

CHUKA



UNIVERSITY

UNIVERSITY EXAMINATIONS

EXAMINATION FOR THE AWARD OF DEGREE OF BACHELOR OF SCIENCE**PHYS 112: PHYSICS A****STREAMS:****TIME: 2 HOURS****DAY/DATE: THURSDAY 06/12/2018****11.30 A.M – 1.30 P.M****INSTRUCTIONS****Answer question one and any other two questions****QUESTION ONE (30MKS)**1 a) Given $\mathbf{r}_1=3\mathbf{i}-2\mathbf{j}+\mathbf{k}$, $\mathbf{r}_2=2\mathbf{i}-4\mathbf{j}-3\mathbf{k}$, $\mathbf{r}_3= -\mathbf{i}+2\mathbf{j}+2\mathbf{k}$. Findi) the magnitudes of $2\mathbf{r}_1-3\mathbf{r}_2-5\mathbf{r}_3$ [2marks]ii) $\mathbf{r}_1 \times \mathbf{r}_3$ [3marks]

b) i) Define refraction of light [2marks]

ii) A ray of light travelling through a liquid of absolute refractive index 1.4 is incident on the plane surface of a Perspex block at an angle of 55° . Calculate the angle of refraction in the Perspex if it has an absolute refractive index 1.5

[4marks]

c) i) Define the following

Coplanar vectors

Specific heat capacity

Acceleration

[3marks]

ii) A body of mass 50 kg initially moving at 20 m/s accelerates to a velocity of 30 m/s in 5 seconds. Calculate the force acting on the body. [3marks]

d) A wave whose displacement is given by $y=a \sin(\omega t-kx)$ moving in one direction is reflected at a barrier and interferes with the incoming wave. Show that the resultant of the two is given by $Y=A \sin \omega t$ where $A = 2a \cos kx$ [4marks]

e) State Newton's laws of motion [3marks]

f) A horizontal cord 5 m long has a mass of 1.45 g. What must be the tension in the cord if the wavelength of a 120 Hz on it is to be 60 cm. How large a mass must be hung from its end to give it this tension. [4marks]

g) Differentiate between heat capacity and latent heat [2marks]

QUESTION TWO (20MKS)

2 a) i) Define the following terms

Principle focus

Focal length [2marks]

ii) Show that image formed by a plane mirror is as far behind the mirror as the object is in front [6marks]

b) An object is placed 20 cm from a concave mirror of focal length 15 cm, show using ray construction the location of the image, describe the characteristics of the image [6marks]

c) By applying mirror formula, find the position of an object that gives an image located 15 cm in front of a concave mirror of focal length 10 cm. [6marks]

QUESTION THREE (20MKS)

3 a) Define specific latent heat of fusion [2marks]

b) 5 kg of ice at a temperature of -4°C is converted to water at a temperature of 75°C . Calculate the quantity of heat used. (Take specific heat capacity of ice 2100 J/kg/k , specific latent heat of fusion of ice $1.7 \times 10^5\text{ J/Kg}$, specific heat capacity of water 4200 J/kg/k) [7marks]

c i) Explain why heat transfer is faster in metal conductors than in non metals [2marks]

ii) The specific heat of water is 4184 J/kg/K . By how many joules does the internal energy of 50 g of water change as it is heated from 21°C to 37°C ? [4marks]

d) Differentiate between evaporation and boiling [3marks]

e) State the first and second laws of thermodynamics [2marks]

QUESTION FOUR (20MKS)

4a) i) Differentiate between free simple harmonic motion and damped harmonic motion

[2marks]

ii) Two organ pipes 60cm and 61cm long are found to give a beat frequency of 2.6 Hz when each is sounding its fundamental note. Neglecting the end correction

Calculate

I the velocity of sound in air [3marks]

II The frequency of the two notes [4marks]

b) State any three factors affecting the velocity of waves along a stretched string [3marks]

c) A body of mass 4 kg is supported by springs which have equivalent stiffness of 2500 N/m. i) The mass is initially displaced downwards by 10 mm from the equilibrium position and then released.

ii) The body is struck by an impulse of 10 Ns which acts vertically downwards. In both cases determine the expression for displacements. [8marks]

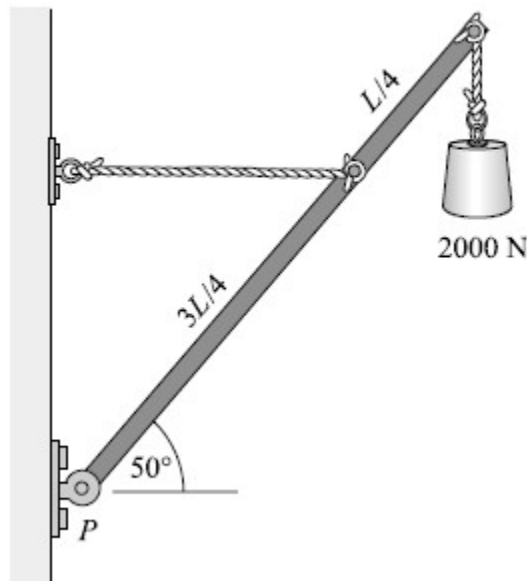
QUESTION FIVE (20MKS)

5 a) Starting from Newton's second law of motion show that

$F=ma$ [2marks]

b) Where must a 0.8 kN object be hanged on a uniform, horizontal, rigid 100 N pole of length 20 m so that a girl pushing up at one end supports one third as much as a woman pushing up at the other end? [7marks]

c) A uniform 0.4 kN rod is supported as shown below, find the tension in the tie rope and the force exerted on the rod by the pin at P. [8marks]



d) A 300 g object slides 80 cm along a horizontal table top. How much work is done in overcoming the friction between the object and the table if the coefficient of kinetic friction is

0.2

[3marks]
