TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF APPLIED AND HEALTH SCIENCES

DEPARTMENT OF MATHEMATICS & PHYSICS

UNIVERSITY EXAMINATION FOR:

DIPLOMA IN ANALYTICAL CHEMISTRY

APS 2101: PHYSICS I

END OF SEMESTER EXAMINATION

SERIES: MAY 2016

TIME:2HOURS

Instructions to Candidates

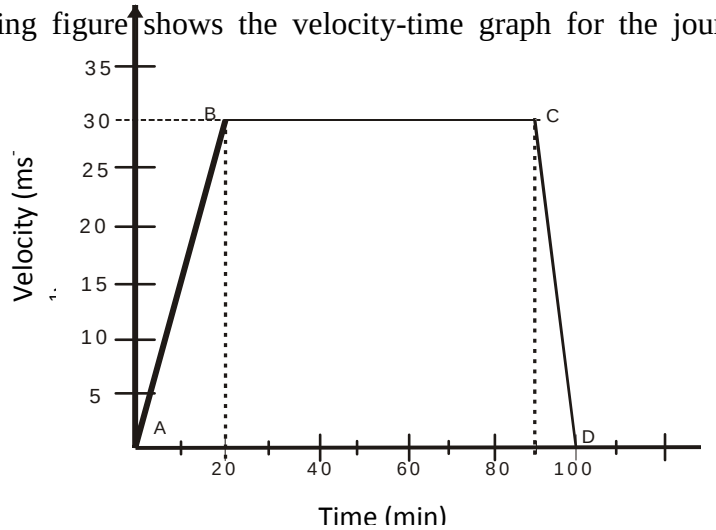
You should have the following for this examination
Answer Booklet
examination pass
mathematical table or calculator
student ID
This paper consists of **FIVE** questions.
Attempt question ONE (Compulsory) and any other TWO questions.
This paper consists of 5 printed pages

Do not write on the question paper.

Question ONE (30mks)

a) When a mass is attached to a spring, the acceleration is $a = k\,x/m$ where a is acceleration, x is a length, m is mass, and k is a spring constant. Find the units of k. (3mks)

b) The following figure shows the velocity-time graph for the journey of a car in 100 minutes



i) Determine the acceleration of the car between A and B and between C and D. (2mks)

ii) Determine the distance covered by the car during the journey. (2mks)

iii) Determine the average speed of the car. (1mk)

c) A student pulls a block of wood of mass 4kg along a horizontal surface by applying a constant force of 15N. Calculate the co- efficient of friction on the surface. (2mks)

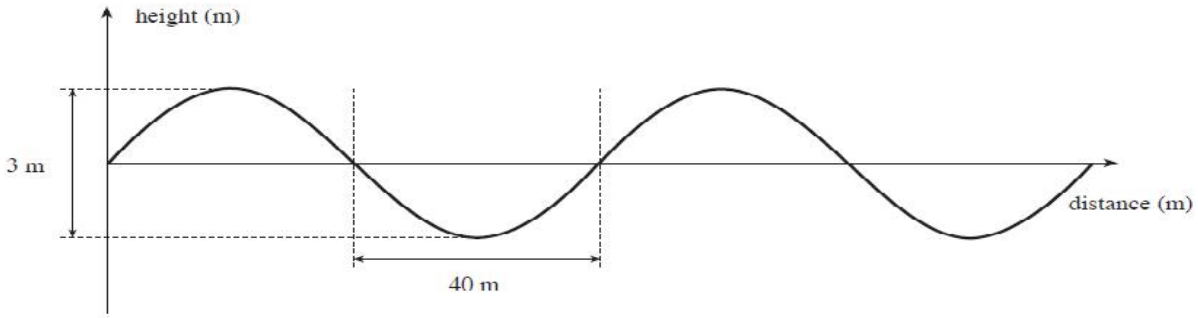
d) A car traveling at 72km/h undergoes a uniform acceleration of $0.5m/s^2$.Find the time taken for its velocity to decrease to one quarter of the initial value. (3mks)

e) A body in a uniform circular motion experiences acceleration despite moving at a constant speed. Explain. (1mk)

f) i)Explain any two differences between electromagnetic waves and mechanical waves (2mks)

ii) All waves can exhibit phenomena such as refraction and diffraction. Explain (2mks)

g) The diagram represents a wave on the ocean.



(a) Use the information given in the diagram to find:

(i) the wavelength of the wave: (1mk)

(ii) the amplitude of the wave. (1mk)

(b) The frequency of the wave is 0·14 Hz. (2mks)

h) Explain why using a fan in summer feels so refreshing (1mk)

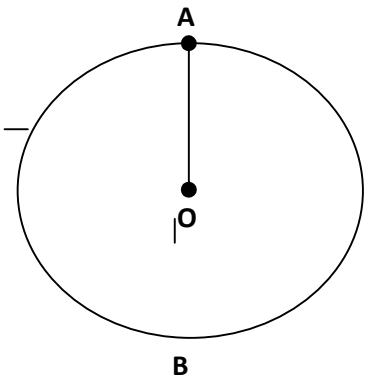
i) A concrete railroad tie has a length 2.45 meters on a hot, sunny, 35°C day. What is the length of the railroad tie in the winter when the temperature dips to -25°C? Coefficient of linear expansion of concrete $\alpha = 12 \times 10^{-5}\ (^0C)^{-1}$) (3mks)

j) Explain the two differences between temperature and heat (2mks)

k) Explain the uses of radio waves and x-rays (2mks)

