AN ROINN OIDEACHAIS

(Department of Education).

BRAINSE AN MHEÁN-OIDEACHAIS

(Secondary Education Branch).

LEAVING CERTIFICATE EXAMINATION, 1926.

HONOURS

APPLIED MATHEMATICS.

WEDNESDAY, 23rd JUNE.—AFTERNOON, 4 TO 6 P.M.

Five questions may be answered.

Questions 5, 6, 7, 8 carry somewhat higher marks.

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

1. State the conditions of equilibrium of three forces acting on an extended body in one plane.

C is a point vertically above A, the pivot of a light rod AB, and AC = AB. B is attached to C by a cord and a mass m is attached to B. Show that the thrust on the rod is independent of the length of the cord and find the tension of the cord when AB makes an angle θ with the horizontal.

2. State the laws of friction.

A ladder with its centre of gravity at its mid-point rests with one end on the ground and the other against a vertical wall. Show that the greatest inclination to the wall consistent with equilibrium is $\tan^{-1}\frac{2\mu}{1-\mu^2}$ where μ is the coefficient of friction both with ground and wall.

3. A body revolves with initial angular velocity ω_0 and uniform angular acceleration α: write down equations giving the angular velocity and the angle described in time t and derive an equation not involving t.

A wheel is making n revolutions per minute and t seconds later it is found to be making n' revolutions per minute: what is its acceleration (supposed uniform)? How many revolutions has the wheel made in the interval?

4. The resistance to a train weighing W tons and travelling at v miles per hour is R lbs. wt. per ton : find the rate of working of the engine.

The train consumes w tons of coal per hour and the burning of 1 lb. of coal produces s ft.-lbs. of energy : what proportion of the energy is usefully employed by the engine ?

Evaluate when $W=100$, $v=60$, $R=10$, $w=\frac{1}{2}$, $s=10^7$.

5. The equation of the path of a projectile referred to horizontal and vertical axes is $y=x-\frac{x^2}{64}$; find the angle at which it was projected and the initial velocity. Find also the direction of motion after t seconds. (*Note.*—g may be taken as 32).

6. A number of unequal particles are distributed in a straight line : find a formula for the position of the centre of gravity.

Two masses m_1 and m_2 are attached to the ends of a light string passing over a smooth peg : show that the acceleration of the centre of gravity is $\left(\frac{m_1-m_2}{m_1+m_2}\right)^2 g$.

7. A mass m hangs from a light spiral spring. Show that, if m is pulled down slightly and released, it will move with simple harmonic motion. Find the greatest velocity and the periodic time of m, showing clearly on what they depend.

8. In a pulley system a weight W is raised with uniform acceleration by means of a load Q : show that the ratio of the accelerations of P and W is equal to the velocity ratio of the machine, friction and the weight of the pulleys being neglected.

If in any system of pulleys there is equilibrium when a weight W is supported by a load P, show that if P be increased to Q, W will ascend with acceleration $\frac{g\,P\,(Q-P)}{P^2+QW}$.