A/Q II

OXFORD LOCAL EXAMINATIONS

GENERAL CERTIFICATE OF EDUCATION

Summer Examination, 1951

Advanced and Scholarship Level

PHYSICS, PAPER II

MONDAY, JUNE 25. TIME ALLOWED—3 HOURS

[Write the number of the paper, Q II, on the left at the head of each sheet of your answers in the space provided.

You will have THREE questions allotted to you, and you will be required to attempt TWO of these and TWO only. Every observation should be recorded as it is made, on a sheet of paper which is to be handed in to the Examiner. At the end of each experiment a description of the method used should be given, together with a diagram of the apparatus. In all experiments an estimate should be given of the accuracy which is expected in the result. You are not required to prove the formulae given or any other standard formulae.

Mathematical tables and squared paper, as necessary, are provided.]

(Take g as 981 cm./sec.^{2})

1. Support the given metre-stick horizontally upon the knife edges, which should be set symmetrically about its mid-point. Suspend a suitable load M gm., as instructed by the Invigilator, from the mid-point. Observe the depression d cm. of the mid-point for different separations L cm. of the knife edges, taking values of L lying between 40 cm. and 80 cm. Plot a graph of L^3 against d, and obtain the value of L^3/d from the gradient of the graph. Measure the breadth b cm. and the depth c cm. of the metre-stick, and calculate Young's modulus for its material using the formula

$$Y = \frac{MgL^3}{4bc^3d} \text{ dynes per sq. cm.}$$

2. Find the focal length of the given convex lens, with the help of a plane mirror. Then determine the radius of curvature of each face in turn, by the method which involves floating the lens on mercury and observing the position at which a pin held on the principal axis of the lens coincides without parallax with its own real image.

3. Compare the magnetic moments of the two given magnets by timing their vibrations when suspended one at a time in the stirrup provided so as to make small oscillations about a vertical axis in the earth's field.

[The appropriate moment of inertia is given by the formula $I = W\left(\frac{L^2+B^2}{12}\right)$ gm. cm.^{2}, where W is the mass in grams, L the length in centimetres, and B the breadth in centimetres.]

4. Determine the specific heat of glass by the method of mixtures. You are reminded that glass is a bad conductor, so that both the initial heating and the exchange of heat in the calorimeter will take a considerable time; correction for cooling during the latter process should be made.

5. Set up the potentiometer using a 2-volt accumulator as driver cell, and obtain readings for the balance length required for the Daniell cell when on open circuit, and when short circuited by resistances of 2, 3, and 5 ohms in turn. Calculate the internal resistance of the cell.

Confirm your result by making measurements with the tangent galvanometer of the current flowing in a circuit comprising the galvanometer, the Daniell cell, and a suitable known resistance in series. The invigilator will tell you which coil of the galvanometer to use, and the resistance and reduction factor of this coil.

6. Determine the surface tension of the given solution S (which wets glass) by the capillary-tube method.

7. Determine the apparent coefficient of expansion of the given liquid relative to glass, using the apparatus provided.

8. Make observations of the magnification m of the real image formed by the given convex lens for ten different positions of the object, measuring the object distance u in each case. Plot a graph of $1/m$ against u, and deduce the focal length of the lens from this.

9. Measure the resistance of the given coil of wire when immersed in melting ice and in boiling water; taking the latter temperature to be 100° C., determine the temperature coefficient of resistance of the material of the wire.

Measure the resistance at air temperature, and hence obtain a value for the air temperature.