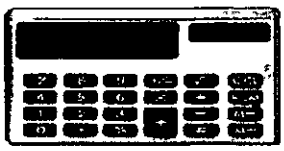
UNIVERSITY EXAMINATIONS



UNIVERSITEITSEKSAMENS

UNISA university of south africa

PHY1505

May/June 2016

MECHANICS (PHYSICS)

Duration 2 Hours

100 Marks

EXAMINERS

FIRST PROF GJ RAMPHO
SECOND MR T TSHUMA

Use of a non-programmable pocket calculator is permissible

Closed book examination

- This paper consists of 3 pages
- Mark allocation for each question is indicated in brackets to the right
- ANSWER ALL THE QUESTIONS

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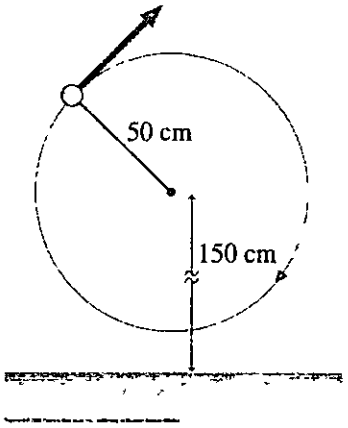
1 State three equations of motion and explain all the symbols [15]

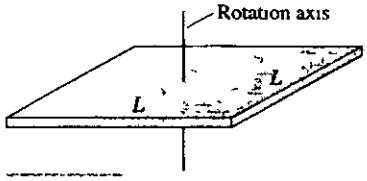
2 (a) State Newton's first law of motion (5)

(b) A 60 g ball is tied to the end of a 50-cm-long string and swung in a vertical circle The center of the circle, as shown in the figure below is 150 cm above the floor The ball is swung at the minimum speed necessary to make it over the top without the string going slack If the string is released at the instant the ball is at the top of the loop, how far to the right does the ball hit the ground? (15)



[20]

3 Determine the expression for the moment of inertia I of a square plate of uniform density ρ with side length L and mass M rotating about its center



[15]

4 (a) Ball 1, with a mass of 100 g and travelling at 10 m/s, collides head-on with ball 2, which has a mass of 300 g initially at rest What is the final velocity of each ball if the collision is

i perfectly elastic? (7)

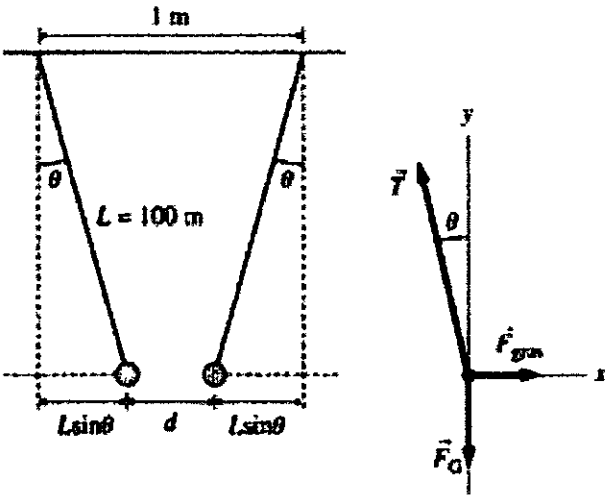
ii perfectly inelastic? (7)

(b) What quantities are conserved for perfectly elastic collisions? (6)

[20]

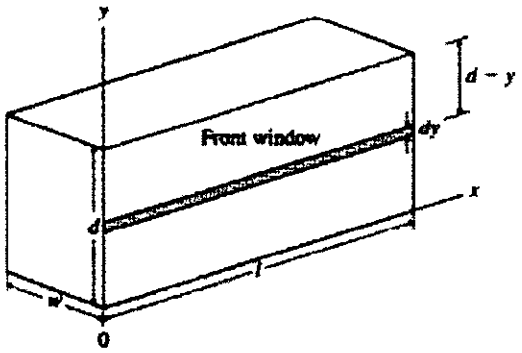
5 (a) State Newton's Law of Universal Gravitation (5)

(b) Two 100 kg lead spheres are suspended from 100-m-long mass-less cables The tops of the cables have been carefully anchored exactly 1 m apart



What is the distance between the centers of the spheres? (10)
[15]

6 An aquarium tank is 100 cm long, 35 cm wide, and 40 cm deep It is filled to the top



(a) What is the force of the water on the bottom ($100\,cm \times 35\,cm$) of the tank?
Hint: This problem requires an integration (6)

(b) What is the force of the water on the front window ($100\,cm \times 40\,cm$) of the tank? (5)

(c) State the equation of continuity for flowing ideal fluids (4)
[15]

Physical Constants

gravitational constant	$G = 6\,67 \times 10^{-11}\,\mathrm{N\,m^2\,kg^{-2}}$
gravitational acceleration	$g = 9\,81\,m\,s^2$
mass of the Earth	$M_E = 6\,0 \times 10^{24}\,\mathrm{kg}$
radius of the Earth	$R_E = 6.4 \times 10^6\,\mathrm{m}$
density of water	$\rho_w = 1000\,\mathrm{kg/m^3}$