MENGO SENIOR SCHOOL

END OF TERM 1 2003 EXAMS

S.5 PHYSICS PAPER 2

TIME: 2 HOURS

INSTRUCTIONS:
-Attempt any four questions
-All questions carry equal marks.

Q1(a) What do you understand by the following terms as applied to curved mirrors.
(i) Focal point
(ii) Caustic surface

(b) If you are provided with one optical pin only and a concave mirror. Describe an experiment you can carry out to determine the focal length of that mirror using a method of no parallax.

(c) A pole 4m long is laid along the axis of a convex mirror of focal length 1m. The end of the pole nearer to the mirror is 2m from it. Find:
(i) The length of the image of the pole.
(ii) The magnification produced.

(d) An erect image three times the size of the object is obtained with a concave mirror of radius of curvature 36cm.
(i) Sketch a simple ray diagram to show the formation of the image.
(ii) Calculate the distance of the object from the mirror.

Q2(a) Define the terms below as applied to mirrors.
(i) Aperture
(ii) Focal length

(b)(i) Show that the displacement d suffered by the image of an object placed below a glass block of thickness t and refractive index n is given by

$$d = t\left[1 - \frac{1}{n}\right]$$

(ii) An ink mark appears to have been displaced through a distance of 1 cm when it is placed below a glass block of thickness 1 cm and refractive index 1.5 on top of which is a liquid of thickness 4cm. Calculate the refractive index of this liquid.

(c) Describe a simple experiment you would carry out to determine the refractive index of a transparent liquid using the real and apparent depth method.

(d) A tank contains a slab of glass 8cm thick and of refractive index 1.6. Above this is a liquid of depth 4.5cm and refractive index 1.5

Q3

(a)(i) What do you understand by the term refraction of light.

(ii) State the laws of refraction of light.

(b)(i) Using well labelled diagrams, explain the terms critical angle and total internal reflection.

(ii) Describe the critical angle method for determining the refractive index of a transparent liquid.

(c)(i) Show that the refractive index n of a glass prism in air at minimum deviation is given by:

$$n = \frac{\sin\left[\frac{D+A}{2}\right]}{\left[\frac{A}{2}\right]}$$

Where D is the value of the angle of minimum deviation.

(ii) Show that for small angles of incidence with a prism of small angle A, the deviation d produced by the prism is given by

$d = (n-1)\,A$

Q4.

(a)(i) A ray of light is refracted through a prism of angle 70^0 . If the angle of refraction in the glass at the first face is 28^0. What is the angle of incidence in the glass at the second face?

(ii) The angle of a glass prism is 60^0 and the minimum deviation of light through the prism is 39^0. Calculate the refractive index of the glass.

(iii) The refractive index of a glass prism is 1.66 and the angle of the prism is 60^0. Find the minimum deviation.

(b) A right angled prism ABC has angle BAC and ACB = 45^0 and refractive index 1.60. A ray of light is incident upon the hypotenuse face AC so that after refraction it strikes face AB and emerges at minimum deviation.

(i) What is the smallest angle of incidence upon AC for which the ray can still emerge at AB.

(ii) If the angle of incidence upon AC is made zero, what will be the net deviation of the ray?

Q5.

(a)(i) State the laws of reflection of light.

(ii) Deduce a formula connecting u.v and r, the distances of object, image and centre of curvature from a concave mirror.

(b) A mirror forms an erect image 30cm from the object and twice its height.

(i) What is the position of the mirror?

(ii) Find the radius of curvature of this mirror.

(c)(i) Establish the formula $\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$ for a convex mirror

(ii) In an experiment with a concave mirror the magnification m of the image is measured for a series of values of v and a curve is plotted between m and v. What curve would you expect to obtain and how would you use it to deduce the focal length of the mirror.

END