

1934

## Elementary Physics (1st Year): Technical School Examinations 1934

Department of Education: Technical Instruction Branch

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# COURSES IN APPLIED CHEMISTRY.

(39.)

## AN ROINN OIDEACHAIS.

(Department of Education.)

## BRAINSE AN CHEÁRD-OIDEACHAIS.

(Technical Instruction Branch.)

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### TECHNICAL SCHOOL EXAMINATIONS.

1934.

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### ELEMENTARY PHYSICS.

(First Year.)

*Tuesday, May 1st—7 to 10 p.m.*

*Examiner*—PROFESSOR FELIX E. HACKETT, M.A., M.SC., PH.D.

*Co-Examiner*—E. P. BARRETT, ESQ., B.A., B.SC.

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### GENERAL INSTRUCTIONS.

You are carefully to enter on the Answer Book and Envelope supplied your Examination Number and the subject of examination, but you are not to write your name on either. No credit will be given for any Answer Book upon which your name is written, or upon which your Examination Number is not written.

You must not have with you any book, notes, or scribbling-paper.

You are not allowed to write or make any marks upon your paper of questions.

You must not, under any circumstances whatever, speak to or communicate with another candidate; and no explanation of the subject of the examination may be asked for or given.

You must remain seated until your Answer Book has been taken up, and then leave the examination-room quietly. You will not be permitted to leave before the expiration of twenty minutes from the beginning of the examination, and will not be re-admitted after having once left the room.

If you break any of these rules, or use any unfair means, you are liable to be dismissed from the examination, and your examination may be cancelled by the Department.

*Three hours are allowed for this paper. Answer Books, unless previously given up, will be collected at 10 p.m.*

## INSTRUCTIONS.

*Read the General Instructions on page 1.*

(a) The same number of marks is allotted for each question.

(b) Answers must be written in ink; sketches may be made in pencil.

(c) Write the number of the question distinctly, in the margin of your paper, before the answer.

(d) Not more than *six* questions may be attempted, of which not more than *three* may be selected from Section A, and not more than *three* from Section B.

NOTE.—Books of logarithmic and trigonometrical tables (four places) are provided.

## SECTION A.

*(Not more than three questions may be taken from this Section.)*

1. How is it shown that the height of the barometer measures the pressure of the atmosphere?

A mercury barometer reads 76 cm. at sea-level. When brought to the top of a mountain close at hand, it falls to 70 cm. Find approximately the height of the mountain in metres, taking the weight of 1 litre of air at ordinary temperatures as 1.2 grams and the density of mercury as 13.6 grams per c.c.

2. Describe some of the thermometers in common use. What devices have been applied to adapt liquid-in-glass thermometers to read maximum and minimum temperatures?

3. Define the terms "coefficient of linear expansion," "coefficient of cubical expansion."

Find the volume of 1 gram of mercury at 100° C. if its density is 13.596 at 0° C. and its coefficient of cubical expansion is .00018.

4. The steel bottles in which gaseous oxygen is sold are stated to contain sixteen pounds of oxygen at a pressure of one ton per square inch at 15° C. Given that one

standard atmosphere of 76 cm. of mercury is equivalent to a pressure of 14.4 lbs. per square inch and at this pressure and 0° C., one litre of oxygen weighs 1.429 grams, find the weight of one litre of oxygen at the same pressure at 15° C. and hence the volume of the oxygen in the container.

(1 lb = 454 grams).

5. In an experiment in the latent heat of fusion of ice 15.30 grams of ice were added to 122.07 grams of water at 21.3° C. The weight of the copper calorimeter and copper stirrer was 21.5 grams. The final temperature was 10.1° C. If the specific heat of copper be .093 calculate the value of the latent heat of fusion of ice given by the experiment.

6. A beaker of water containing some fine particles in suspension is heated slowly on a sand bath. Describe the general circulation of the water as it is heated. What happens, as the boiling point is approached? If a test tube containing water were suspended in the boiling water, would the water in it also boil?

## SECTION B.

*(Not more than three questions may be taken from this Section.)*

7. Explain how you would arrange a suitable source of light, a slit, a prism and a lens to project a spectrum on a screen. Give a diagram showing the passage of the red rays through the arrangement. What effect is produced on the spectrum, if cobalt-blue glass is placed over the slit? Why does a stick of red sealing-wax have a dark appearance in the green region of the spectrum?

8. You are supplied with a large bowl containing water, a piece of cork, an unmagnetised needle and a magnet. Show how you can use this apparatus to find the magnetic meridian, to demonstrate lines of force, and to show that the poles of a magnet have equal and opposite strengths.

9. How is a Daniell cell made up? State generally how the current passes through the solutions in the cell and what chemical changes accompany the passage of the current.

10. Describe some form of ammeter, explaining why the moving pointer is deflected by the current.

Describe in detail an ammeter of any type, explaining how, if possible, its range of measurement can be modified.

11. A voltmeter is connected across the terminals of a Daniell cell. It reads 1.04 volts. The cell is used to send current through different combinations of a 5-ohm. and a 2-ohm. resistance. For the 5-ohm. and 2-ohm. in series the voltmeter reads 0.81 volt, for the 5-ohm. alone 0.74 volt for 2-ohm. alone 0.52 volt. Deduce the current taken from the cell in each case and plot the reading of the voltmeter against the current taken from the cell. If the reading for the 5-ohm. and 2-ohm. resistances in parallel was 0.43 volt, find from your graph the current through the combination and hence its resistance. How could the resistance of the combination be calculated?

12. Give a short account of the construction of an induction coil and explain its action.