AN ROINN OIDEACHAIS M.56

LEAVING CERTIFICATE EXAMINATION, 1965

PHYSICS—HONOURS

THURSDAY, 24th JUNE—Afternoon, 3 to 5.30

Not more than six questions to be attempted

1. Define (i) force, (ii) kinetic energy.
A bullet of mass 1 oz. and moving horizontally with a velocity of 800 ft. per sec. passes through a fixed block of wood 6 inches thick, the average resistance offered by the wood being 450 lb. wt. Find the kinetic energy of the bullet, in ft. lb., on emerging from the wood. What constant retarding force, in lb. wt., would now bring the bullet to rest in a distance of 9 inches ?

(66 marks)

2. (a) Deduce an expression for the pressure of a gas in terms of the kinetic theory, indicating the assumptions made.

(b) Outline the principles involved in establishing a scale of temperature. Give a brief account of any form of gas thermometer.

(66 marks)

3. Define refractive index.
Describe an experiment to measure the refractive index of the material of a glass prism.
Given that the speed of light in air is 3×10^8 metres per sec. and that the critical angle for glass is $41^\circ\ 48'$, find the speed of light in the glass.

(66 marks)

4. Show, by means of ray-diagrams, how an image of an object may be formed by (i) a plane mirror, (ii) a convex mirror, (iii) a convex lens. State the nature of the image in each case.
Outline a method of measuring the focal length of a convex mirror.
An object stands erect on the axis of a convex lens of focal length 15 cm. Find the two positions at which the lens must be placed in relation to an object so that in each case a real image of the object may be formed on a screen placed at a fixed distance of 80 cm. from the object.

(66 marks)

OR

4. State briefly the main evidence in favour of the wave theory of light. Discuss one phenomenon which cannot be explained satisfactorily by this theory.
Describe a method of measuring the wavelength of monochromatic light.

(66 marks)

5. Describe a terrestrial method by which the velocity of light has been measured.

(66 marks)

OR

5. (i) Write a note on the transmission, reflection and refraction of sound.

(ii) If the velocity of sound in a gas is expressed by the formula $V = \sqrt{\frac{\gamma p}{\rho}}$ where p = pressure, ρ = density, γ = constant, deduce that its velocity is independent of variations in pressure but dependent on temperature.

(iii) Given the velocity of sound in air, describe how you would measure its velocity in a solid medium e.g. a brass rod.

(66 marks)

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6. Give an account of the construction of a thermionic diode and explain the principle on which it works.

Discuss the relation between the current through the diode and the applied potential between its electrodes. In what respect does this differ from the relation obtained on passing an electric current through a metallic conductor ?

Mention <u>one</u> application of the thermionic diode.

(66 marks)

<u>OR</u>

6. Describe how you would measure at a point in the laboratory (i) the angle of dip, (ii) the horizontal component of the earth's magnetic field intensity, given a magnet of known magnetic moment.

Hence show, with the aid of a diagram, how the total intensity of the earth's magnetic field at the same point may be calculated.

(66 marks)

7. Describe a gold-leaf electroscope.

State the factors which determine the capacity (capacitance) of a parallel plate condenser. Describe an experiment to illustrate how the capacity depends on any <u>one</u> of the factors you mention.

Derive an expression for the resultant capacity of two condensers when they are connected (i) in series, (ii) in parallel.

(67 marks)

<u>OR</u>

7. Give an account of an experiment by which the ratio of the charge of an electron to its mass $\left(\frac{e}{m}\right)$ has been determined. Outline the theory of the experiment.

A cathode-ray beam enters a uniform magnetic field which acts at right angles to the motion of the beam. The flux density of the magnetic field is 2×10^{-3} weber per metre^2 (or 20 gauss). If the electrons are deflected into a circular path of radius 0·1 metre, calculate their velocity.

(Given $\frac{e}{m} = 1{\cdot}76 \times 10^{11}$ coulomb per kgm. in the M.K.S. system <u>or</u> $1{\cdot}76 \times 10^{7}$ e.m.u. per gm. in the C.G.S. system).

(67 marks)

8. Describe a moving-coil galvanometer and explain the principle on which its action depends. On what factors does the sensitivity of the instrument depend ?

A moving-coil galvanometer has a resistance of 5 ohms and gives a full scale deflection of the pointer for a current of 20 milliamps. What resistance is required to convert the galvanometer into (i) an ammeter reading from 0 - 2 amps full scale, (ii) a voltmeter reading from 0 - 10 volts full scale ?

(67 marks)

9. Distinguish between natural and artificial radioactivity.

Give a short account of the discovery of the neutron.

Describe, in words, the two following nuclear reactions referring particularly to the significance of the symbols and the numbers associated with them:-

(i) $_{7}N^{14} + {}_{2}He^{4} \rightarrow {}_{8}O^{17} + {}_{1}H^{1}$

(ii) $_{11}Na^{23} + {}_{0}n^{1} \rightarrow {}_{11}Na^{24} \rightarrow {}_{12}Mg^{24} + {}_{-1}e^{0}$

(67 marks)

<u>OR</u>

9. State Faraday's laws of electrolysis and describe an experiment to illustrate <u>one</u> of them.

Define the ampere.

Describe how you would calibrate an ammeter by electrolysis <u>or</u> otherwise.

(67 marks)

10. Write brief notes on any <u>two</u> of the following:-

(i) gravitation,

(ii) the electromagnetic spectrum,

(iii) the production and properties of x-rays,

(iv) the principles underlying the action of an alternating current generator.

(67 marks)