a constant speed of 2 m/s. The work done on the object during one revolution is:
- (1) 0 J
 - (2) 1 J
 - (3) 2 J
 - (4) 4 J
 - (5) 16 J
- (3)

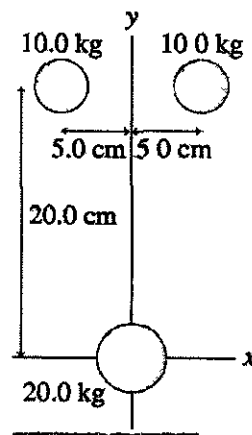
[TURN OVER]

- 7 A wheel, turning at a constant rate, completes 100 revolutions in 10 s Its angular speed is:
- (1) 0.31 rad/s
 - (2) 0.63 rad/s
 - (3) 10 rad/s
 - (4) 31 rad/s
 - (5) 63 rad/s
- (3)
- 8 Mercury is a convenient liquid to use in a barometer because it:
- (1) is a metal.
 - (2) has a high boiling point.
 - (3) expands little with temperature
 - (4) has a high density
 - (5) looks silvery
- (3)
- 9 The pressure exerted on the ground by a man is greatest when.
- (1) he stands with both feet flat on the ground
 - (2) he stands flat on one foot
 - (3) he stands on the toes of one foot
 - (4) he lies down on the ground.
 - (5) all of the above yield the same pressure
- (3)
- 10 A block of ice at 0 °C containing a piece of cork is floating on the surface of ice water in a beaker When all the ice has melted the water level
- (1) is higher.
 - (2) is lower
 - (3) is the same
 - (4) depends on the initial ratio of water to ice.
 - (5) depends on the shape of the ice block.
- (3)
[30]

SECTION B

ANSWER ALL THE QUESTIONS IN THIS SECTION IN AN EXAMINATION BOOK

- A 2.0 kg steel block is at rest on a steel table. A horizontal string pulls on the block
 - What is the minimum string tension needed to move the block? (5)
 - If the string tension is 20 N, what is the block's speed after moving 1.0 m? (5)
 - If the string tension is 20 N and the table is coated with oil, what is the block's speed after moving 1.0 m? (5)
- Susan's 10 kg baby brother Paul sits on a mat. Susan pulls the mat across the floor using a rope that is angled 30° above the floor. The tension is a constant 30 N and the coefficient of friction is 0.20. Use work and energy to find Paul's speed after being pulled 3.0 m. [10]
- A 75 kg shell is fired with an initial speed of 125 m/s at an angle of 55° above the horizontal. Air resistance is negligible. At its highest point the shell explodes into two fragments, one four times more massive than the other. The heavier fragment lands directly below the point of the explosion. If the explosion exerts forces only in the horizontal direction, how far from the launch point does the lighter fragment land? [15]
- Figure P13.29 shows three masses



- What are the magnitude and the direction of the net gravitational force on the 20.0 kg mass? Give the direction as an angle. [10]
- A 100 g mass on a 1.0 m long string is pulled 8.0° to one side and released. How long does it take for the pendulum to reach 4.0° on the opposite side? [10]
 - Your science teacher has assigned you the task of building a water barometer. You have learned that the pressure of the atmosphere can vary by as much as 5% from 1 standard atmosphere as the weather changes
 - What minimum height must your barometer have? (5)

[TURN OVER]

- (b) One stormy day the TV weather person says, "The barometric pressure this afternoon is a low 29.55 inches." What is the height of the water in your barometer?

