KABARAK UNIVERSITY

UNIVERSITY EXAMINATIONS

2009/2010 ACADEMIC YEAR

FOR THE DEGREE OF BACHELOR OF EDUCATION SCIENCE

COURSE CODE: **PHYS 122**

COURSE TITLE: **GEOMETRIC OPTICS**

STREAM: **SESSION II**

DAY: **SATURDAY**

TIME: **9.00 – 11.00 A.M.**

DATE: **28/11/2009**

INSTRUCTIONS:

Answer Question **1** (compulsory) and any **other two**

You may need the following:

1. Acceleration due to gravity $g = 9.8\ ms^{-2}$
2. Refractive index of water $\eta = 1.33$
3. Index of refraction $\eta =$ –

   - Symbols have usual meaning

PLEASE TURN OVER

QUESTION ONE

(a) The law of Refraction is defined through the Relationship $\frac{\theta}{\theta} = — =$ constant

where υ is the speed of light in the first medium and is the speed of light in the second medium.

(i) Show that Snell's law is given by $\sin\theta = \sin\theta$. (2 mks)

(ii) Explain what happens to the frequency, wave length and speed as light travels from one medium into another. (3 mks)

(iii) Is it possible to have total internal reflection for light incident from air on water? Explain (4 mks)

(b) The arc of a rainbow appears with Red on top and violet on the bottom. Explain (3 mks)

(c) Objects viewed under water with naked eye appear blurred and out of focus. A diver using a mask has a clear view of under water objects. Explain (4 mks)

(d) What happens to the focal length of any lens of index of refraction η when it is immersed in a fluid which has an index of refraction of η ? (7 mks)

(e) Two thin converging lens of focal lengths $= 8$ cm and $= 10$ are separated by 12 cm. Find the position and magnification of final image if the object is 25 cm to the left of first lens. (8 mks)

(f) You wish to reflect sunlight from a mirror out some paper in order to start a fire. What type of mirror do you need and why? (3 mks)

(g) If you want to focus the image of on object close to the camera, how can you adjust the converging lens? (2 mks)

(h) Explain the difference between spherical and chromatic can a curved mirror have? Why?

QUESTION TWO

A ball is dropped at t = 0 from rest 3 cm directly above the vertex of a mirror that

has a radius of curvature of 1.5m.

Describe the image of the ball;

(i) At $= 0$ (8 mks)

(ii) When the ball just touches the vextex of mirror. (3 mks)

(iii) At any other time (4 mks)

QUESTION THREE

A thin hollow air convex lens is immersed in tank of water. The hollow lens has radii 20 cm and 30 cm respectively

(i) Calculate the focal length of this air lens.

(ii) A fish at a distance of 2 cm swims away from the lens at speed of 2cm S^{-1}. Find the speed of the image.

QUESTION FOUR

Two mirrors are at an angle of α with each other. A ray is incident on the first mirror at an angle θ to the normal.

(a) Find the direction β of the ray after it is reflected from the second mirror. (11 mks)

(b) Determine the condition for which;

(i) $\beta = \alpha$ (2 mks)

(ii) Light is reflected straight back to its origin ($\beta = 180°$) (2 mks)