AN ROINN OIDEACHAIS

(Department of Education).

BRAINNSE AN MHEADHON-OIDEACHAIS

(Secondary Education Branch).

LEAVING CERTIFICATE EXAMINATION, 1937.

FULL COURSE.

PHYSICS.

THURSDAY, 24th JUNE.—AFTERNOON 1 P.M. TO 3 P.M.

Not more than *six* questions may be attempted.

All questions are of equal value.

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1. Describe how you would determine, experimentally, the ratio between the illuminating powers of two sources of light.

A lamp is situated 50 cms. from a photometer. A thick block of glass is placed between the lamp and the photometer, and to produce the same intensity of illumination at the photometer as before, it is necessary to move the lamp 5 cms. closer to the photometer. What fraction of the light is lost in the glass ?

2. Explain how it appears that the bottom of a lake is nearer to the surface of the water than it really is, and show that $\frac{d}{t}=\mu$ (d, is the true depth of the lake ; t, its apparent depth viewed vertically ; μ, the index of refraction of the water). Show in detail how this result may be used to determine experimentally the refractive index of a liquid.

3. The lens of a camera gives a real image of an object which is 2 metres away, on a plate situated 10 cms. from the lens. (*a*) Of what type is the lens, and what is its focal length ? (*b*) If it is required to form an image of an object which is 100 cms. away on the plate, what kind of lens must be used with the camera lens, and what focal length will it have ?

4. A concave mirror forms a real image of an object, the image being twice as large as the object. If the focal length of the mirror is 30 cms., where is the object situated ?

How would you exhibit experimentally a real image formed by reflection at a concave mirror ?

5. Describe an apparatus which is suitable for investigating the relation between the acceleration produced by a given force and the mass on which the force acts. Explain how you would use the apparatus to investigate this relation. What result would you expect from this experiment ?

6. An electric railway truck (mass=2 tons) accelerates from 0 to 20 miles per hour in 40 seconds. Find the horse-power exerted. While running (with the electric current shut off) at 20 miles per hour, it strikes another truck which is stationery, and the two travel on together. If the mass of the second truck is $\frac{1}{2}$ ton, find what their velocity is after the collision.

[1 horse-power=550 ft.-lbs. per second.

7. A certain waterfall is 50 metres high. Find the kinetic energy of 100 grams of water on reaching the bottom of the fall. If $\frac{3}{4}$ of the kinetic energy is used in raising the temperature of the water, find the increase in temperature in the water at the bottom of the fall. [Mechanical Equivalent of Heat=$4{\cdot}2\times10^7$ ergs per cal.]

8. The magnetic field at a point on a line through the centre of a magnet at right angles to the axis of the magnet is $\frac{M}{(d^2+l^2)^{\frac{3}{2}}}$.

How would you verify experimentally that the intensity of the field is proportional to $\frac{1}{(d^2+l^2)^{\frac{3}{2}}}$?

9. Explain what you understand by "electrostatic induction." Give an account of the construction and operation of the Wimshurst machine. Where does the energy come from, which is dissipated in the spark ?

10. State Ohm's law.

A certain galvanometer has a resistance of 5 ohms and gives a full-scale deflection for a current of 0·015 ampere. What resistance would you require to use it (*a*) as a voltmeter with a full-scale deflection for 6 volts, (*b*) as an ammeter with a full-scale deflection for 1·5 amperes ? Draw diagrams showing how you would connect the resistance in each case.

11. State Faraday's laws of electrolysis and show how they can be explained on the ionic theory.

A constant current is passed through an ammeter and a copper voltameter which are connected in series. The current, as read on the ammeter is exactly 1 ampere. After 30 minutes, the copper cathode is 0·624 grams heavier. What is the true value of the current ? [Electro-chemical equivalent of copper=0·00033 grms. per coulomb.]

12. A high difference of potential is produced in an induction coil by means of electro-magnetic induction. Explain clearly, using diagrams, how this is done. What difference is there between the potential difference when the circuit is made and when it is broken ? Why does this difference exist ?