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LEAVING CERTIFICATE EXAMINATION, 1951.

PHYSICS.—HONOURS.

THURSDAY, 14th *JUNE*.—EVENING, 4 TO 6.

Not more than *six* questions to be answered.
One question *at least* must be answered from each section.

SECTION I.

1. Describe how you would measure the specific gravity of oil using a U-tube. Explain the theory of the method.

A cork weighing 10 grams floats in oil. What volume of glass must be attached to the cork so that the whole will float submerged in the oil ?

(Sp. gr. of cork=0·5 ; sp. gr. of oil=0·9 ; sp. gr. of glass=2·5.)

2. The driver of an express train travelling at a speed of 60 miles per hour shuts off steam on seeing a goods train 1,320 feet ahead, which is travelling at a steady speed of 15 miles per hour in the same direction and on the same track. What is the least force, in lbs. wt. per ton, with which the motion of the express must be resisted so that a collision may be avoided ?

3. State Boyle's law and Charles' law.

Deduce from them the relationship between the temperature and pressure of a mass of gas at constant volume.

A steel vessel filled with air at 15°C. and at a pressure of one atmosphere is sealed and heated to 800°C. Find the pressure of the air in the heated vessel. (Assume that the expansion of the vessel is negligible.)

SECTION II.

4. The focal length of a combination of two thin converging lenses in contact is F, and the focal lengths of the lenses are f_1 and f_2 respectively ; prove the relationship $\frac{1}{F}=\frac{1}{f_1}+\frac{1}{f_2}$. Using this relationship, describe how you would measure the focal length of a diverging lens.

Describe, also, how you would measure the focal length of a concave lens by using a concave mirror.

5. What is meant by magnifying power in the case of a telescope ?

Two convex lenses are arranged to form a telescope. The focal lengths of the object glass and eye-piece are 30 inches and 2 inches, respectively. Show, by means of a diagram, the paths of the rays by which the eye on looking through the eye-piece sees the image of a distant object.

Calculate the magnifying power when this image is seen (i) at a great distance, (ii) at a distance of 12 inches, from the eye. Find also, the distance between the lenses in each case.

6. Prove the relationship connecting the index of refraction of the material of a prism, the refracting angle of the prism, and the angle of minimum deviation of a ray of light.

Describe the spectrometer and explain how you would use it to measure one of the angles of a prism.

Section III.

7. Given a bar magnet of known magnetic moment, describe how you would use it in conjunction with a deflection magnetometer to measure the horizontal component of the earth's magnetic field. Prove any formulae you use. Describe briefly what further work is necessary to measure the total intensity of the earth's magnetic field.

8. A current of c amps. is passed through two conductors joined in parallel, the resistances of which are x ohms and y ohms, respectively. Find expressions in terms of c, x and y for the current flowing in each of the conductors.

An ammeter, graduated to measure currents not greater than 1·5 amps., is required to measure currents up to 15 amps. and a shunt is employed for this purpose. If the resistance of the ammeter is R ohms, calculate the resistance of the shunt.

9. Describe the construction of a storage cell (lead accumulator).

Describe the changes that take place within the cell (i) when it is being charged, (ii) when it is discharging.

Describe a method of testing the state of charge of the cell.

10. What is an electric condenser ?

Show that the capacity of a parallel plate condenser is $\dfrac{A}{4\pi l}$, where

A is the area of the insulated plate and l is the distance between the plates. In what units is your answer expressed ?

The charge on a parallel plate air condenser is 50 units. The area of the insulated plate is 55 sq. cms., and the distance between the plates is 3 mms. Calculate the energy of the charge in ergs.