AN ROINN OIDEACHAIS

LEAVING CERTIFICATE EXAMINATION, 1969

PHYSICS - HONOURS

Six questions to be answered

1. State Newton's laws of motion or Newton's law of gravitation.
   (i) If a car of mass 1000 kg. is travelling at a uniform speed of 12 metres per second, find what constant retarding force would be required to bring it to rest in 6 seconds.
   (ii) Calculate the acceleration due to gravity on the surface of a certain planet given that the acceleration due to gravity on the surface of the earth is 9·8 metres per sec^2., and $\frac{\text{radius of earth}}{\text{radius of planet}} = \frac{15}{8}$ and $\frac{\text{mean density of earth}}{\text{mean density of planet}} = \frac{10}{7}$.

(66 marks)

2. (a) Write a note on the concept of temperature. Refer in your answer to temperature definition (i) on the mercury-in-glass scale (ii) on the gas scale.
   (b) Given the kinetic theory equation $p = \frac{1}{3}nm\overline{c}^2$ (where p = the pressure of a gas, n = the number of molecules per unit volume of the gas, m = the mass of a molecule, $\overline{c}^2$ = the mean-square velocity of the molecules) show how any <u>one</u> of the gas laws may be deduced from it.
   Calculate the root-mean-square velocity of the molecules of a gas at S.T.P. given that the density of the gas at S.T.P. is 9×10^{-5} gm. per c.c., and the density of mercury is 13·6 gm. per c.c.
   Take g = 980 cm. per sec^2.

(66 marks)

3. In the case of each of any <u>three</u> of the following phenomena, explain the phenomenon on the basis of the corpuscular (particle) theory or the wave theory of light: reflection, refraction, interference, diffraction.
   Explain how the photoelectric effect affected the theory of the nature of light.
   Monochromatic light of wavelength 6,000 Å falls normally on a diffraction grating of 5,000 lines per cm. How many orders of spectra may be obtained ? (1Å = 10^{-8} cm.)

(66 marks)

4. Show how a reasonably pure spectrum of white light may be obtained. Explain the occurrence of dark lines (Fraunhofer) in the solar spectrum.
   What are the principal characteristics of wave motion ?
   "X-rays, gamma rays, visible and invisible light rays are said to be essentially similar in nature." Give reasons in support of this statement.

(66 marks)

5. Describe experiments, one in each case, (i) to verify the inverse square law of force between magnetic poles, (ii) to measure the ratio of the charge to mass of the hydrogen ion.
   Give the relevant theory in the case of (i).

(66 marks)

6. Discuss the process of conduction of electricity in (i) a metal, (ii) an electrolyte, (iii) a gas, (iv) a thermionic diode. Show in each case how the current varies with the applied potential.
   Write a note on any <u>one</u> practical application of the thermionic diode.

(66 marks)

7. Describe, and explain the principles underlying the operation of, (i) a moving-coil milliammeter, (ii) an X-ray tube. Give the factors which determine the sensitivity of (i) and the quality (penetrating power) of the X-rays produced in (ii).

(67 marks)

8. State the laws of electromagnetic induction and describe how they may be tested experimentally.
   Give an account of a simple alternating current generator. Show how it may be converted into a direct current generator.
   Mention an instrument that may be used to measure both alternating and direct current.

(67 marks)

9. Give an account of radioactivity with particular reference to the following: (i) the nature of the radiations emitted from radioactive substances, (ii) radioactivity detectors, (iii) the production of radioactive isotopes, (iv) the particles normally used as projectiles for the bombardment of elements, (v) mass-energy conservation in nuclear reactions.

(67 marks)

10. Write notes on any <u>two</u> of the following:
   (a) the use of vectors in physics,
   (b) the optical differences between mirrors and lenses,
   (c) the capacitance and energy of charged condensers,
   (d) the Compton effect and pair production.

(67 marks)