BEGINNING OF TERM III EXAMINATION, 2017

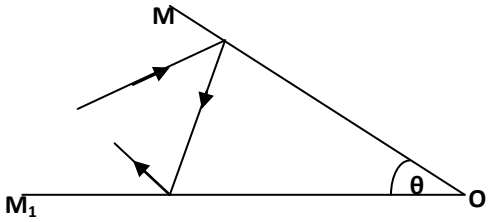
S.5 PHYSICS PAPER 2

INSTRUCTION: Attempt **ANY THREE** Questions

Where necessary use $\frac{1}{4\pi\varepsilon_0} = 9.0\times10^9\ Fm^{-1}$

1.a) Distinguish between the two types of reflection (4marks)

b) The diagram below shows two plane mirrors MO and M_1O inclined at an angle θ. A ray of light is incident on one mirror MO as shown. Derive the expression for net deviation of the light ray in terms of θ. (3marks)



c) Describe how the focal length of a concave mirror can be obtained by an optical pin and tripod stand with a clamp. (4marks)

d) A real image of an object placed at a point, A, a distance, x , from a convex lens is formed 30.0 cm from the lens. When a convex mirror is made to face the lens at a distance 10cm apart the image and the object coincide at A.

(i) Find the distance x and the focal length of the convex mirror, given that the focal length of the lens is 7.5 cm. (5marks)

(ii) Draw a ray diagram to illustrate the formation of the image above. (2marks)

e) State two reasons why a convex mirror is used a car driving mirror. (2marks)

2. a) State two differences between mechanical and electromagnetic waves giving one example of each. (4marks)

b) What is a wave front? (1mark)

(ii) State the two types of wave fronts, and explain how each is produced. (4marks)

c) (i) what is a progressive wave? (1mark)

(ii) State two examples of a progressive wave (2marks)

d) The displacement, y, of a progressive wave is given by the equation

$y = 2.5\sin 2\pi(\frac{t}{2} - \frac{3x}{5})$, where y and x are in cm and t in seconds. Use the equation to find amplitude, frequency, wavelength, speed and wave vector of the wave. (8marks)

3. a) State Coulomb's law of electrostatics (1mark)

b)Two small identical conducting spheres, each of mass 10g are suspended by a silk thread 20 cm long from the same point. On being charged, spheres, which were originally in contact, take up positions with their centres 5 cm apart. What was the charge given to the spheres? (5marks)

c(i) Define the term electric potential and electric field intensity (2marks)

(ii) Derive the relationship between the two terms in (i) above (3marks)

d) Three charges 3μC, - 2μC and - 5μC are placed at points A, B, and C in a straight line. A fourth charge – 4μC is placed at appoint D directly above B. Given AB = BC = BD = 20 cm, find the electric field intensity and electric potential at B (7marks)

e) Show that the total flux passing normally through any closed surface whatever its shape is always equal to $\frac{Q}{\varepsilon_o}$; where **Q** is the total charge endorsed by the surface and ε_o is the permittivity of free space. (2marks)

4.a) Define the term refractive index of a medium (2marks)

b) A microscope is first focused on a scratch on the inside of the bottom of an empty glass dish. Water is then poured in and it is found that the microscope has to be raised by 1.1cm for refocusing. Chalk dust is sprinkled on the surface of water and this dust comes into focus when the microscope is raised an additional 3.4cm. Find the refractive index of water. (4marks)

c) Describe an experiment to determine refractive index of a liquid using the air cell method. (5marks)

d) (i) Define the terms principal focus and radii of curvature of a convex lens.(2marks)

(ii) Derive an expression relating the two terms in (i) above, given that the refractive index of the lens material is n. (5marks)

(iii) Given that the radii of curvature of a converging meniscus are 10 cm and15 cm, find the focal length of the lens, given refractive index of lens material is 1.55. (3marks)