# AN ROINN OIDEACHAIS

**(Department of Education).**

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## LEAVING CERTIFICATE EXAMINATION, 1957.

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## PHYSICS.—HONOURS.

*SATURDAY, 15th JUNE.*—MORNING, 10 TO 12.30.

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**Not more than *six* questions to be answered.**

*One* question *at least* must be answered from each section.

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SECTION I.

1. Two masses, one of 200 grams and one of 205 grams, are connected to one another by a light inextensible string which passes over a light smooth pulley. Find, (i) the acceleration of the system, (ii) the tension in grams weight of the string, after the masses have been released.

[66 marks.]

2. Define 'kinetic energy.'

A body of mass $m$ lb. moves with a velocity of $v$ feet per second. What is the kinetic energy of the body in foot pounds?

A missile of mass 4 lb. and moving horizontally with a velocity of 1,120 feet per second will only just pass through a fixed vertical armour-plate 6 inches thick. Calculate the average resistance to penetration of the plate.

If the velocity of the missile were 2,240 feet per second, by how much should the thickness of the plate be increased so that the missile would emerge with a velocity of 560 feet per second?

[Assume the resistance to penetration of the plate to be uniform.]

[66 marks.]

3. Name three fundamental particles of which atoms are composed. What is the nature of the charge, if any, on each of these particles and how do the masses of the particles compare with one another?

Given that the atomic number of an element is 2 and that the mass of its nucleus is four times the mass of the hydrogen nucleus, draw a diagram to illustrate the structure of the atom of the element.

"The atoms of an element may differ in structure from one another." Discuss this statement and give an example to illustrate it.

[67 marks.]

## Section II.

4. Establish the relationship $\mu=\frac{\sin\frac{1}{2}(A+D)}{\sin\frac{1}{2}A}$ where $\mu$ is the index of refraction of the material of a translucent prism of refracting angle A and D is the angle of minimum deviation.

Describe fully, with the aid of a diagram, a method of measuring the refracting angle of a glass prism using a spectrometer.

[66 marks.]

5. Using the usual notation, establish a formula for the focal length of a concave lens.

Describe fully Galileo's telescope (opera glass) and indicate by a ray diagram how the eye, on looking through the instrument, sees the final image.

What advantages and disadvantages has this telescope compared with the terrestrial telescope ?

[66 marks.]

6. Assuming Boyle's law and Charles' law show that for a given mass of gas at constant volume $P=kT$, where P is the pressure, T is the absolute temperature, of the gas, and $k$ is a constant.

A metal vessel for storing compressed air has a safety device which allows the air to escape when the pressure of the air within is 100 lb. per square inch. At a temperature of 17°C. the vessel contains air at a pressure of 90 lb. per square inch. At what temperature will the safety device operate, assuming that the expansion of the vessel is negligible ?

[67 marks.]

## Section III.

7. Define (*a*) magnetic moment of a bar magnet, (*b*) magnetic intensity at a point in a magnetic field.

What is meant by the *equivalent* length of a bar-magnet ?

Using the usual notation, establish the relationship

$$H\tan\theta=F=\frac{2Md}{(d^2-l^2)^2}$$

for a point on the prolongation of the axis of a bar-magnet, the axis of which is perpendicular to the magnetic meridian. Describe how this relationship may be applied to find the equivalent length of a bar-magnet.

[66 marks.]

8. Define the *coulomb*.

What is an electric condenser? State the factors on which the capacity of an electric condenser depends and describe an experiment in support of your answer.

A condenser is made up of two sheets of metal each of area 300 sq. cms. and 4 mm. apart in air. Calculate the capacity of the condenser, establishing any formula you use and stating in what units your result is expressed.

[66 marks.]

9. Describe how you would use a potentiometer (*a*) to compare the electromotive forces of two cells, (*b*) to measure the internal resistance of a cell. Explain the theory of the method in each case.

[67 marks.]

10. Establish an expression for the effective resistance of $n$ conductors, all of different resistances, when the conductors are joined in parallel.

The terminals of a cell of electromotive force 1·1 volts and internal resistance 0·5 ohms are joined by two wires in parallel, the resistances of the wires being 2 ohms and 3 ohms, respectively. Find the total current traversing the circuit and, also, the current in each wire.

[67 marks.]