

BEGINNING OF TERM EXAMS

23RD SEPTEMBER, 2002

S5 PHYSICS P510/2

TIME: 2 HOURS.

Instructions:

- Attempt any four question.
 - All questions carry the same marks.
- 1-
- a) (i) State the laws of reflection of light. (2)
 - (ii) Why do you think totally reflecting prisms are better reflectors than the plane silvered mirrors. (2)
 - b) (i) What do you understand by the term principal focus as applied to spherical mirrors.. (2)
 - (ii) Using a diagram describe the auxiliary converging lens method for determining the focal length of a convex mirror. (5)
 - c) (i) What do you understand by the term virtual image. (1)
 - (ii) A concave mirror of radius of curvature 25cm faces a convex mirror of focal length 10cm that is 30cm away from it. An object is placed midway between the mirrors. Find the nature and position of the image formed first by reflection at the concave mirror and then at the convex mirror. (5)
 - d) List three characteristics of images formed by plane mirrors. (3)

- 2- a) (i) What do you understand by the term refraction of light. (1)
- (ii) State the laws of refraction of light. (2)

- b) A ray of light is incident obliquely from a vacuum onto a glass block of refractive index n and thickness d such that the angle of refraction in the glass is α .

Show that the time taken for the light to propagate through the glass is given by;

$$t = \frac{nd \sec \alpha}{C}$$

Where C is the velocity of light in air. (5)

- c) (i) Differentiate between the terms refractive index and refracting angle for a given prism. (2)
- (ii) A ray of monochromatic light is incident at an angle of 30° on a prism of refractive index 1.52. What is the largest refracting angle of this prism for which the light just emerges out of the opposite face? (5)
- d) (i) What do you understand by the term symmetrical passage of a ray of light through a glass prism. (1)
- (ii) Differentiate between deviation and dispersion of white light by a glass prism. (4)
- 3- a) (i) State clearly the sign convention you employ in optics. (2)
- (ii) The image obtained with a converging lens is erect and three times the length of the object. The focal length of the lens is 20cm. Calculate the object and image distances. (5)
- b) (i) A beam of light converges to a point 9cm behind a diverging lens of focal length 15cm. Find the image position and draw sketches illustrating it. (5)

- (ii) The surface of a biconvex lens are 8cm and 12cm radius of curvature. If one refractive index of the glass is 1.5. Calculate the focal length. (4)

- c) The curved surface of a plano-concave lens is 10cm radius of curvature and the refractive index of glass is 1.6. Calculate the focal length. (4)

- 4- a) (i) What do you understand by the term magnification as applied to lenses. (1)

- (ii) An object is 80cm away from a screen. A convex lens forms an image of this object on the screen. Find the value of the focal length of the lens given that the image was three times the size of the object. (5)

- b) Define the following terms as applied to microscopes.

 - (i) Angular magnification. (1)
 - (ii) Normal adjustment. (1)
 - (iii) The near point. (1)

- c) Describe with the aid of diagrams, how:
 - (i) a single biconvex lens can be used as a magnifying glass. (4)
 - (ii) two biconvex lenses can be arranged to form a compound microscope in normal adjustment. (4)

- c) Derive the expression for the angular magnification of a compound microscope in normal adjustment. (3)

- 5- a) (i) Explain the term chromatic aberration as applied to a converging lens. (2)

- (ii) The curved surface of a plano-convex lens has a radius of curvature of 40cm and is made of crown glass for which the refractive indices for red and blue light are 1.515 and 1.520 respectively calculate the longitudinal chromatic aberration for the lens. (4)

- b) A concave lens of focal length 20cm is placed 45cm to the right of a convex lens of focal length 30cm. A small object of height 1.0cm is placed 50cm to the left of the converging lens and at right angles to the axis of the lens system. Find:
- (i) The position and nature of the image formed. (5)
 - (ii) The size of the image (2)
- c) (i) What do you understand by the term critical angle? (2)
- (ii) A is the vertex of a regular glass prism. The angle A being 30° . A ray of light Op is incident at P on one of the faces enclosing angle A in a direction such that angle $OPA = 40^\circ$.
- Show that if the refractive index of glass is 1.5, the ray cannot Emerge from the second face. (use sketch). (5)