

AN ROINN OIDEACHAIS

(Department of Education).

BRAINSE AN MHEÁN-OIDEACHAIS

(Secondary Education Branch).

LEAVING CERTIFICATE EXAMINATION, 1954.

APPLIED MATHEMATICS—PASS.

FRIDAY, 18th JUNE.—AFTERNOON, 2.30 TO 4.30.

Not more than *six* questions may be answered. All questions are of equal value.

Mathematical Tables may be obtained from the Superintendent.

1. State the parallelogram law of forces, and describe briefly how you would test the truth of the law by experiment.

A heavy bob is supported by two strings making an angle of 50° with each other, and is in equilibrium. The tensions in the strings are 7 lb. wt. and 10 lb. wt., respectively. Find the weight of the bob.

2. A uniform bar AB is 3 feet long and weighs 8 lb. The bar is smoothly hinged at A and is supported at B by a string attached to a fixed peg at C, 5 feet vertically above A, so that the angle ABC is a right angle. Find the magnitude of (i) the tension in the string, (ii) the reaction of the hinge.

3. A block is resting on a rough plane inclined to the horizontal at an angle of 10° . A force of 4 lb. wt. will just cause the block to move up the plane, and a force of 2 lb. wt. will just cause the block to move down the plane, the force in each case being applied along the line of greatest slope. Find the coefficient of friction between the block and the plane.

4. Explain what is meant by the "centre of gravity" of a body. A triangular portion CDE is cut out of a square lamina ABCD. If $AB=6$ inches and $CE=DE=5$ inches, find the position of the centre of gravity of the remainder. How would you test your answer by an experiment?

5. A particle is projected with an initial velocity of 24 ft. per sec. up the line of greatest slope of a smooth plane which is inclined to the horizontal at an angle of 30° . Find (i) the greatest distance which the particle will travel up the plane, (ii) the position and velocity of the particle 2 seconds after projection.

6. A mass of 9 ounces is held at rest on a smooth horizontal table. It is connected by a light inextensible string passing over the edge of the table to a mass of 3 ounces hanging freely, the portion of the string which is horizontal being 2 feet in length. If the system is then released, find (a) the acceleration of the masses, (b) the time taken by the 9 ounce mass to reach the edge of the table.

7. A ship is travelling at 15 m.p.h. in a direction 30° west of north, and a second ship is travelling north-east at 10 m.p.h. Find, graphically or otherwise, the velocity of the second ship relative to the first, in magnitude and direction.

8. An engine raises water from a depth of 40 feet and delivers it at the rate of 200 gallons a minute, with a velocity of 30 ft. per sec. Find the horse-power at which the engine is working.

[One gallon of water weighs 10 lb.]

9. A cylindrical vessel of internal diameter 8 inches is filled to a depth of 18 inches with a liquid of specific gravity 0.8. Find the total thrust of the liquid on the bottom of the vessel, given that one cubic foot of water weighs $62\frac{1}{2}$ lb.

When a piece of metal weighing 6 lb. is suspended by a vertical string so that it is totally immersed in the liquid the total thrust on the bottom is increased by 2 lb. wt. Find (i) the specific gravity of the metal, (ii) the tension in the string.