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(Department of Education.)

LEAVING CERTIFICATE EXAMINATION, 1946.

MONDAY, 24*th JUNE.*—Morning, 10 to 12.

PHYSICS.—HONOURS.

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.

SECTION I.

1. Describe the construction of the common balance, and explain the principle upon which it works. Describe two methods of obtaining the true weight of a body using a balance the arms of which are unequal in length. A grocer using such a balance weighs out two separate " pounds " of sugar. For the first customer he uses the left-hand pan, for the second the right-hand pan. Show that he loses profit on the transaction.

2. Describe Fletcher's Trolley.

Explain fully how you would use it to demonstrate how the acceleration of a body is related to the force which acts upon it.

3. Explain the principle of conservation of momentum.

A gun weighing 100 tons fires a shell weighing 1 ton with velocity 2000 feet/sec. The recoil of the gun is resisted by a hydraulic mechanism producing a constant retarding force of 50 tons weight. How far will the gun recoil ? Calculate the ratio of the initial kinetic energies of the gun and shell.

4. Justify theoretically the assertion that the pressure in a liquid is the same for all points at the same depth and acts equally in all directions. A tall cylinder is filled to the brim with water and is sealed by means of a tightly fitting thin rubber sheet. In it is a small test tube which contains a little air so that it just rises to the top of the cylinder and floats with its bottom uppermost. Pressure is applied to the rubber sheet by means of the thumb. Explain what occurs (*a*) when the pressure is applied, and (*b*) when it is released.

SECTION II.

5. A pan of water in which floats ice of mass 1000 grams has a surface area of one square metre and lies exposed to the sun's rays. Supposing that 80% of the heat received is reflected or otherwise lost, and that it takes 20 minutes and 45 seconds to melt all of the ice, find the average rate at which energy is being received from the sun in ergs per square cm. per second.

$J = 4 \cdot 2 \times 10^7$ ergs/calorie. Latent heat of fusion of ice $= 80$ calories/gram.

6. Give a brief account of the three processes by which heat may be lost from a body, or transferred from one body to another.

Describe an experiment which will demonstrate differences between the thermal conductivities of various substances, *or* Give a sketch of a reasonably efficient domestic hot water supply, explaining the physical principles involved.

7. Explain by means of a diagram the principle of the compound microscope, showing how the final image is formed. Explain how the instrument is focussed, giving the underlying theory. Deduce an expression for the magnifying power of the instrument ?

8. Establish the formula for lenses

$$1/v - 1/u = 1/f\ ;$$

v=image distance, u=object distance, f=focal length, explaining the conditions in which you would expect it to hold.

The owner of a camera with a lens of 5 cm. focal length wishes to photograph a postage stamp 28×20 mm. so that its image just fills a plate 35×25 mm. The focussing arrangements normally permit of the lens being moved away from the plate to such distance that objects 90 cms. from the lens are brought sharply to a focus. To photograph nearer objects an extension tube must be fitted to hold the lens still further from the plate. Calculate the minimum length of tube required to photograph the stamp.

SECTION III.

9. Describe the construction of the moving-coil galvanometer. Explain how the deflection may be made directly proportional to the strength of the current flowing in it. How would you modify such an instrument so that it could be used as a voltmeter ?

10. The coil of a tangent galvanometer is set so that its plane makes an angle 30° with that of the magnetic meridian. The coil has a mean radius of 10 cms. and contains 100 turns of wire. The horizontal component of the earth's magnetic field is 0·18 oersted. Calculate the value of the current in amperes which will set the magnet of the instrument at right angles to the magnetic meridian.

11. Explain the principle of the potentiometer, and describe how it might be used to find the internal resistance of a cell.

12. A house contains 20 similar lamps, each of 100 candle power. The supply voltage is 220 volts. Each lamp is alight for an average period of 2 hours per day, and the Supply Board bill for energy consumed during a 60-day period is £3 0s. 0d. @ 6d. per unit. Calculate (*a*) the luminous efficiency in watts per candle power, (*b*) the current consumption of each lamp.