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Magnetism and Electricity: Technical School Examinations 1933

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AN ROINN OIDEACHAIS
(Department of Education),

BRAINSE AN CHEARD-OIDEACHAIS
(Technical Instruction Branch).

SPECIAL EXAMINATIONS FOR POST OFFICE EMPLOYEES.

1933.

MAGNETISM AND ELECTRICITY.

Monday, May 8th—7 *to* 10 *p.m.*

Examiner—J. D. FERGUSON, ESQ., B.SC. (Eng.), A.M.I.E.E., M.A.I.E.E., M.I.R.E.

Co-Examiner—J. P. HACKETT, ESQ., B.E., A.R.C.SC.I.

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 commencement 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*) EIGHT questions only may be attempted. Where feasible, answers must be illustrated by simple sketches.

(*b*) Equal values are attached to the questions.

(*c*) Answers must be written in INK; diagrams may be drawn in PENCIL.

(*d*) Write the number of the question distinctly, in the margin of the paper, before the answer.

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(1) What is meant by the "horizontal and vertical components" of the earth's magnetic force at a place? Calculate the value of the horizontal component at a place where the total force of the earth's magnetism is 0.48 and the vertical component is 0.45.

(2) Give brief explanations of the following terms:—Moment of a Magnet, Magnetic Equator, Astatic Needles, Magnetic Induction.

(3) Define the Unit Magnet Pole and the Law of Inverse Squares. A magnetic pole of strength 12 units repels another pole, placed at a distance of 3 centimetres from it, with a force of eight dynes. Find the strength of the second pole.

(4) What relationship exists between the capacity of a condenser, the electrostatic charge on it and the potential between its plates? A spherical conductor, whose diameter measures four centimetres, is charged with + 20 units of electricity; calculate the potential at the surface of the sphere.

(5) Describe the apparatus known as an "electrophorus" and explain with sketches how it can be used to charge a Leyden Jar.

(6) How would you calculate the joint capacity of a number of condensers (*a*) in series, (*b*) in parallel? The joint capacity of four equal condensers in series is two microfarads. What would be their joint capacity if connected in parallel?

(7) A piece of wire is bent into the form of a square, and the ends soldered. If the resistance between adjacent corners be six ohms, what is the resistance between opposite corners?

(8) Explain, by means of a diagram, how a simple trembler bell works. Show how a pair of metal handles should be connected to the bell in order to obtain an electric shock from it, and explain the effect which produces the shock.

(9) What is meant by the "electro-chemical equivalent" of a substance? Calculate the weight of copper deposited on the cathode of a copper voltameter by a current of two amperes for 15 minutes. The E.C.E. of copper may be taken as 0.000329 gram per coulomb.

(10) Describe the action of an electric current on a magnet, and explain how it is made use of in a simple type of galvanometer.

(11) Define the terms, Flux, Reluctance and Magneto-motive-force as applied to a magnetic circuit. A solenoid is wound with 1,000 turns and carries a current of 0.5 ampere, and another solenoid is wound with 100 turns and carries ten amperes; compare their magneto-motive-forces.

(12) Five similar cells are arranged in series, and the circuit completed through a coil of wire and a galvanometer. The resistances of the battery, coil and galvanometer are 10, 50 and 20 ohms respectively. If the difference of potential between the terminals of the galvanometer is 2 volts, what is the e.m.f. of each cell of the battery?