AN ROINN OIDEACHAIS

LEAVING CERTIFICATE EXAMINATION, 1974

PHYSICS—HIGHER LEVEL

WEDNESDAY, 26 JUNE—MORNING, 9.30 to 12.15

Any **six** questions to be answered.

All the questions carry the same marks.

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

(*a*) The velocity of a train increases uniformly from 10 m s^{-1} to 25 m s^{-1} in 3 seconds; find the acceleration.

(*b*) Write down an expression for the period of a simple pendulum.

(*c*) Define the unit of work i.e. the joule.

(*d*) Define temperature on the Celsius scale for a constant volume gas thermometer.

(*e*) What is meant by the specific heat capacity of a substance?

(*f*) Name the primary colours. What are complementary colours?

(*g*) Why does a prism disperse light?

(*h*) Make a copy in your answer-book of the pear shaped conductor as shown in Fig. I. If the conductor is charged show how the charge would be distributed.

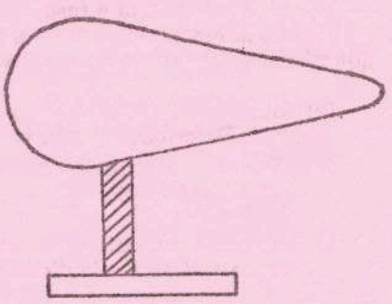

FIG. I

(*i*) Give any two factors which affect the capacitance of a capacitor.

(*j*) What is (i) magnetic dip, (ii) magnetic declination?

(*k*) Write down an expression for the magnetic flux density at the centre of a circular coil of N turns, radius r metres and carrying a current I amperes.

(*l*) What is the basic principle of a moving-coil meter?

(*m*) Why does a moving-coil voltmeter have a high resistance?

(*n*) Fig. II shows a Wheatstone bridge circuit. If the bridge is balanced, find the value of R.

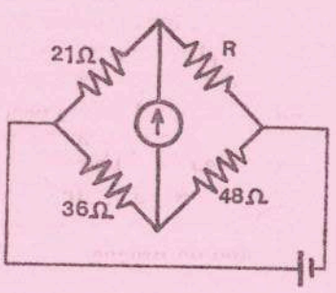

FIG. II

(*o*) What is the relative order of magnitude of wavelengths in the X-ray and visible regions of the electromagnetic spectrum?

(*p*) What is the historical significance of the reaction

$$^{7}_{3}Li + {}^{1}_{1}H \rightarrow {}^{4}_{2}He + {}^{4}_{2}He + Q \text{ (energy)}?$$

2. State Newton's law of gravitation.

Describe how the value of the gravitational constant, G, has been determined experimentally.

Calculate the mean density of the earth assuming that $G = 6{\cdot}7 \times 10^{-11}$ N m^2 kg^{-2}; $g = 9{\cdot}8$ m s^{-2}; the earth's radius = 6400 km.

[P.T.O.

3. (*a*) State the principal assumptions made in the kinetic theory of gases.

Derive the expression $$p = \frac{1}{3}\frac{n\,m\,\overline{c^2}}{v}$$

(*b*) Describe how a knowledge of spectra may be applied in the measurement of the temperature of the flame of a bunsen burner.

4. (*a*) Compare infra-red, ultra-violet and visible light under the headings (i) nature, (ii) wavelength, (iii) absorption, (iv) detection.

(*b*) Describe any form of telescope and show by means of a ray diagram how the final image is formed. Distinguish between chromatic aberration and spherical aberration.

5. Explain the terms (*a*) constructive interference, (*b*) destructive interference.

In a Young's interference experiment the interference fringes are formed on a screen a distance D from the double slits. What is the effect on the interference fringes of

(i) bringing the screen closer to the slits,

(ii) reducing the separation of the slits,

(iii) covering one of the slits,

(iv) using light of longer wavelength,

(v) using white light?

In a Young's interference experiment, two parallel slits are 0·5 mm apart. Fringes with an average separation of 1·2 mm are formed on a screen placed a distance of 1 m from the slits. Calculate the wavelength of the light.

6. State the factors on which the heat produced in a current-carrying conductor depends. Describe experiments in support of your answer.

Explain the role of a fuse in an electric circuit.

What is meant by inductance? When a transformer is connected to a d.c. source it blows a fuse but not when connected to an a.c. source of the same voltage: explain.

7. (*a*) State Faraday's laws of electrolysis.

Describe how you would measure the electrochemical equivalent of an element, e.g. copper.

(*b*) Describe an experiment to compare the electromotive force of two cells and give the theory associated with the experiment.

8. Compare thermionic emission and photoelectric emission.

Describe a thermionic diode and show how the current varies with the potential applied.

The work function of a certain metal is $3{\cdot}0 \times 10^{-19}$ J s. Show why you would expect light of wavelength $5{\cdot}0 \times 10^{-7}$m (500 nm) to eject electrons from the metal. Hence find the maximum kinetic energy of the emitted electrons. ($c = 3{\cdot}0 \times 10^{8}$ m s^{-1}; $h = 6{\cdot}6 \times 10^{-34}$ J s)

9. Discuss the experimental evidence that led to the conclusion that alpha particles are helium nuclei.

What is meant by the half-life of a radioactive isotope?

Describe how the half-life of a radioactive isotope of relatively short half-life may be measured.

Write a brief note on radioactivation analysis. What is the advantage of this method of analysis?

10. Answer any *two* of the following.

(*a*) Describe an experiment which shows interference in sound waves.

How do sound waves differ from light waves?

(*b*) Explain how the principle of electromagnetic induction is illustrated in the operation of a simple alternating current generator.

(*c*) On what does the penetrating power of X-rays depend?

The maximum frequency of the X-rays produced in an X-ray tube is $8{\cdot}0 \times 10^{18}$ hertz. At what potential difference is the tube operating?

($h = 6{\cdot}6 \times 10^{-34}$ J s; $e = 1{\cdot}6 \times 10^{-19}$ C)

(*d*) Discuss the dual nature (particle and wave) of photons and electrons. Refer to the work of Compton and de Broglie.