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(Department of Education).

LEAVING CERTIFICATE EXAMINATION, 1953.

PHYSICS.—HONOURS.

FRIDAY, 19th JUNE.—MORNING, 10 TO 12.

Not more than *six* questions to be answered.
***One* question *at least* must be answered from each section.**

SECTION I.

1. State Boyle's law and also Charles's law.

Describe how the truth of Charles's law may be tested by experiment.

What mass of air leaves a room, the capacity of which is 100 cubic metres, when the pressure of the air changes from 78 cms. of mercury to 76 cms., and its temperature rises from 0° C. to 15° C. ?

[One litre of air at N.T.P. weighs 1·29 grams.]

[66 marks.]

2. A thin lamina is in the form of a quadrilateral ABCD in which AB is parallel to and equal to half DC. BC, CD and DA are 4 inches, 10 inches and 3 inches long respectively. Find the distance of the centre of gravity of the lamina from the middle point of DC.

If the lamina is suspended freely from B, calculate the angle the side BC makes with the vertical.

[66 marks.]

3. Two scale pans, each of mass $\frac{1}{2}$ lb., are connected by means of a light inextensible string passing over a smooth pulley. A mass of 3 lb. is placed on one pan and a mass of 6 lb. on the other. Find the acceleration and, also, the reactions of the scale pans on the masses during motion.

[67 marks.]

SECTION II.

4. Derive a formula for the focal length of (*a*) a concave mirror, (*b*) a convex mirror, in terms of u and v, where u and v are the distances of the object and image, respectively, from the pole of the mirror. State clearly what conventions of sign you use.

At what distance from a concave mirror of focal length 40 cm. should an object be placed to obtain (i) a real image, (ii) a virtual image, the image being double the height of the object in each case.

[66 marks.]

5. State the laws of refraction of light.

Prove the relationship

$$\mu = \frac{\sin\frac{1}{2}(\delta + \alpha)}{\sin\frac{1}{2}\alpha}$$

for a glass prism, where μ is the index of refraction of the glass, α is the refracting angle of the prism, and δ is the angle of minimum deviation of a ray of light passing through the prism.

Describe an accurate method of measuring δ, the angle of minimum deviation.

[66 marks.]

6. Describe a terrestrial method for finding the velocity of light.

[67 marks.]

Section III.

7. Describe how to compare the magnetic moments of two bar magnets.

Knowing the magnetic moment of a bar magnet, describe how to find at a point P the magnitude of the horizontal component of the earth's magnetic field.

Describe briefly what further work would be required to find the total strength of the earth's magnetic field at P.

[66 marks.]

8. Explain by means of examples what is meant by electrostatic potential.

A positively charged conductor A is held near (i) an insulated conductor B, (ii) an earthed conductor C. What changes, if any, will be brought about in the potentials of each of the three conductors, and what will be the signs of the charges produced on B and C, respectively ?

How may these phenomena be explained ? [66 marks.]

9. Three conductors of resistance x, y and z ohms, respectively, are joined (*a*) in series, (*b*) in parallel. Find an expression for the effective resistance in each case.

A uniform wire of resistance 4 ohms is bent in the form of a square ABCD. The poles of a battery of E.M.F. 5 volts and internal resistance 1·5 ohms are connected to A and C by wires of negligible resistance. Find the current in the circuit.

If a conductor of 3 ohms resistance is connected firstly to A and C and secondly to B and D, what change, if any, is brought about in the current in the circuit in each case ?

[67 marks.]

10. A current, C amps, flows in a wire of resistance R ohms. Starting from the definition of the absolute unit of potential difference, show that H, the heat produced in calories per second in the wire, is given by

$$JH = C^2R \times 10^7,$$

where J is the mechanical equivalent of heat.

By applying this equation, describe how the value of J may be measured in the laboratory.

[67 marks.]