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(Department of Education).

LEAVING CERTIFICATE EXAMINATION, 1955.

PHYSICS.—HONOURS.

SATURDAY, 21st JUNE—MORNING, 10 TO 12.

Not more than *six* questions to be answered.

***One* question *at least* must be answered from each section.**

SECTION I.

1. Write a note on radiation and convection as applied to heat.
In a heating system in which hot water is used, the water leaves the furnace at a temperature of 170°F. and returns to it at a temperature of 120°F. If the water circulates at the rate of 2 cubic feet per minute, how much heat leaves the system in one hour ?

[66 marks.]

2. Describe Attwood's machine and describe, also, how it may be used to investigate the relationship between mass and acceleration, the accelerating force being constant.

[66 marks.]

3. Define the units in which (*a*) force, (*b*) energy, (*c*) power, are measured.
A railway truck weighing 15 tons is pulled up an incline of 1 in 160 at a constant speed of 20 miles per hour by an engine weighing 50 tons. If the frictional resistance to motion is equivalent to 20 lbs. weight per ton, find (i) the horse-power at which the engine is working (ii) how far the truck will continue to travel up the incline after it is slipped from the engine.

[67 marks.]

SECTION II.

4. State the laws of reflection of light.

(*a*) If a plane mirror is rotated through an angle x, prove that a reflected ray is rotated through an angle $2x$.

(*b*) What is the angle between two plane mirrors if a ray of light which is parallel to one of the mirrors and which is reflected by both is then parallel to the other ?

(*c*) A boy, five feet tall and standing erect, wishes to see his full image in a plane mirror hanging vertically. What is the least length of mirror he requires ? If his eye is 4 feet 8 inches from the floor, how far is the bottom of the mirror from the floor ?

Illustrate your answer by means of diagrams.

[66 marks.]

5. Prove a formula for the focal length of a concave mirror in terms of u, v, where u and v are the distances of the object and image, respectively, from the mirror.

Show, with the aid of a diagram, how a concave mirror can produce (*a*) a real image, (*b*) a virtual image, of an object.

When an object is placed on the principal axis of a concave mirror, a real image three times as high as the object is formed, and when the object is moved a distance of 12 cms. along the axis, a virtual image three times as high as the object is formed. Find the radius of curvature of the mirror.

[66 marks.]

6. Describe a simple form of compound microscope and show by means of a diagram the paths of the rays by which the eye sees the final image.

What defects are associated with this simple type of microscope and how are these defects remedied ?

[67 marks.]

Section III.

7. Define (*a*) line of magnetic force, (*b*) unit intensity of magnetic field.

Describe how to plot the resultant magnetic field in the region of a given bar magnet with its magnetic axis horizontal and in the plane of the magnetic meridian and its north-seeking pole pointing *North*.

Indicate by means of a diagram the nature of the field and explain how the pole strength of the magnet may be calculated, using the diagram.

[66 marks.]

8. What is meant by (*a*) potential, (*b*) intensity of electric field ? Define the units in which these are measured.

Describe a gold-leaf electroscope and explain how it could be used to show that when a piece of glass is rubbed with silk, the glass and the silk acquire equal and opposite charges.

Explain, also, how the charge on a conductor may be transferred entirely to another conductor.

In each case show by means of diagrams the nature of the induced charges and the distribution of the lines of force during the operation.

[66 marks.]

9. Describe the Wheatstone bridge method of comparing resistances. Give the underlying theory.

Define specific resistance and describe how to measure the specific resistance of the material of a given wire of uniform cross-section.

[67 marks.]

10. State the laws of electromagnetic induction and describe how they may be tested experimentally.

Show how the working of a simple dynamo depends on these laws.

[67 marks.]