# AN ROINN OIDEACHAIS
**(Department of Education).**

**BRAINNSE AN MHEADHON-OIDEACHAIS**
**(Secondary Education Branch).**

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**LEAVING CERTIFICATE EXAMINATION, 1937.**

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**PASS.**

## APPLIED MATHEMATICS.

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

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

Mathematical Tables may be obtained from the Superintendent.

1. A body moving in a straight line has the following velocities at the times stated :

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Velocity in feet per sec. | 0 | 1·2 | 2·7 | 7·5 | 14·7 | 24·3 | 30 |
| Times from start in secs. | 0 | 2 | 3 | 5 | 7 | 9 | 10 |

Explain how the Velocity-time curve enables the total distance travelled by the body and its average velocity to be determined, and find their values in the above case.

2. A boat is propelled so that its speed in still water would be 12 miles per hour.

(*a*) What is its average speed during two journeys one up-stream and the other down-stream between two places situated on the bank of a river flowing at the rate of 4 miles per hour ?

(*b* In what direction must it be propelled in order to cross directly from one bank of the river to an exactly opposite point on the other bank ?

3. A particle moving in a straight line on a horizontal table 4 feet above the ground level shoots over the edge and strikes the floor at a horizontal distance of 20 feet away.

Neglecting air resistance find the magnitude and direction of its velocity

(*a*) At the instant of leaving the table.

(*b*) At the instant of reaching the floor.

4. Compare the mass of a body which starting from rest moves a distance of 36 feet in 3 seconds under the action of a steady force of 30 lbs. wt. with the mass of a body which when a force of 10lbs. wt. is applied to it changes in velocity from 15 feet per second to 25 feet per per second in a distance of 50 feet.

5. What is the "parallelogram of accelerations?" and show that the velocity acquired by a body in sliding from rest down a smooth incline, is the same as that acquired in falling freely through the same vertical distance.

Compare the times taken in moving through the same vertical distance in the two cases.

6. Two equal masses of 500 grammes each are connected by a light string passing over a light frictionless pulley. An extra mass of 90 grammes is placed on one of them and the system starts to move. After 2 seconds the extra mass is removed.

Calculate the distance moved by either mass in 5 seconds and the tension in the string before and after the removal of the extra mass.

State in what units you express the distance and the tension respectively.

7. A uniform sheet of metal is cut in the form of the capital letter L. The length of the longer limb is 8 inches and of the shorter limb 6 inches. The width of each limb is 2 inches. Find the position of the centre of gravity of the figure relative to the two adjacent outside edges.

8. To two nails A and D in a vertical surface are attached the ends of a piece of string longer than the distance AD. A mass weighing 10 lb. hangs from a point B in the string and a body of unknown mass from another point C. AB is inclined at 60° to the horizontal, BC is horizontal and CD is inclined at 30° to the horizontal.

Calculate the tension in each portion of the string and the value of the unknown mass.

State in what units you express the mass.

9. Three forces acting on a particle keep it in equilibrium. Show that each force is proportional to the sine of the angle between the other two.

Use this theorem to find the ratio between the force P required to keep a body at rest on a smooth plane inclined at an angle $\alpha$ to the horizontal and the weight W of the body, (*a*) when P acts up the plane and parallel to it, (*b*) when P acts horizontally.

10. A moving railway truck weighing 2 tons collides with a stationary truck weighing 3 tons and the two move forward together through a distance of 56 feet before coming to rest. If the average force retarding the motion is 10 lb. per ton of truck what was the velocity of the moving truck just before the collision?