

AN ROINN OIDEACHAIS

(Department of Education.)

LEAVING CERTIFICATE EXAMINATION, 1943.

PHYSICS.—HONOURS.

SATURDAY, 19th JUNE.—AFTERNOON, 1.30 TO 3.30.

Six questions may be attempted of which at least *two* must be taken from Section II.

SECTION I.

1. Explain the terms *work* and *power*, and give their dimensions in terms of the fundamental units of mass, length and time.

When the engine is working at full power, the speed of a motor truck weighing 3 tons is 12 miles per hour on a level road, and is 5 miles per hour up an incline of 1 in 10. Assuming resistance per ton to vary as the square of the speed, find the horse power of the engine.

2. A boy standing on the bank of a river decides to swim to the nearest point on the opposite bank. The river is 100 yards wide and flows with a velocity of $1\frac{1}{2}$ miles per hour. The boy can swim at the rate of 2 miles per hour in still water.

Indicate by means of a diagram the direction in which he should swim in order to reach the desired point in the shortest time, and calculate the time.

3. State the principle of Archimedes and describe an experiment in support of its truth.

A balloon is filled with hydrogen at atmospheric pressure. The fabric of the balloon weighs 100 grams. If the volume of the balloon is 100 litres calculate the force necessary to prevent it rising from the ground.

If the balloon is set free what will be its initial acceleration, assuming that the resistance of the air is negligible?

[Density of air and of hydrogen at atmospheric pressure = 1.29 gm. per litre and 0.09 gm. per litre respectively].

4. Find a formula for the focal length of a concave lens and show that the image formed by such a lens is always smaller than the object.

Describe how the focal length of a concave lens may be determined experimentally.

A convex lens of focal length 12 cm. is placed in contact with a concave lens. The resulting combination is converging and its focal length is 24 cm. Calculate the focal length of the concave lens.

5 (a) What do you understand by the angle of minimum deviation of a prism ?

(b) Explain fully how to determine (a) the angle of a prism ; (b) the angle of minimum deviation by means of the spectrometer. How may the refractive index of the prism be obtained from these measurements ?

6. Describe the construction of the compound microscope and show with the aid of a diagram how the final image is obtained.

A microscope consists of an eyepiece of focal length 4 cm. and an object glass of focal length 1 cm., the distance between the centres of the lenses being 14.5 cm. An object of height 1 mm. is placed at a distance of 1.1 cm. from the object glass. Calculate the position and size of the image seen through the microscope.

SECTION II.

7. What do you understand by :—unit pole, magnetic moment ?

(a) Find a formula for the intensity due to a bar magnet of length $2l$ cm. and magnetic moment M , at a distance d cm. from its mid-point along a line at right angles to the magnetic axis.

(b) Explain how H , the horizontal component of the earth's magnetic field, may be determined experimentally.

8. State Ohm's law and deduce the relation between the resistances of the arms of a Wheatstone's network when "balanced".

Explain how the resistance of a wire may be determined by using Wheatstone's bridge. How would you then determine the specific resistance of the material of the wire ?

9. What do you understand by the "mechanical equivalent of heat" ? How may it be determined experimentally ?

The temperature of 1 kilogram of water, in an electric kettle, is raised from 15°C . to 65°C . in 10 minutes. The kettle is used on a 220 volt supply and takes a current of 2 amps. What percentage of the energy supplied is used in raising the temperature of the water ?

[The mechanical equivalent of heat may be taken as 4.2 joules per calorie].

10. Describe the construction of a secondary cell. Explain the chemical action that takes place while the cell is being charged and also while it is being discharged.

What tests would you apply to verify that the cell is fully charged ?