AN ROINN OIDEACHAIS
(Department of Education).

BRAINSE AN MHEÁN-OIDEACHAIS
(Secondary Education Branch).

LEAVING CERTIFICATE EXAMINATION, 1927.

HONOURS

APPLIED MATHEMATICS.

THURSDAY, 23rd *JUNE.*—Afternoon, 4 to 6 p.m.

Five questions may be answered.

Questions at the end of the paper carry somewhat higher marks.

Tables of Measures, Constants and Formulae, and Logarithm Tables may be obtained from the Superintendent.

1. A ship A sailing due N. at 15 miles per hour is at a certain instant 41 miles due E. of another ship B which is sailing E. at 12 miles per hour. When will the ships be nearest together?

2. Explain the variations of the force between the floor of a lift and the feet of a man standing on it during the upward and downward journeys from rest to rest.

3. A bullet weighing 1 oz. is fired horizontally into a block of wood weighing 12 lbs. suspended so that the wood and the bullet embedded in it swing without rotation to a height of 2 ft. 6 ins. Find the velocity of the bullet on entering the wood.

4. What is meant by Simple Harmonic Motion?

Show that the bob of a simple pendulum moves with Simple Harmonic Motion when the angle of swing is small.

Find an expression for the periodic time of the pendulum.

5. Show that the area under a force distance diagram represents work done.

The force exerted by a spring is proportional to the extension of the spring and a force of 5 lbs. wt. produces an extension of 2 ins. Show graphically the relation between the tension and the extension and deduce the work done in extending the spring through 10 inches.

Show that the work done on such a spring when stretched a feet is $\dfrac{Pa}{2}$ ft. lbs., where P lbs. wt. is the tension for extension a feet.

6. A body of W lbs. can just be maintained at rest on a rough inclined plane by a force P lbs. wt. acting along the plane, or by a force Q lbs. wt. acting horizontally.

Show that $\dfrac{\sec^2 \varphi}{P^2} = \dfrac{1}{Q^2} + \dfrac{1}{W^2}$ where φ is the angle of friction.

7. Find the acceleration of a particle which moves with uniform speed in a circle.

A train is to travel round a curve of radius r ft. If a ft. is the distance between the rails, find the height b ft. to which one rail should be raised above the level of the other so as to eliminate side pressure on the rails for trains travelling at v ft. per sec.

If a train of W tons weight moves on such a track with speed nv feet per sec. prove that there is now a side pressure on the rails of approximately $W \dfrac{b}{a} (n^2 - 1)$ tons wt.

8. A shot at the instant of projection breaks into two parts of masses m_1 and m_2 lbs., the first part starting with velocity v_1 at an angle θ_1 to the horizontal and the second with velocity v_2 at an angle θ_2 to the horizontal. Show that the centre of gravity moves as if the whole shot started with velocity v at an angle θ to the horizontal; and find v and θ in terms of m_1, m_2, v_1, v_2, θ_1, θ_2.