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

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## LEAVING CERTIFICATE EXAMINATION, 1948.

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*SATURDAY, 19th JUNE.*—MORNING, 10 TO 12.

## PHYSICS.—HONOURS.

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Not more than *six* questions to be attempted of which one at least must be selected from each Section. All questions are of equal value.

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### SECTION I.

1. A flask is exhausted of air, sealed and weighed. The flask is then broken, and the fragments are collected and weighed. Explain fully why the weights differ. Explain also how you could estimate the difference, given the density of air under the conditions of temperature and pressure during the experiment.

2. Explain, giving examples, (*i*) conservation of energy, (ii) conservation of momentum. A simple pendulum of length 100 cms., the bob of which weighs 10 grams, is drawn aside through an angle of 60° and then released. Calculate (*a*) the velocity, (*b*) the momentum of the bob when passing through the position of rest for the first time.

3. A block of wood weighing 5 lb. rests on a smooth horizontal table. Attached to the block is a string of negligible weight which passes over a frictionless pulley fixed to the edge of the table, and carries a weight of 2 lb. hanging freely. Find how far the system moves in the first second after it is released. If the string is then cut, find how far (*a*) the weight, (*b*) the block moves during the next second. $g=32$ feet/sec.$^2$

4. Define the moment of a force about a point.

A uniform bar AB is 100 cms. long and weighs 50 grams. Weights of 100 grams, 30 grams, and 75 grams are suspended from the bar at distances from A of 5 cm., 25 cm., and 70 cm., respectively. The loaded bar is supported horizontally by two spring balances at points 10 cms. and 90 cms. from A, respectively. Find the readings of the spring balances..

### SECTION II.

5. Explain what is meant by saturation vapour pressure. How would you make a determination of the saturation vapour pressure of a liquid such as ether at room temperature ?

6. Show by sketch how you would employ a transparent right-angled prism to bend a ray of light through (*a*) 90°, (*b*) 180°. What will be the minimum value of the index of refraction of the material of a right-angled prism which may be used for such purpose ? Prove your statement for either case (*a*) or (*b*).

7. Explain, by means of diagrams, the principle of the compound microscope, showing how the final image is formed, and how it happens that it is much larger than the object.

8. A closed copper flask containing air under high pressure is suspended in a hollow vessel through which dry steam may be passed. The flask weighs 96 grams and contains 4·3 grams of air. The initial temperature of the flask and contents is 16° C. Dry steam at 100° C. is passed through the vessel until temperature equilibrium is established and 1·617 grams of steam are condensed on surface of the flask. Calculate the specific heat of air.

Latent heat of steam=540 calories/gram.

Specific heat of copper=0·1.

## Section III.

9. What determines the rate of evolution of heat in a conductor through which an electric current is flowing ? Justify your statement, using the definition of unit difference of potential. The heating element of a small water distillation plant has a resistance of 22 ohms and carries a current of 10 amps when in use. Calculate (*a*) the weight of distilled water delivered per second by the plant, (*b*) the cost of distilled water per kilogram if electricity is charged for at 1½d. per kilowatt hour. Neglect the energy required to raise the water to boiling point.

Mechanical equivalent of heat=$4{\cdot}2 \times 10^7$ ergs/calorie.

Latent heat of steam=540 calories/gram.

10. Define "unit magnetic pole," "magnetic moment," "magnetic field strength at a point." With the middle point of a short bar-magnet as centre, a circle is described with radius large compared with the length of the magnet. Find the ratio of the field-strength at the pair of points where the circle is cut by the production of the axis of the magnet, to that at the points where the same circle is cut by the production of the right bisector of the axis.

11. Give the theory of the potentiometer, and describe a practical form of the instrument. Explain how you would use it to measure the current flowing through a conductor of known resistance.

12. Give a description of the common induction coil, and show how its working depends on the principles of electromagnetic induction.