AN ROINN OIDEACHAIS

(Department of Education).

LEAVING CERTIFICATE EXAMINATION, 1959.

PHYSICS.—HONOURS.

TUESDAY, 9th JUNE.—AFTERNOON, 3 TO 5.30.

Not more than *six* questions to be answered.

One question *at least* must be answered from each section.

SECTION I.

1. Show that the centre of gravity of a uniform triangular plate is the same as that of three equal weights placed, respectively, at the corners of the triangle.

A uniform plate is in the shape of an equilateral triangle ABC of side 4 inches. If a portion of the plate also in the shape of an equilateral triangle of side *one* inch and vertex A is now cut away, find the distance from BC of the centre of gravity of the remainder of the plate.

[66 marks.]

2. A 4 lb. mass on a smooth plane inclined at 30° to the horizontal is connected by a light string which passes over a light frictionless pulley at the top of the plane to a mass of 3 lbs. which hangs vertically, and the masses are in motion. Find the acceleration of the system.

If the string were cut when the velocity of the system was 2 ft./sec., what distance would each of the masses travel in the next *half* second ?

[66 marks.]

3. Describe an experiment to demonstrate the triangle of forces.

Three forces act inwards at the middle points, respectively, of the sides of a triangle, each force being perpendicular to the side on which it acts and its magnitude being proportional to the length of that side. Prove that the forces are in equilibrium.

[67 marks.]

SECTION II.

4. Describe fully a method of measuring the mechanical equivalent of heat.

A car of mass 3,000 lbs. is travelling at a speed of 60 miles per hour. Assuming that all the kinetic energy of the car is converted into heat in bringing the car to rest, find how many British thermal units (B.T.U.) of heat are generated.

[Mechanical equivalent of heat=778 ft. lb./B.T.U.]

[66 marks.]

5. Establish the formula $\mu = \frac{\sin \frac{1}{2}(A+D)}{\sin \frac{1}{2}A}$ for the passage of light through a glass prism, where μ is the refractive index of glass, A the refracting angle of the prism and D the angle of minimum deviation.

Describe how you would measure the angle A using a spectrometer.

[66 marks.]

6. Prove that the focal length of a combination of two thin lenses in contact is given by $\frac{1}{F} = \frac{1}{f_1} + \frac{1}{f_2}$, where F is the focal length of the combination and f_1, f_2 are the focal lengths, respectively, of the two lenses.

Hence, or otherwise, describe how you would measure the focal length of a given concave lens.

[67 marks.]

SECTION III.

7. Define magnetic moment of a bar magnet.

Establish an expression for the intensity of the magnetic field due to a bar magnet at a point on the perpendicular bisector of the axis of the magnet.

The poles of a given bar magnet are 10 cms. apart. The magnetic field due to the magnet is 2 *oersted* at a point on the perpendicular bisector of the axis of the magnet and 5 cms. from its centre. Calculate the pole strength of the magnet.

[66 marks.]

8. Define, intensity of electrical field, potential, capacity.

Prove that the capacity of a parallel plate condenser is (*a*) directly proportional to the area of the insulated plate, (*b*) inversely proportional to the distance between the plates.

Describe how you would use a parallel plate condenser and a gold leaf electroscope to find out if there is a difference of potential between the poles of a cell.

[66 marks.]

9. State Faraday's laws of electrolysis and describe an experiment to test one of them.

Define electrochemical equivalent of an element.

In 25 minutes a given current deposits (*a*) 2·80 gms. of silver, and (*b*) 0·83 gms. of copper. Calculate from these results (i) the current, (ii) the *chemical* equivalent of copper, given that the chemical equivalent of silver is 108. [Electrochemical equivalent of silver is 1118×10^{-6} gms.]

[67 marks.]

10. Describe an experiment to measure the resistance of a wire of given length using the potentiometer and give the underlying theory.

A 3-ohm resistance (A) and a 6-ohm resistance (B) are in parallel and are connected in series with an 8-ohm resistance to form a circuit with a battery, the difference of potential between the poles of the battery being 20 volts. Find (i) the effective resistance of A and B, (ii) the current in the circuit, (iii) the current through each resistance.

[67 marks.]