M.56.

AN ROINN OIDEACHAIS.

LEAVING CERTIFICATE EXAMINATION, 1963.

PHYSICS—HONOURS.

FRIDAY, 14th JUNE—Afternoon, 3 to 5.30.

Not more than six questions to be answered.

One question at least must be answered from each section.

SECTION I.

1. (a) If a body falls freely under gravity, show that the loss of potential energy is equal to the gain in kinetic energy.

(b) A truck slides from rest down a road inclined at an angle of 30° to the horizontal. Assuming that the force opposing motion down the slope is equivalent to one fourth of the normal force exerted by the truck on the road, find, by applying the principle of conservation of energy or otherwise, the velocity of the truck when it has traversed a distance of 100 yds.

(66 marks.)

2. (a) State the Principle of Archimedes. Explain how the principle is applied to find the true weight of a body which has been weighed in air.

(b) A block of wood of specific gravity 0·60, when weighed in air, is exactly counterpoised by a standard brass weight of 100 gms. Assuming that the balance is accurate, find the true weight of the wood, when the density of the air is 0·0013 gm./cm^3 (Specific gravity of brass 8·4.)

(66 marks.)

3. (a) What do you understand by conservation of momentum ?

(b) A mass of 4 cwt. initially at rest, falls through a vertical height of 9 ft. and on striking another body of mass 1 ton, coalesces with it, driving it 6 inches into the ground. Find the common velocity of the combined masses after the impact and the average resistance of the ground to the penetration.

(67 marks.)

SECTION II.

4. (a) Describe how you would investigate the relationship between the pressure and the temperature of a fixed mass of gas when its volume remains constant. State the relationship you would expect to obtain and explain how this relationship is utilised in thermometry.

(b) The density of hydrogen at S.T.P. is 0·09 gm./litre. What is its density at 27°C. and 740 mm. pressure ?

(67 marks.)

5. (a) Establish the formula $\mu = \frac{\text{Sin } \frac{1}{2}(A + D)}{\text{Sin } \frac{1}{2} A}$,

where μ is the index of refraction of the material of a glass prism, A is the refracting angle of the prism and D is the angle of minimum deviation.
Describe how you would use a spectrometer to measure the angle A of the prism.

(b) Illustrate, by diagrams, how a glass prism may be used to change the direction of a ray of light through (i) 90°, (ii) 180°, giving brief explanations.

(66 marks.)

6. (a) Construct ray diagrams showing the formation of

(i) a virtual image in a concave mirror,
(ii) a magnified real image using a convex lens,
(iii) the image of a distant object using a concave lens.

(b) In case (i) above, the image is three times magnified and the distance between the object and image is 80 cm. Calculate the radius of curvature of the mirror.

(67 marks.)

SECTION III.

7. (a) Write explanatory notes on the terms:- electron, proton, nucleus, atomic number, atomic weight.

(b) Give an account of the atomic structure of any two elements, other than hydrogen, dealing specifically with the terms mentioned in (a) above.

(67 marks.)

8. (a) Describe the magnetometer and state how it may be used to compare the strength of the field of a bar magnet with the horizontal component of the earth's magnetic field. Establish any formula used.

(b) Two bar magnets, A and B, produce equal deflections of a magnetometer needle when their distances from it are respectively 15 and 20 cm. What is the ratio of their magnetic moments ? You may assume that the lengths of the magnets are small compared to their distances from the magnetometer needle and that the magnetometer lies on the major axis of the magnets.

(66 marks.)

9. (a) A uniform wire of resistance 5 ohms is bent into the form of a circle and terminals are fixed to opposite ends of a diameter. Explain how you would measure the resistance between the terminals, using a Wheatstone bridge circuit. Calculate the value of the resistance.

(b) A battery of e.m.f. 4·5 volts and internal resistance 5 ohms is connected in series with a galvanometer of resistance 100 ohms and a 30 ohm coil. Draw the circuit and calculate the current in the galvanometer (i) before, (ii) after the battery is shunted with a 20 ohm resistance.

(66 marks.)

10. (a) State Faraday's Laws of Electrolysis. Define (i) the Faraday, (ii) the electrochemical equivalent of a metal. Calculate the time required to deposit a layer of silver 0·05 mm. thick on a plate of total area 500 sq. cm. if the current used is 1·25 amperes.

Electrochemical equivalent of silver = 0·001118 gm./coulomb.
Density of silver = 10·5 gm./cm^3.

(b) Outline the method by which you would measure the electrochemical equivalent of copper.

(67 marks.)