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LEAVING CERTIFICATE EXAMINATION, 1952.

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. A cylindrical rod floats vertically in a vessel of water, and a length of 2 inches of the rod projects above the surface of the water. Oil of specific gravity 0·85 is poured on top of the water and does not mix with it. Find the depth of the oil if the rod is just completely immersed.

[66 marks.]

2. A smooth plane makes an angle of 30° with the horizontal. A mass of 16 lbs. on the plane is connected by a light inextensible string, passing over a smooth pulley at the top of the plane, to a mass of 12 lbs. which hangs freely. Find (*a*) the velocity of the masses 5 seconds after the system is released, (*b*) the distance travelled by them in that time, (*c*) the tension in the string during motion.

[66 marks.]

3. Describe how the mechanical equivalent of heat may be found by experiment.

A mass of ice at 0°C. topples over a cliff and falls freely to the ground. If *half* the total energy made available by the fall is converted into heat in the ice, and if *one hundredth* of the mass of ice is thereby melted, find the height of the cliff.

[Mechanical equivalent of heat $=4{\cdot}2\times10^7$ ergs per calorie ; $g=981$ cm. per sec.^{2} ; latent heat of fusion of ice $=80$ calories per gm.]

[67 marks.]

SECTION II.

4. Define (i) index of refraction, and (ii) critical angle of a medium.

If the index of refraction of glass is 1·5, calculate the critical angle of glass.

Explain fully (*a*) how a ray of light may be turned through an angle of 90° by using a right-angled glass prism, (*b*) why it is not possible when looking through the side of a glass cube to view a mark on the base of the cube.

[66 marks.

5. Find a formula for the focal length of a concave mirror in terms of the distances of the object and image from the pole of the mirror.

Describe how you would find the focal length of a concave mirror by locating, by the method of parallax, the position of the image of an object when the image is (*a*) real, (*b*) virtual.

[66 marks.]

6. Show that the focal length of a thin convex lens is given by the formula $\frac{1}{v}-\frac{1}{u}=\frac{1}{f}$, where u and v are the distances of the object and image, respectively, from the lens and f is the focal length of the lens.

A square picture of side 8 cm. is projected on a square screen of side 3 metres by means of a lens, so that a well defined image of the picture just fills the whole of the screen. If the screen is at a distance of 10 metres from the lens, find the focal length of the lens.

[67 marks.]

Section III.

7. Define "magnetic field strength at a point."

A point P is taken on the production of the major axis of a *short* bar magnet and another point Q is taken on the production of the vertical bisector of the major axis, P and Q being at equally *great* distances from the centre of the magnet. Assuming that the force between magnetic poles varies inversely as the square of the distance between them, show that the magnetic field strength at P is *twice* the magnetic field strength at Q.

Describe an experiment to demonstrate this. [66 marks.]

8. Describe how you would measure the resistance of a piece of wire by Wheatstone's method.

Describe, also, what further work you would do to find out the specific resistance of the material of the wire.

[66 marks.]

9. Describe how you would find by experiment the electro-chemical equivalent of copper.

A tangent galvanometer was joined in series with a battery and a silver voltameter. The deflection of the needle was 45° and the mass of silver deposited in the course of an hour was 0·105 grams. Assuming that the electro-chemical equivalent of silver is 0·00112 gm./coulomb, calculate the reduction factor of the galvanometer.

[67 marks.]

10. Find an expression for the capacity of an isolated spherical conductor of radius a cms.

How is the capacity affected when the sphere is surrounded by a concentric hollow sphere which is earthed, and which is b cms. in radius? Find an expression for the capacity in this case and comment on its value

(i) when b is very nearly equal to a,

(ii) when b is very great compared to a.

Deduce from your result an expression for the capacity of a parallel plate condenser of area A sq. cms., the plates being x cms. apart.

[67 marks.]