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(Department of Education).

BRAINSE AN MHEAN-OIDEACHAIS
(Secondary Education Branch).

LEAVING CERTIFICATE EXAMINATION, 1957.

APPLIED MATHEMATICS—PASS.

THURSDAY, 13th JUNE.—AFTERNOON, 2.30 TO 5.

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

Mathematical Tables may be obtained from the Superintendent.

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1. Forces of 6, 1, 5 lb. wt. act along the lines OL, OM, ON respectively, the angles LOM, MON, LON being 30°, 90°, 120°, respectively. If R is the resultant of the three forces, find

(i) the components of R in two perpendicular directions;

(ii) the magnitude of R, correct to one decimal place;

(iii) the angle which the line of action of R makes with OL, correct to the nearest degree.

2. A non-uniform bar MN, 6 feet long, rests horizontally on two supports, one at each end. A vertical force of 7 lb. wt. applied at M will just raise the bar off the support at M. A vertical force of 8 lb. wt. applied at N will just raise the bar off the support at N. Find the weight of the bar and the position of its centre of gravity.

3. A 21-lb. wooden slab can just be made to move on a rough horizontal plane by a downward force of 14 lb. wt. acting at 60° to the vertical. Find the coefficient of friction between the block and the plane.

If the plane were tilted to make an angle of 60° with the horizontal, find the least horizontal force that would keep the slab at rest on the plane.

4. The wind is blowing at 8 m.p.h. from a direction 30° West of South. (*a*) If a man walks due West at $2\frac{1}{2}$ m.p.h. find, graphically or otherwise, the velocity of the wind relative to the man, in magnitude and direction. (*b*) At what speed should the man walk due West so that the wind would appear to him to be blowing at 10 m.p.h.?

5. Two masses, of 7 ounces and 9 ounces respectively, are connected by a light inextensible string passing over a smooth pulley. Find the acceleration of the masses and the tension in the string, in ounces weight, when the system is released.

When the 9-ounce mass has fallen through 2 feet it is brought to rest on hitting the ground: how much farther will the 7-ounce mass rise?

6. A particle was uniformly accelerated for 10 seconds and was then uniformly retarded for 5 seconds; in that 15 seconds it travelled from A to B, a distance of 550 feet. If its velocity at A was 20 feet per second, and its velocity at B was 30 feet per second, find (i) the uniform acceleration and (ii) the uniform retardation, in feet per sec^2.

7. Define *work* and *power*.

Find, in foot pounds, the work done (*a*) in raising a 16lb. shot to a height of $5\frac{1}{2}$ feet, (*b*) in giving the 16lb. shot a velocity of 22 feet per second.

If an engine does 154 foot pounds of work in half a second, find the horse-power at which the engine is working.

8. A uniform bar AB weighing 10 lb. is supported by two strings BC, AC attached to a fixed peg C. If D, E are the mid-points of AB, BC, respectively, show that CDE is a triangle of forces. Given that AC=6 inches, BC=4 inches, CD=4 inches, find the tensions in the strings.

9. Describe in brief how you would show experimentally that the pressure at a point in a liquid depends on (i) the depth of the point below the surface, (ii) the specific gravity of the liquid.

A cylinder containing some mercury is floating upright in a liquid of specific gravity 0·85. If the base of the cylinder is 6 inches below the surface of the liquid, find the height of mercury in the cylinder (the weight of the cylinder itself may be neglected).

[Specific gravity of mercury, 13·6.]