



MAASAI MARA UNIVERSITY

REGULAR UNIVERSITY EXAMINATIONS 2018/2019 ACADEMIC YEAR SECOND YEAR SECOND SEMESTER

**SCHOOL OF SCIENCES
BACHELOR OF SCIENCE AND BACHELOR
OF EDUCATION (SCIENCE)
COURSE CODE: PHY 1208
COURSE TITLE: GEOMETRIC OPTICS**

**DATE: 29TH APRIL, 2019
4.30PM**

TIME: 2.30-

INSTRUCTIONS TO CANDIDATES

1. Answer Question **ONE** and any other **TWO** questions
2. *Question one carries 30 marks while each of the others carries 20 marks.*
3. *Credit will be awarded for clear explanations and illustrations.*

Speed of light in vacuum = $3.0 \times 10^8 \text{ m/s}$

Index of refraction of air = 1.00

Index of refraction of crown glass = 1.52

Index of refraction of water = 1.33

This paper consists of 4 printed pages. Please turn over.

QUESTION ONE

- a) Explain the duality nature of light
(2marks)
- b) Explain why it is difficult to see while driving on a rainy night
(2marks)
- c) State two conditions for total internal reflection to occur.
(2marks)
- d) Two mirrors make an angle of 120° with each other. A ray is incident on mirror M_1 at an angle of 65° to the normal. Find the direction of the ray after it is reflected from mirror M_2 .
(4marks)
- e) Two thin converging lenses of focal lengths $f_1=10.0\text{cm}$, and $f_2=20.0\text{cm}$ are separated by 20.0cm . An object is placed 30.0cm to the left of lens 1 (of $f_1=10.0\text{cm}$). Find the position and the magnification of the final image.
(5marks)
- f) Distinguish between chromatic aberration and spherical aberration in lenses.
(4marks)
- g) Construct a ray diagram to correct a person with farsightedness
(4marks)
- h) A small fish at a depth d below the surface of a pond. what is the apparent depth of the fish as viewed from directly overhead (3marks)
- i) A converging glass lens ($n=1.52$) has a focal length of 40.0cm in air. Find its focal length when it is immersed in water.
(4marks)

QUESTION TWO

- a) Use diagrams to illustrate the diffraction effects of light waves that meet a barrier with a circular opening:
- Whose diameter is much larger than the light wavelength (2marks)
 - Whose diameter is much smaller than the light wavelength (2marks)
- b) Distinguish between a real image and a virtual image (2marks)
- c) By calculation, locate and describe the image form by an object placed at 5.00cm from a spherical mirror whose focal length is +10.0 cm. (5marks)
- d) Explain the working of a compound microscope (5marks)
- e) With aid of diagram explain the light dispersion on a prism (4marks)

QUESTION THREE

- a) State the Snell's law of refraction of light (2marks)
- b) State any three characteristics of image formed by a plane mirror (3marks)
- c) Explain the observation that when light passes from a material with index of refraction 1.3 into one with index of refraction 1.2 bends toward the normal (2marks)
- d) A light of wavelength 589nm travels through air is incident on a smooth flat slab of crown glass at an angle of 30.0° to the normal. Find the angle of refraction. (3marks)

- e) i. State Fermat's principle
(2marks)
ii. Use Fermat's principle to derive the Snell's law of
refraction
(8marks)

QUESTION FOUR

- a)** State two laws of reflection of light
(2marks)
- b)** With the aid of ray diagram explain how to correct a person
with nearsightedness(myopia)
(5marks)
- c)** Construct a ray diagram to find the image distance and its
description for an object placed 30.0 cm in front of a
converging lens of focal length 10.0 cm
(5marks)
- d)** Explain how a telescope works
(5marks)
- e)** Find the critical angle for an air-water interface
(3marks)

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