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(Department of Education).

BRAINSE AN MHEÁN-OIDEACHAIS.
(Secondary Education Branch).

LEAVING CERTIFICATE EXAMINATION, 1930.

HONOURS.

APPLIED MATHEMATICS.

FRIDAY, 20th JUNE.—Afternoon, 4 to 6 p.m.

Not more than *five* questions may be answered.

Mathematical Tables may be obtained from the Superintendent.

1. Explain the meaning of the terms " speed at a point " and " acceleration." The motion of a body in a straight line is given by the formula $s=10t^3$. Deduce by aid of your definitions the speed and acceleration when $t=3$. What is the relation connecting acceleration and distance? [60 marks.]

2. The suspension of a massive block is sufficiently long to make its arc of swing for small displacements approximately linear. The block is pulled aside from its central position through a conveniently large angle so that a brush fixed upon it can leave a trace on a vertical board falling in frictionless guides.

If the board and block are released simultaneously, what is the initial acceleration of the block? Using this value draw a diagram and show that the initial direction of the trace left on the board makes a right angle with the initial direction of the swing. [55 marks.]

3. A square lamina of iron 12 inches side is suspended by a string from a corner A and is pulled horizontally by a string attached to an adjacent corner B so that AB is at angle of 30° to the horizontal. Determine the tensions in each string, and the inclination of the suspension to the vertical. [55 marks.]

4. A cylinder of wood 13 inches long and 2 inches in radius has a co-axial hole of 1 inch radius drilled in it to depth x.

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If the hole is then filled with lead which has a density 14 times that of the wood, find the position of the C.G. Find the depth to which this hole should be drilled so that on filling it with lead the centre of gravity should be brought as near as possible the drilled end of the cylinder.
[60 marks.]

5. A body moves in a vertical circle at the end of a string 4 feet long. Its speed at the highest point is such that the tension in the string is equal to the weight of the body. Find the tension at the lowest point. Draw a diagram showing the direction of the resultant acceleration when it is moving in a vertical direction in the circle.
[60 marks.]

6. Write down the equations of the motion of a projectile.

A body is projected at any angle and, with a velocity u. Give a construction for its velocity at any subsequent instant t. Show that, at this instant, its direction of motion will intersect its initial direction of motion at a distance $ut/2$ from its point of projection.
[60 marks.]

7. A penny slides 12 inches down a plane inclined at an angle of 30° and acquires a velocity of 40 inches per second. Find the value of the acceleration and hence the kinetic coefficient of friction. Explain how you would determine experimentally for comparison the statical coefficient of friction.
[55 marks.]

8. The weight of a colliery cage and its load is 3 tons. The cage leaves the bottom of the shaft, which is 1,200 feet deep, with a uniform acceleration of 4ft./sec² and continues moving in this way for 9 seconds. The speed then becomes uniform for a period. After this, there is a uniform retardation of 4ft./sec² for 9 seconds, when the top is reached. Find the tension of the rope in tons weight during the acceleration and retardation, and the time taken to make the ascent.
[60 marks.]