

**PHYSICS DEPARTMENT**

**END-OF-TERM II EXAMINATIONS**

**July, 2015**

**S5 PHYSICS**

**Paper 2**

**2 hours 30 minutes**

**INSTRUCTIONS TO CANDIDATES:**

*Attempt* ***ALL*** *questions*

*Assume where necessary:*

*Permittivity of free space, ε0 = 8.85 x 10-12 Fm-1*

**FOR EXAMINER’S USE ONLY**

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| --- | --- | --- | --- | --- | --- | --- |
| Question |  |  |  |  |  | Total |
| Marks scored |  |  |  |  |  |  |

1. (a) Define

(i) **principal focus** of a convex mirror. (1)

(ii) **linear magnification** (1)

(b) (i) Show that the focal length of a spherical mirror is half its radius of curvature. (3)

(ii) Derive an expression for the focal length of a spherical reflector. (5)

(c) Describe an experiment to measure the focal length of a convex mirror using a converging lens. (5)

(d) A hole of area 768 cm2,in a window, is 162 cm in front of a curved mirror. If an image (of the hole) of area 12cm2 forms on a screen in front of the mirror, find the:

(i) linear magnification of the image. (2)

(ii) focal length of the mirror. (3)

2. (a) Explain why a straight rod appears bent when part of it is immersed in a transparent liquid. (3)

(b)(i) State a condition for minimum deviation of a ray of light passing through a prism. (1)

(ii) The minimum deviation of a ray of monochromatic light passing through a prism of refracting angle θ is D. Derive an expression for the relationship between the refractive index, n, of the material of the prism for the light and the angles θ and D. (3)

(c) (i) State, without describing, the adjustments necessary before a spectrometer is used. (3)

(ii) Describe an experiment to measure the refracting angle of a prism using a spectrometer (5)

(d) In the figure below a ray XY in a liquid, makes an angle of 80o with the face PQ of a prism PQR of refracting angle 65o and whose material is of refractive index 1.58. The ray is incident on the face PQ and grazes face PR of the prism.

ng =1.58

**80o**

P

Q

R

X

Y

Find the refractive index of the liquid. (5)

3. (a) (i) What is meant by **electrostatic induction**? (1)

(ii) Define **electric intensity** (1)

(b) A negatively charged body B is placed between two bodies,X and Y, without touching them. X is attracted by B whileY experiences no electrostatic force whatsoever.

(i) Identify the nature of the materials of X and Y. (1)

(ii) Explain the observations. (3)

(c) Derive an expression for the electric potential at a point z metres from an isolated point charge Q in a medium of permittivity ε. (5)

(d) In the figure below, Q1 and Q2 are point charges. Q1 = **3** μC and

Q2 = **-4**μC

P

10cm

10cm

Q2

Q1

Find

(i) the electric potential energy of Q2 (2)

(ii) the magnitude of the electric intensity at point P (4)

(iii) the location of a point A between Q1 and Q2 where the electric potential will be zero (3)

4. (a) What is

(i) a **capacitor**  (1)

(ii) **dielectric strength** (1)

(b) A capacitor is formed of two parallel plates separated by air. It is charged and then isolated. If now an insulated metal plate is inserted in between the plates, explain what happens to the p.d. (3)

(c) (i) State two factors which affect the capacitance of a capacitor. (2)

(ii) Describe an experiment to compare capacitances of two capacitors.

(5)

(d) Derive an expression for the equivalent capacitance of three capacitors connected in parallel. (3)

(e) In the figure below calculate the energy stored in the 40μF capacitor.

(5)

60V

40 µF

20µF 20µF

10 µF

5. (a) Define

(i) **Electromotive force** (1)

(ii) **Internal resistance** (1)

(b) (i) Explain why a conductor **heats up** when a current passes through it and that the heating effect is **independent of the direction** of the current. (3)

(ii) State Ohm’s law (1)

(iii) Describe an experiment to verify Ohm’s law (5)

(c) Derive an expression for the equivalent resistance of three resistors connected in parallel. (3)

(d) When a source of emf 2V is connected to a parallel combination of a resistance R and 2Ω a current of 1A is drawn from the source. When the combination of the resistors is changed to series, the current becomes A. Determine

(i) the value of R (5)

(ii) the internal resistance of the source (1)