(5)

[10]

USEFUL INFORMATION

coefficient of static friction for steel $\mu_s = 0.80$

coefficient of kinetic friction for steel $\mu_k = 0.60$

universal gravitational constant $G = 6.67 \times 10^{-11} \text{ Nm}^2/\text{kg}^2$

gravitational acceleration $g = 9.8 \text{ m/s}^2$

density of water $\rho_w = 1000 \text{ kg/m}^3$

pendulum angle as a function of time $\theta(t) = \theta_{\max} \cos(\omega t + \phi_0)$

$$m_1 u_1 + m_2 u_2 = m_1 v_1 + m_2 v_2$$

$$\frac{1}{2} m_1 u_1^2 + \frac{1}{2} m_2 u_2^2 = \frac{1}{2} m_1 v_1^2 + \frac{1}{2} m_2 v_2^2$$

$$A_1 v_1 = A_2 v_2$$

$$p_1 + \frac{1}{2} \rho v_1^2 + \rho g h_1 = p_2 + \frac{1}{2} \rho v_2^2 + \rho g h_2$$

PART 1 (GENERAL/ALGEMEEN) DEEL 1

STUDY UNIT e.g PSY100 X
STUDIE EENHEID by PSY100 X

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PAPER NUMBER
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INITIALS AND SURNAME
VOORLETTERS EN VAN

DATE OF EXAMINATION
DATUM VAN EKSAMEN

EXAMINATION CENTRE (E G PRETORIA)
EKSAMENSENTRUM (BY PRETORIA)

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9	9	9	9	9	9

For use by examination invigilator
Vir gebruik deur eksamenopsiener



IMPORTANT

- 1 USE ONLY AN HB PENCIL TO COMPLETE THIS SHEET
2. MARK LIKE THIS 
- 3 CHECK THAT YOUR INITIALS AND SURNAME HAS BEEN FILLED IN CORRECTLY
- 4 ENTER YOUR STUDENT NUMBER FROM LEFT TO RIGHT
- 5 CHECK THAT YOUR STUDENT NUMBER HAS BEEN FILLED IN CORRECTLY
- 6 CHECK THAT THE UNIQUE NUMBER HAS BEEN FILLED IN CORRECTLY
- 7 CHECK THAT ONLY ONE ANSWER PER QUESTION HAS BEEN MARKED
- 8 DO NOT FOLD

BELANGRIK

1. GEBUIK SLEGS N HB-POTLOOD OM HIERDIE BLAD TE VOLTOOI
2. MERK AS VOLG 
3. KONTROLEER DAT U VOORLETTERS EN VAN REG INGEVUL IS
4. VUL U STUDENTENOMMER VAN LINKS NA REGS IN
5. KONTROLEER DAT U DIE KORREKTE STUDENTENOMMER VERSTREK HET
6. KONTROLEER DAT DIE UNIEKE NOMMER REG INGEVUL IS
7. MAAK SEKER DAT NET EEN ALTERNATIEF PER VRAAG GEMERK IS
8. MOENIE VOU NIE

PART 2 (ANSWERS/ANTWOORDE) DEEL 2

1	א1 ב1 ג1 ד1 ה1 ו1 ז1 ח1 ט1 י1
2	א2 ב2 ג2 ד2 ה2 ו2 ז2 ח2 ט2 י2
3	א3 ב3 ג3 ד3 ה3 ו3 ז3 ח3 ט3 י3
4	א4 ב4 ג4 ד4 ה4 ו4 ז4 ח4 ט4 י4
5	א5 ב5 ג5 ד5 ה5 ו5 ז5 ח5 ט5 י5
6	א6 ב6 ג6 ד6 ה6 ו6 ז6 ח6 ט6 י6
7	א7 ב7 ג7 ד7 ה7 ו7 ז7 ח7 ט7 י7
8	א8 ב8 ג8 ד8 ה8 ו8 ז8 ח8 ט8 י8
9	א9 ב9 ג9 ד9 ה9 ו9 ז9 ח9 ט9 י9
10	א10 ב10 ג10 ד10 ה10 ו10 ז10 ח10 ט10 י10
11	א11 ב11 ג11 ד11 ה11 ו11 ז11 ח11 ט11 י11
12	א12 ב12 ג12 ד12 ה12 ו12 ז12 ח12 ט12 י12
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34	א34 ב34 ג34 ד34 ה34 ו34 ז34 ח34 ט34 י34
35	א35 ב35 ג35 ד35 ה35 ו35 ז35 ח35 ט35 י35

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