AN ROINN OIDEACHAIS M.56

LEAVING CERTIFICATE EXAMINATION, 1967

PHYSICS—HONOURS

THURSDAY, 15th JUNE—MORNING, 10 to 12.30

Six questions to be attempted.

1. (a) Discuss Newton's law of gravitation.
If the acceleration due to gravity at the surface of the earth is 981 cm. per sec^2. and the radius of the earth (assumed spherical) is $6{\cdot}4 \times 10^6$ metres, calculate the acceleration due to gravity at a height 8×10^5 metres above the surface of the earth.

(b) Define (i) energy, (ii) work.
A 4 lb. mass acted upon by a constant force has its velocity increased from 20 ft. per sec. to 30 ft. per sec. in a distance of 25 ft. Find the magnitude of the force.

(66 marks)

2. "The wave theory of light gained much support as a result of measurements of the velocity of light in air and in liquid media." Comment on this statement.
Show how (i) interference, (ii) diffraction, may be demonstrated in the laboratory. Describe an experiment to measure the wavelength of monochromatic light.

A parallel beam of sodium light of wavelength 5890Å falls normally on a diffraction grating, and the first order diffracted image is formed at an angle of 20°42′ with the normal. Calculate the number of lines per centimetre ruled on the grating.

(1Å = 10^{-8} cm.)

(66 marks)

3. (a) Give an account, with theory, of a method of measuring the refractive index of a transparent liquid e.g. water.
Calculate the critical angle for glass/water given that the refractive index for air/glass is $\frac{3}{2}$ and for air/water $\frac{4}{3}$.

(b) Describe an experiment to measure the focal length of a convex lens.
Show, by means of a ray-diagram, the optical arrangement of any form of telescope.

(66 marks)

4. State concisely what is meant by (i) an emission spectrum, (ii) an absorption spectrum. Refer in your answer to continuous, line and band spectra.
State the approximate wavelength limits of the visible spectrum. How may the existence of radiations just beyond the visible spectrum limits, i.e. infra-red and ultra-violet, be confirmed ? Comment on the properties of these radiations.

(66 marks)

5. Describe an experiment (i) to compare the magnetic moments of two bar magnets, (ii) to measure the internal resistance of a cell. Give the theory underlying the experiment in either (i) or (ii).

(66 marks)

6. What are electrons ?
Outline any two methods by which a beam of electrons may be produced. Show how the ratio of the charge to mass $\left(\frac{e}{m}\right)$ of the electron has been determined.

(66 marks)

7. State the laws of electromagnetic induction and describe how they may be demonstrated experimentally.
Explain how the principles of electromagnetic induction are illustrated in the operation of (i) a simple alternating current generator, (ii) a transformer.

(67 marks)

8. What are X-rays and gamma rays ? In what respect do they differ ?
Outline a method of producing X-rays. Name any gamma ray emitter.
Explain the process by which a charged gold-leaf electroscope may be discharged by X-rays or gamma rays. Indicate briefly how an ionisation current may be measured.
Calculate the minimum wavelength of the X-rays produced in an X-ray tube when operating at a potential difference of 60,000 volts ($h = 6{\cdot}6 \times 10^{-34}$ joule sec. or $6{\cdot}6 \times 10^{-27}$ erg sec.; $e = 1{\cdot}6 \times 10^{-19}$ coulomb; $c = 3 \times 10^8$ metres per sec.)

(67 marks)

9. Explain the term 'artificial radioactivity'.
With regard to each of the following nuclear reactions refer to its significance in the field of nuclear science development:-

(i) $_7N^{14} + {}_2He^4 \longrightarrow {}_8O^{17} + {}_1H^1$

(ii) $_4Be^9 + {}_2He^4 \longrightarrow {}_6C^{12} + {}_0n^1$

(iii) $_3Li^7 + {}_1H^1 \longrightarrow {}_2He^4 + {}_2He^4 + Q(\text{energy})$.

Write a note on mass-energy conservation in nuclear reactions. Indicate the methods employed for the large scale release of energy from atomic nuclei.

(67 marks)

10. Write brief notes on any two of the following:-

(a) the conservation of momentum and energy,
(b) gas thermometers,
(c) the capacitance (capacity) and energy of charged condensers,
(d) the nature of sound.

(67 marks)