



**JOMO KENYATTA UNIVERSITY
OF
AGRICULTURE AND TECHNOLOGY
UNIVERSITY EXAMINATIONS 2015/2016**

**FIRST YEAR SECOND SEMESTER EXAMINATION FOR THE DEGREE OF
BACHELOR OF FOOD SCIENCE AND NUTRITION, WATER AND ENVIRONMENT
MANAGEMENT, ANIMAL HEALTH, LAND RESOURCE AND FOOD SCIENCE AND
TECHNOLOGY**

SPH 2161 PHYSICS II

DATE: APRIL 2016

TIME: 2 HOURS

INSTRUCTIONS

Attempt QUESTION ONE and any other TWO questions.

QUESTION ONE carries 30 marks and the rest carry 20 marks each.

Question One

- a) Use a labeled ray diagram to show that the angle of deviation, D for a ray of light incident on a plane mirror is twice the glancing angle. (3 Marks)
- b) What are the two conditions for total internal reflection of light to occur? (2 marks)
- c) Find the critical angle for a glass - water boundary if $n_g = 1.51$ and $n_w = 1.33$ (4 marks)
- d) Explain what is meant by "Critical angle" (1 mark)
- e) Differentiate between a wave and a vibration. (2 marks)

f) Explain clearly the distinction between transverse waves and longitudinal waves.

(2 marks)

g) Sound waves are longitudinal waves in air. The speed of sound depends on temperature: at 20°C it is 344 m/s . What is the wavelength of a sound wave in air at 20°C if the frequency is 262 Hz ?

(2 marks)

h) What is the speed of sound in air when the temperature is 20°C ? given:

$$\gamma = 1.4, R = 8.314\text{ J/molK}; M = 29\text{ g/mol}$$

(2 marks)

i) Distinguish between the epoch and phase of a vibration.

(2 marks)

j) (i) State Coulomb's law of electrostatics.

(2 marks)

(ii) Two objects, whose charges are $+1.0\text{ C}$ and -1.0 C , are separated by 1.0 km . Find the magnitude of the attractive force that either charge exerts on the other

(3 marks)

k) Draw electric field lines around electric dipoles of different polarity.

(2 marks)

l) An electric heater consumes 3.6 MJ when connected to a 250 V supply for 40 minutes .

Find the power rating of the heater and the current taken from the supply. (3 marks)

QUESTION TWO

a) State the laws of refraction

(2 marks)

b) A ray of light is moving from a material having a high index of refraction into a material with a lower index of refraction. Is the ray bent toward the normal or away from it? Explain

(2 marks)

c) A diverging lens has a focal length of -5.0 cm . If an object is held 4.0 cm from the lens, what are the location and magnification of the image?

(4 marks)

b) Write a mathematical statement of the Len's markers' equation explaining all terms used

(2 marks)

c) What is the focal length of a double convex lens made from glass with refractive index = 1.52 . If $R_1 = 0.35\text{ m}$ and $R_2 = -0.35\text{ m}$

(4 marks)

d) The critical angle for total internal reflection at a liquid- air interface is 42.5° .

i) Determine the refractive index of the liquid

(2 marks)

- ii) If a ray of light travelling from the liquid to air makes an angle of incidence at the interface of 30° with the normal, what angle does the refracted ray in the liquid make with the normal? (4 marks)

QUESTION THREE

- a) Explain how the frequency of a tuning fork can be determined by the method of beats. (3 marks)
- b) A tuning fork A produces 4 beats/second with a tuning fork B of frequency 256. A is filed and the beats occur at shorter intervals. What was its original frequency? (4 marks)
- c) A sinusoidal wave traveling in the positive x - direction has an amplitude of 15.0 cm, a wavelength of 40.0 cm, and a frequency of 8.00 Hz. The vertical position of an element of the medium at $t = 0$ and $x = 0$ is also 15.0 cm. (i) Find the wave number k , period T , angular frequency ω , and speed v of the wave. (ii) Determine the phase constant ϕ and write a general expression for the wave function (6 marks)
- d) Define sound and state two factors that determine the speed of sound. (3 marks)
- e) What length of closed pipe is needed to resonate with a fundamental frequency of 256 Hz? What is the second overtone? Assume that the velocity of sound is 340 M/s. (4 marks)

QUESTION FOUR

- a) In a flashlight, the current is 0.40 A, and the voltage is 3.0 V. calculate
- The power delivered to the bulb
 - The electrical energy dissipated in the bulb in 5.5 minutes of operation. (4 marks)
- b) Name four advantages of an alkaline cell over a lead-acid cell (4 marks)
- c) An iron ring of mean diameter 10 cm is uniformly wound with 2000 turns of wire. When a current of 0.25 A is passed through the coil a flux density of 0.4 T is set up in the iron. Find
- The magnetizing force and
 - The relative permeability of the iron under these conditions. (6 marks)
- d) With aid of a diagram explain the main parts of a cathode ray oscilloscope (6 marks)