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(Department of Education).

BRAINNSE AN MHEADHON-OIDEACHAIS
(Secondary Education Branch).

LEAVING CERTIFICATE EXAMINATION, 1940.

HONOURS.

PHYSICS.

FRIDAY, 21st JUNE.—AFTERNOON 1.30 TO 3.30 P.M.

Not more than *six* questions in all may be attempted, and not more than *four* of these should be taken in any one Section.

All questions are of equal value.

Section I.

1. State the principle of the conservation of energy. Define Potential Energy and Kinetic Energy.

If a body (*a*) falls freely under gravity (*b*) slides down a smooth inclined plane, show that the sum of its potential and kinetic energies is constant throughout the motion.

2. If a cyclist works at the rate of $\frac{1}{10}$ H.P. and goes 12 miles per hour on the level, show that the resistance to motion is equivalent to a force of $3\frac{1}{8}$ lbs. weight.

If the mass of the machine and its rider be 12 stone, show that, up an incline of 1 in 50, the speed will be reduced to about 5·8 miles per hour where the force resisting motion (apart from the weight of rider and machine) is still the same.

3. Distinguish between mass and weight. A mass of 10 lb. is hung from a spring balance attached to a lift. What will be the reading of the balance when the lift is moving (*a*) with an upward acceleration of 4 ft. per sec.^{2}, (*b*) with a downward acceleration of 4 ft. per sec.^{2}, (*c*) with uniform velocity ?

4. Find a formula for the focal length of a combination of two thin lenses in contact in terms of their respective focal lengths.

A convex lens of focal length 30 cms. is placed in contact with a concave lens of focal length 15 cms. Find the nature and focal length of the combination.

5. What is meant by Joule's mechanical equivalent of heat and how may it be measured experimentally ?

What is the velocity of a leaden bullet if on striking a target the heat developed by the impact is just sufficient to melt the bullet, assuming that all the energy is converted into heat in the bullet ?
Specific heat of lead$=0.03$. Latent heat of fusion of lead$=6$ cals. Melting pt. of lead$=327°$ C. Initial temperature of bullet$=20°$ C.

6. Name two methods for finding the velocity of light and give a detailed account of one of them.

7. Describe the astronomical telescope and draw a diagram to show the paths of rays by which the eye sees the image of a point on the object. Show how to find an expression for the magnifying power of the telescope.

Section II.

8. Account for the occurrence of neutral points near a bar magnet placed on a horizontal plane.

Explain clearly how you would determine the moment of a magnet, if H, the horizontal component of the earth's magnetic field, were known.

[If an equation is used it must be proved.]

9. Describe the tangent galvanometer and show how it is used to measure an electric current.

There are 20 turns on the coil of a tangent galvanometer, and the radius of the turns is 15 cms. How many amperes are required to give a deflection of 45°, if 0.18 dyne/unit pole is the value of H, the horizontal component of the earth's magnetic field ?

10. What do you understand by the specific resistance of a substance ? Explain how you would determine experimentally an accurate value for the specific resistance of a material in the form of a wire.

The resistance of a metal wire of diameter 0·1 cm. and of length 1 metre is 0·12 ohm. Find the specific resistance of the metal.

11. What circumstances determine (a) the magnitude, (b) the direction of the current induced when the pole of a magnet is introduced into a coil of wire ?

Explain the essential features of a simple form of dynamo for producing direct current.

12. What is Ohm's Law ? Describe an experiment in which a tangent galvanometer is used, to illustrate the Law.

A battery is connected to a tangent galvanometer of resistance 40 ohms, and a deflection of 60° is observed. When a resistance of 36 ohms is placed in series with the galvanometer the deflection is 45°. Find the resistance of the battery.

If the E.M.F. of the battery is 2 volts, find the reduction factor of the galvanometer.

[It is assumed that the plane of the coil of the galvanometer is parallel to the earth's field.]