S 46

OXFORD LOCAL EXAMINATIONS

SCHOOL CERTIFICATE

WEDNESDAY, JULY 13, 1949

TIME ALLOWED—$1\frac{3}{4}$ HOURS

Physics II

[Write PHYSICS II at the head of each sheet of your answers.
Answer any FIVE questions.
Illustrate your answers by diagrams wherever these will make your answers clearer.]

[*Mathematical tables and squared paper are provided.*]

Mechanics

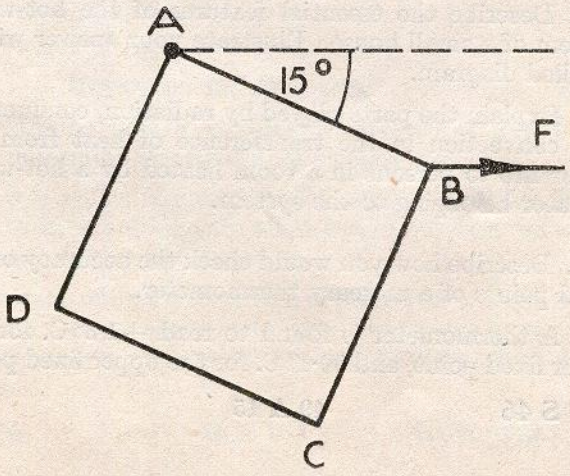
1. Distinguish between the *pressure* and the *thrust* experienced by a plane surface which is immersed in a liquid.

Calculate the pressure due to a vertical column h cm. high of liquid of density d gm. per c.c.

Describe any one application of this result to the measurement of pressures.

2. State the *triangle of forces* rule, and describe an experiment to verify it.

A square board $ABCD$, made of uniform material and weighing 18 lb., is pivoted at the corner A. It is pulled aside by a horizontal force F applied at B, so that the side AB makes an angle of 15° with the horizontal. Use a graphical method to find the value of F, and the magnitude and direction of the reaction of the pivot at A.



3. What do you understand by the *efficiency* of a machine?

Describe how you would attempt to measure experimentally the efficiency of a simple sheaved pulley system.

Explain why the value of the efficiency is always considerably less than 100 per cent.

4. State *Hooke's law*. Describe how you would test whether it holds for the extension of a spiral spring, and explain how it is involved in the ordinary spring balance.

The indications of a spring balance loaded with the same body are slightly different in different parts of the earth, while if a body is weighed on a beam balance the result is the same wherever the experiment is done. How do you explain these facts?

Heat and Light

5. Define the *latent heat of vaporization* of a liquid, and describe how you would determine its value for water at 100° C.

Explain in terms of the kinetic theory what is happening when water evaporates into the air at ordinary temperatures, and why the temperature of the remaining water is lowered.

6. Describe the essential features of the hot-water system of a small house. Illustrate your answer with a labelled diagram.

Explain the parts played by radiation, conduction, and convection in the transference of heat from the boiler fire to persons in a room heated by a hot-water radiator belonging to the system.

7. Describe how you would check the accuracy of the fixed points of a mercury thermometer.

A thermometer is found to read +1·3° C. for the lower fixed point, and 99·1° C. for the upper fixed point.

How may the readings given by this thermometer be corrected when it is used to determine temperatures between 0° C. and 100° C.?

The bulb of a mercury thermometer up to the 0° C. mark has a volume of 0·5 c.c., and the area of cross-section of the stem is 0·0006 sq. cm. Given that the apparent coefficient of expansion of mercury in glass is 0·00018 per C. degree, find the distance between the 0° C. and 100° C. graduations.

8. Describe the human eye, and compare its optical behaviour with that of a photographic camera.

What kind of spectacles are needed for the correction of short sight? Illustrate your answer by diagrams showing what happens to rays from a distant object point (*a*) in the uncorrected short-sighted eye, (*b*) after correction with spectacles.

9. Explain the terms *pole*, *principal axis*, *principal focus*, as applied to a concave mirror.

Describe with full experimental details how you would determine the focal length of a concave mirror.

A small object 2 cm. high is placed upright on the principal axis of a concave mirror of focal length 5 cm. at a distance of 3 cm. from the pole. Find the position, size, and nature of the image.

[*Read this question* (9) *with care. No credit will be given for descriptions of measurements made for a lens, or for solutions to the problem which confuse a concave mirror with a lens.*]

Magnetism and Electricity

10. Describe how a gold-leaf electroscope may be used to determine the sign of an electric charge.

How would you charge an electroscope by induction? Describe and explain what would be observed at each stage of the operation.

The case of an electroscope is placed on a block of wax, while the cap is earthed; when the case is given a charge, the leaves are seen to diverge. Explain why this happens.

11. Describe a simple form of horseshoe electromagnet. Illustrate your answer by a clear diagram in which the poles are labelled and the direction of the electric current is shown.

Explain why a rod of soft iron becomes magnetized when it is tapped while lying horizontally in the magnetic meridian.

State what you would expect to find if the rod were held vertically and similarly treated.

12. Describe some form of moving-coil galvanometer, and explain the principles on which it works.

Two moving-coil galvanometers each have a resistance of 40 ohm and give a full-scale deflexion with 1·5 milliamp. One of them, X, is shunted with a resistance of 0·404 ohm to convert it into an ammeter. To what current does its maximum deflexion correspond? The other, Y, is converted into a voltmeter by placing a resistance of 1,960 ohms in series with it. What is the greatest potential difference it can measure?

Draw a circuit diagram indicating how you would connect up the instruments to measure the resistance of a coil which is expected to be about 20 ohms.

13. State *Faraday's laws of electrolysis.*

Describe how you would measure the electrochemical equivalent of copper, and state the precautions you would take in order to obtain an accurate result.

In a certain experiment a copper voltameter is placed in series with a tangent galvanometer, and the following readings are obtained:

Mass of copper cathode at start:	23·47 gm.
Mass of copper cathode at end:	24·13 gm.
Duration of experiment:	50 min. 0 sec.
Steady galvanometer deflexion:	52·0°.

Taking the electrochemical equivalent of copper as 0·00033 gm. per coulomb, find the reduction factor of the tangent galvanometer.