LEAVING CERTIFICATE EXAMINATION, 1974

PHYSICS—ORDINARY 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*) Define velocity.

   (*b*) What is the weight in newtons of a 2 kg mass on the earth's surface ($g = 9{\cdot}8$ m s^{-2})?

   (*c*) Write an expression for the force of attraction between the earth of mass M kg and a satellite of mass m kg when the distance between their centres is d metres.

   (*d*) For a definition of temperature complete the equation $\frac{t}{100} = \frac{X_t -}{X_{100} -}$ where X is some property which varies as heat is added.

   (*e*) Which of the following is Avogadro's number:

   $$6{\cdot}67 \times 10^{-11}, \quad 6{\cdot}023 \times 10^{23}, \quad 3{\cdot}0 \times 10^{8}?$$

   (*f*) What magnification is obtained when an object is placed 10 cm in front of a concave mirror and the image is formed 30 cm from the mirror?

   (*g*) What is meant by diffraction?

   (*h*) Which of the following has the shortest wavelength: ultra-violet rays, X-rays, radio waves, infra-red rays?

   (*i*) What property of light indicates that light consists of transverse waves?

   (*j*) Fig. I represents three lights projected on a screen. What colour will the shaded area be?

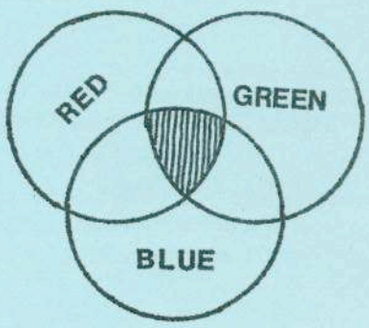

FIG. I

   (*k*) Name the unit of electrical resistance.

   (*l*) How may a moving-coil galvanometer be converted into a voltmeter?

   (*m*) What electrical unit is defined in terms of the force between two long thin cylindrical parallel current-carrying conductors?

   (*n*) What are neutrons?

   (*o*) What is meant by the half-life of a radioactive substance?

   (*p*) Name a famous scientist in the field of atomic physics.

2. What is (*a*) kinetic energy, (*b*) momentum? Write down the law of conservation of momentum.
   A mass of 3 kg moving with a velocity of 10 m s^{-1} collides with a mass of 2 kg which is at rest. After collision both masses move on together as a combined mass. Calculate (i) the velocity of the combined mass, (ii) the change in kinetic energy due to the collision.

3. State Boyle's law.
   In a Boyle's law apparatus as shown in Fig. II the volume of a gas in the tube A is 10 cm^3 when the level of the mercury in the tube B is 4 cm above the level of the mercury in A. The pressure of the atmosphere is 760 mm of mercury. Find the height of the mercury in B above the mercury in A when the volume of the gas is 8 cm^3.

   Show how the kinetic theory equation

   $$p = \frac{1}{3}\frac{nmc^2}{v}$$ is related to Boyle's law.

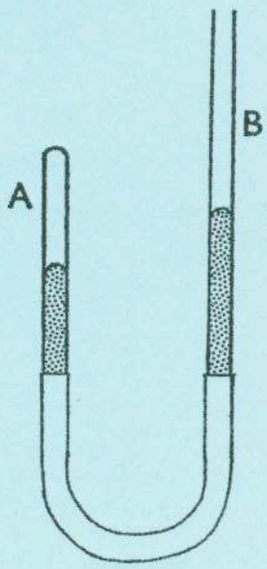

FIG. II

4. Draw a ray diagram to show how a real image of an object is formed by a convex lens.
Show, with the aid of ray diagrams, how (i) two convex lenses may be combined to magnify a distant object, (ii) two convex lenses may be combined with a prism to produce a pure spectrum.

5. Explain the basic physical principles involved in each of the following.
   (*a*) The real depth of a swimming pool filled with water is greater than its apparent depth.
   (*b*) Sunlight which is passed through ordinary glass will not produce sun tan.
   (*c*) A crackling sound is sometimes heard when dry hair is combed.
   (*d*) When a television set is switched on there is generally a slight delay before a picture appears.

6. Describe how you would carry out any *two* of the following experiments in the laboratory:
   (*a*) to measure the velocity of sound in air,
   (*b*) to measure the horizontal component of the earth's magnetic field strength,
   (*c*) to demonstrate Ohm's law for a given metallic conductor,
   (*d*) to measure the temperature of a substance which is of the order of 500°C using an electrical thermometer.

7. State the laws of electromagnetic induction. Describe a simple laboratory experiment to demonstrate *one* of them.
Describe, with the aid of a diagram, a simple a.c. generator and explain how it operates.
In what way may an a.c. generator be modified to produce direct current?

8. Describe, with the aid of a diagram, a moving-coil ammeter and explain how it operates.
Give an account of an experiment by which the accuracy of an ammeter may be checked.

9. What are electrons?
Give an account of the liberation of electrons by photoelectric emission.
What part is played by electrons (i) in the production of X-rays, (ii) in the formation of line spectra?

10. Answer any *two* of the following.
   (*a*) Describe a primary cell e.g. Daniell or Leclanché cell and indicate how polarisation is minimised in the cell you select.

   (*b*) Find the total capacitance of the arrangement shown in Fig. III.

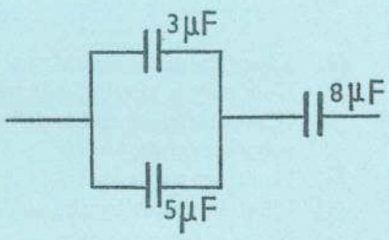

FIG. III

   (*c*) How may it be shown in the laboratory that sound can be (i) reflected, (ii) refracted?
   (*d*) Give a brief account of nuclear fission. How may the energy released be used to generate electricity?