LEAVING CERTIFICATE EXAMINATION, 1979

PHYSICS—ORDINARY LEVEL

MONDAY, 25 JUNE—MORNING, 9.30 to 12.30

Any **six** questions to be answered.
All the questions carry the same marks.

1. Answer *eleven* of the following items *(a)*, *(b)*, *(c)*, etc. All the items carry the same marks. *Keep your answers short.*

*(a)* Define acceleration.

*(b)* "Alcohol evaporates faster than water." Explain this statement in terms of the forces between the molecules in the liquids.

*(c)* What is magnetic dip?

*(d)* Explain the term: critical angle.

*(e)* Fig. I illustrates part of the experimental arrangement used in Young's experiment to demonstrate the interference of light. What is the apparatus required between A and S to complete the arrangement?

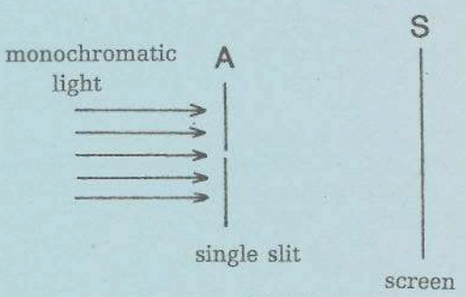


Fig I.

*(f)* What property of a sound wave determines loudness?

*(g)* To convert a moving-coil galvanometer to an ammeter a ———— resistance is connected in ———— with the meter. What words are omitted from this statement?

*(h)* Define the unit of current i.e. the ampere.

*(i)* Write an expression for the heat produced by a current of $I$ amperes flowing through a resistance of $R$ ohms for $t$ seconds.

*(j)* The apparatus as shown in Fig. II was used to measure the resistance R. Identify the meters X and Y.

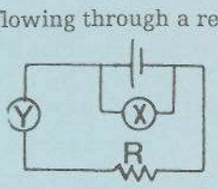


Fig. II

*(k)* What is the function of a split-ring commutator?

*(l)* Which of the following is the value of the specific charge (the ratio of charge to mass) of the electron in coulombs per kilogram,

$$9{\cdot}65 \times 10^{4},\ 6{\cdot}6 \times 10^{-16},\ 1{\cdot}76 \times 10^{11},\ 9{\cdot}1 \times 10^{-31}\ ?$$

*(m)* What are gamma rays?

*(n)* Give two differences between protons and photons.

*(o)* A neutron is emitted after an $\alpha$ – particle is absorbed by a ${}^{9}_{4}\mathrm{Be}$ atom. What is the isotope that remains?

*(p)* What is meant by nuclear fusion?

2. *(a)* Explain the terms (i) work, (ii) potential energy. In what units is work measured?
Calculate the work done in raising a mass of 500 kg to the top of a building 30 m high.
(Take $g = 9{\cdot}8\ \mathrm{m\ s^{-2}}$.)

*(b)* What is meant by the gravitational constant $G$?
Show that the acceleration due to gravity may be expressed as $\frac{4}{3}\pi R\rho G$ where $R$ is the radius of the earth and $\rho$ is the average density of the earth.

3. State Boyle's law. Describe, with the aid of a diagram of the apparatus, how you would verify this law.

Show how the kinetic theory equation $p = \frac{1}{3}\frac{nmc^2}{V}$ is related to Boyle's law.

A certain mass of gas occupies a volume of $2 \times 10^{-4}$ m$^3$ when the pressure is 760 mm of mercury. What pressure is required to compress the gas into a volume of $0{\cdot}5 \times 10^{-4}$ m$^3$ without change of temperature?

4. Explain the terms (i) dispersion, (ii) diffraction. What is meant by a spectrum?
Describe an experiment in each case to demonstrate (i) and (ii) in the laboratory.
If white light were used in each of the experiments why would you expect diffraction not to be as readily observable as dispersion?

5. Explain the basic physical principles involved in any *four* of the following.

*(a)* When a tuning fork is set vibrating and then rotated slowly close to the ear, it is found that the sound heard varies from loud to soft.

*(b)* A stick partly immersed in water appears to be bent at the water surface.

*(c)* The storage compartment for butter in a household refrigerator is usually positioned as high as possible on the door of the refrigerator.

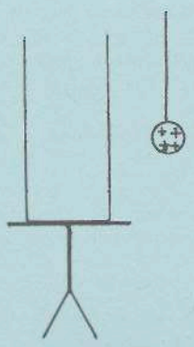
*(d)* Electrical energy is usually transmitted over long distances at high voltage.

*(e)* Fire can sometimes be caused by the use of incorrect fuses in electrical circuits.

6. *(a)* What is meant by electrostatic induction?
A tall metal can is placed on the disc of an uncharged electroscope. A metal sphere suspended by a silk thread is given a positive charge (see diagram). Show, by means of diagrams, the charge on the electroscope case, the charge on the electroscope leaves and the charge on the sphere when

(i) the sphere is lowered into the can but does not touch the inside of the can,

(ii) the sphere is removed after being allowed to touch the inside of the can.



*(b)* Define capacitance.
Two capacitors, one of capacitance 3μF and the other 6μF, are connected in series across a 6 volt battery. Calculate the charge on either one of the capacitors.

7. Describe how you would perform any *two* of the following experiments in the laboratory:

*(a)* to demonstrate the parallelogram of forces,

*(b)* to measure the temperature of a liquid using a constant volume gas thermometer,

*(c)* to measure the focal length of a concave lens,

*(d)* to measure the internal resistance of a cell.

8. Describe how a beam of electrons may be produced in a cathode ray tube. How may such a beam be used to produce X-rays?
State how (i) the penetrating power, (ii) the intensity, of X-rays may be controlled in an X-ray tube.
Calculate the energy of an X-ray photon of frequency $3 \times 10^{18}$ Hz (Take Planck's constant $h = 6{\cdot}6 \times 10^{-34}$ J s.)

9. Distinguish between natural radioactivity and artificial (induced) radioactivity.
What is meant by the half-life of a radioactive isotope? A radioactive isotope has a half-life of 4 hours. What percentage of the original sample remains at the end of 12 hours?
Outline how the radiations from radioactive sources may be detected experimentally.

10. Answer any *two* of the following.

*(a)* Explain the terms (i) reflection, (ii) refraction. How may these phenomena be demonstrated with sound waves?

*(b)* A body is thrown vertically upwards and reaches a height of 10 m. Calculate (i) the initial velocity of the body, (ii) the time which elapses before the body returns to the ground. (Take $g = 9{\cdot}8$ m s$^{-2}$.)

*(c)* State the laws of electromagnetic induction.
Draw a labelled diagram of a simple a.c. generator and explain how its operation is based on the laws of electromagnetic induction.

*(d)* Describe the essential parts of a photoelectric cell. Explain how a photocurrent is produced in such a cell and mention how the current may be varied.