Question TWO(15mks)

(a) The figure below shows a stone of mass 450g rotated in a vertical circle at 3 revolutions per second. If the string has a length of 1.5m, determine:



(i) The linear velocity (3mks)

(ii) The tension of the string at position **A** (4mks)

b) A stone is whirled with uniform speed in horizontal circle having radius of 10cm. It takes the stone 10 seconds to describe an arc length 4cm .Determine

(i) Angular velocity (3mrks)

(ii) The periodic time (3mrks)

(iii) State **two** factors affecting centripetal force (2mrks)

Question THREE (15mks)

a) State Pascal's principle (1mk)

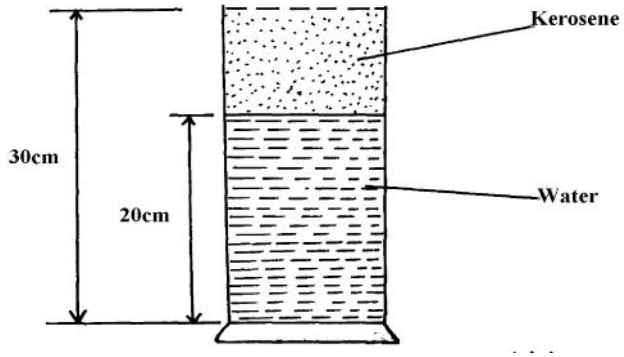
b) What force must be exerted on the master cylinder of a hydraulic lift to support the weight of a 2000kg car resting on a slave cylinder? the master cylinder has a 2 cm diameter and the slave has a 24cm diameter (3mks)

c) The left side of the heart creates a pressure of 120mmHg by exerting a force directly on the blood over an effective area of 15.0cm^2. What force does it exert to accomplish this.(density of mercury is 13600kg/m^3) (3mks)

d) Explain why in early days of commercial flights women were not allowed to wear high heeled shoes? (2mks)

e) The reading on a mercury barometer at Mombasa is 760mm. Calculate the pressure at Mombasa (density of mercury is $1.36 \times 10^{4} Kgm^{-3}$) (3mks)

f) The figure below shows a measuring cylinder of height 30cm filled to a height of 20cm with water and the rest occupied by kerosene



Given that density of water = $1000 Kgm^{-3}$, density of kerosene = $800 Kgm^{-3}$ and atmospheric pressure = 1.03×10^{5} Pascals, determine the pressure acting on the base of the container (3mks)

Question FOUR (15mks)

a) A travelling wave is described by the equation

$$y(x,t) = (0.003)\cos(20x + 200t)$$

where y and x are measured in metres and t in seconds

Calculate the following physical quantities:

i) angular wave number (1mk)

ii) wavelength (1mk)

iii) angular frequency (1mk)

iv) frequency (1mk)

v) period (1mk)

vi) wave speed (1mk)

vii) amplitude (1mk)

viii) particle velocity when $x = 0.3$ m and $t = 0.02$ s (3mks)

ix) particle acceleration when $x = 0.3$ m and $t = 0.02$ s (3mks)

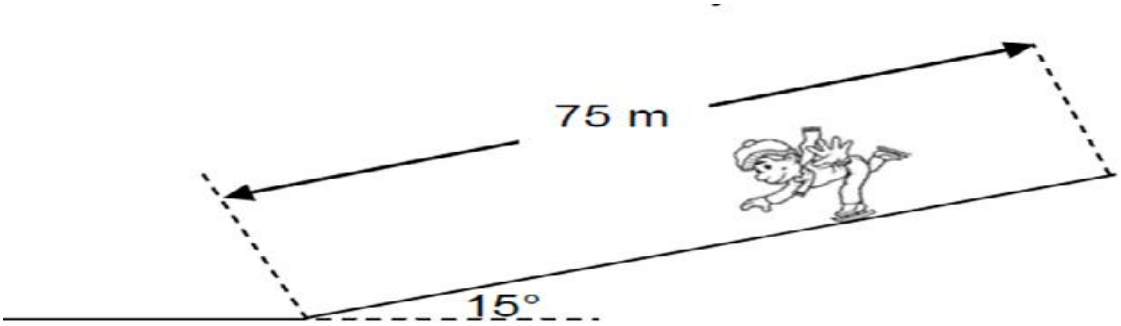
b) Distinguish between transverse and longitudinal waves. (2mks)

Question FIVE (15mks)

a) A wooden crate with mass 100kg is at rest on a stone floor. Given that the coefficients of kinetic and static friction are 0.4 and 0.5 respectively. Calculate

i) The minimum horizontal force F needed to just get the crate moving (2mks)
ii) The minimum force needed to keep the crate in motion at a constant velocity (2mks)
iii) The acceleration of the crate if a force of 550N is applied (2mks)

b) A skier of mass 60kg skies from rest down a slope inclined at an angle of 15^0. The length of the incline is 75 m. He reaches the end of the incline at a velocity of 15m/s. A constant frictional force acts on the skier on his way down



i) Write down the expression for the magnitude of the normal force acting on the skier and then calculate its magnitude (3mks)

ii) Draw a well labeled free body diagram showing all the forces acting on the a skier as he skies down the slope (3mks)

iii) Calculate the average frictional force acting on the skier during his motion down the incline (3mks)

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