AN ROINN OIDEACHAIS

LEAVING CERTIFICATE EXAMINATION, 1973

PHYSICS — ORDINARY LEVEL

FRIDAY, 22 JUNE — MORNING, 9.30 to 12.15

Any **six** questions to be answered.

All the questions carry the same marks.

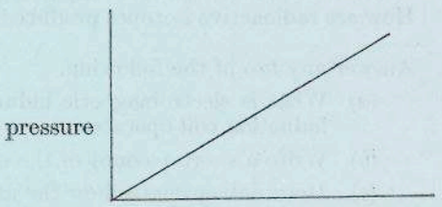
1. Answer *eleven* of the following sixteen items (*a*), (*b*), (*c*), . . . etc. All the items carry the same marks. *Keep your answers short.*

   (*a*) Give an example of a vector quantity.

   (*b*) What constant force will give a body of mass 1 kg an acceleration of 1 m s^{-2}?

   (*c*) Complete the kinetic theory equation $p = \frac{1}{3}\frac{n}{v}$ for the pressure of a gas.

   (*d*) The graph shown was obtained in a Boyle's law experiment. What does the horizontal axis stand for?



   (*e*) For what purpose is a thermocouple used?

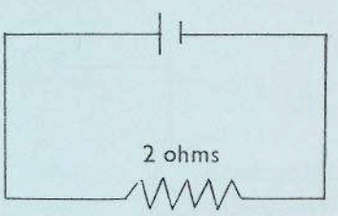
   (*f*) How does the object lens of a compound microscope differ from the object lens of a telescope?

   (*g*) What conclusions regarding the nature of light can be drawn from the fact that light can be polarised?

   (*h*) What are Fraunhofer lines?

   (*i*) Define the watt.

   (*j*) A cell of e.m.f. 5 volts and internal resistance 0·5 ohms is connected to a 2 ohm resistor as shown. What is the current in the circuit?



   (*k*) In what respect does an a.c. dynamo differ from a d.c. dynamo?

   (*l*) What is the effect of passing an electric current through a conductor in a magnetic field?

   (*m*) Why is an X-ray tube surrounded by a lead shield?

   (*n*) When photons of light are incident on the surface of a metal, electrons may be emitted. Write down an equation showing the relation between the frequency of the light incident on the metal and the energy of the emitted electrons.

   (*o*) What is the thermionic effect?

   (*p*) What happens when an electron falls from a high energy level in an atom to a lower energy level?

2. State Newton's law of gravitation. Hence, show that the gravitational constant $G = \frac{gr^2}{M}$ where M = the mass of the earth, r = radius of the earth, g = acceleration due to gravity on the surface of the earth.

   Outline an experiment to measure g.

   Find the acceleration due to gravity at a height of $1{\cdot}6 \times 10^6$ m above the surface of the earth given that the acceleration due to gravity on the surface of the earth is 9·8 m s^{-2} and that the radius of the earth is $6{\cdot}4 \times 10^6$ m.

3. Define (i) energy (ii) specific heat capacity. Outline an electrical **or** a mechanical method for measuring the specific heat capacity of water **or** copper.

   A piece of metal, of specific heat capacity 392 J kg^{-1} K^{-1} is dropped from a height of 80 m above the ground. If when the metal strikes the ground it absorbs one half of its total energy as heat, find the rise in temperature of the metal.

   (Take $g = 9{\cdot}8$ m s^{-2}.)

4. Explain the terms: wavelength, frequency, velocity, and give the relationship between them.
Distinguish between the nature of waves in sound and in light.
Describe a laboratory method for measuring the velocity of sound in air.

5. Explain the basic physical principles involved in each of the following.
   (*a*) A guitar is tuned by tightening or slackening the strings.
   (*b*) All the colours seen on the screen of a colour television set arise from red, green and blue light only.
   (*c*) Electrical systems normally contain fuses.
   (*d*) Large amounts of energy may be obtained from small quantities of nuclear fuel.

6. State the laws of refraction of light and describe how they may be demonstrated by experiment.
The refractive index of glass relative to air is 1·5, and the velocity of light in air is 3×10^8 m s^{-1}. Find the velocity of light in glass.
Which of the following does not travel with the same velocity as light: X-rays, sound waves, ultra-violet rays, radio waves?

7. Describe any *two* of the following experiments:
   (i) to measure the wavelength of sodium light,
   (ii) to compare two low resistances,
   (iii) to determine the sign of the charge on a charged body,
   (iv) to show the variation of current with potential difference in the thermionic diode.

8. State Faraday's laws of electrolysis and describe an experiment to prove *one* of them.
Describe fully the electrolysis of copper sulphate solution using copper electrodes.
Discuss Ohm's law in relation to conduction through electrolytes.

9. Write an account of the properties of the radiations emitted from radioactive substances.
Describe a method for detecting radioactivity.
How are radioactive isotopes produced? Mention any *two* of their uses.

10. Answer any *two* of the following.
   (*a*) What is electromagnetic induction? Describe with the aid of a diagram how a transformer **or** an induction coil operates.
   (*b*) Write a short account of the earth's magnetic field.
   (*c*) Draw a diagram to show the formation of a real image using a convex lens.
   An object is placed in front of a convex lens of focal length 15 cm. A real image, three times the size of the object, is formed. Find the positions of both object and image relative to the lens.
   (*d*) Write down an equation for the effective resistance R when two resistors r_1 and r_2 are connected (i) in series (ii) in parallel. Deduce the expression for (i) **or** (ii).
   Show how a moving-coil galvanometer may be converted into an ammeter.