D1

LEAVING CERTIFICATE EXAMINATION, 1981

PHYSICS—ORDINARY LEVEL

THURSDAY, 25 JUNE—MORNING, 9.30 to 12.30

Any **six** questions to be answered.

All the questions carry the same marks.

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

(a) Define the unit of work, i.e. the joule.

(b) Calculate the initial velocity given to an object to raise it vertically to a height of 20 metres. (Take $g = 10 \text{ m s}^{-2}$).

(c) Complete the following statement: When a mass is dropped vertically from a height . . . . . energy is converted to . . . . . energy.

(d) Define specific heat capacity.

(e) What are Fraunhofer lines?

(f) Which of the following has the *longest* wavelength: ultra-violet light, infra-red light, visible light, X-rays?

(g) What is the cost of using a 100 watt bulb for 10 hours if electric energy costs 4p per kilowatt-hour?

(h) Fig. 1 shows an object situated at a distance which is twice the focal length from a concave mirror. At what position will the image be formed?

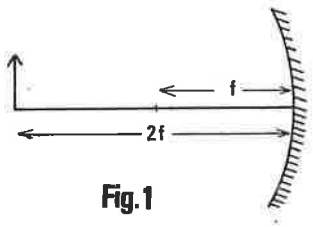


Fig.1

(i) What is the electrochemical equivalent of an element?

(j) Show by means of a diagram, what happens when waves pass through a slit, the width of which is approximately equal to the wavelength of the waves used.

(k) Calculate the magnifying power of a telescope if the focal length of the objective is 100 cm and the focal length of the eyepiece is 2 cm.

(l) Fig. 2 shows a galvanometer connected by brushes to a rectangular coil of wire being rotated between the poles of a magnet. What is the reading of the galvanometer when the coil has rotated through 90° from the position shown in Fig. 2?

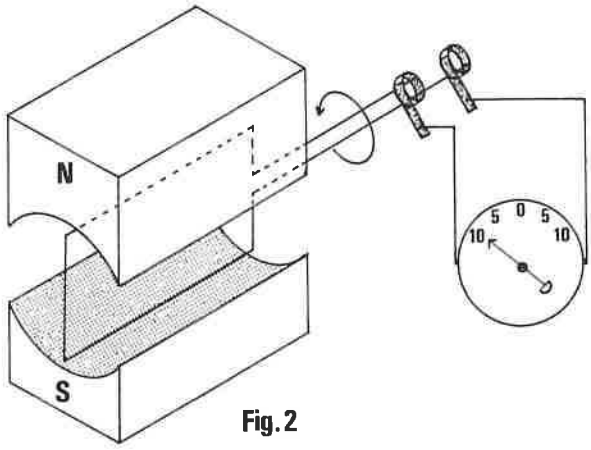


Fig.2

(m) What is the energy of a photon of light of frequency 5×10^6 Hz?
(Take Planck's constant $h = 6{\cdot}6 \times 10^{-34}$ J s)

(n) State one use of a thermionic diode.

(o) Which of the following has (i) the greatest penetrating power, (ii) the greatest ionising ability:
alpha particles, beta particles, gamma rays?

(p) If the half-life of a substance is 4 days, what percentage of the substance is left after 12 days?

2. *(a)* State Newton's first and second laws of motion.
Show how the expression: force = mass × acceleration, may be derived from the second law of motion.

(b) State the law of conservation of momentum.
A bullet of mass 0·01 kg is fired with a speed of 200 m s^{-1} from a gun of mass 10 kg. Calculate the speed of recoil of the gun.

3. Describe a constant volume gas thermometer *or* an electrical resistance thermometer and show how it may be used to measure temperature.

Give two advantages of electrical thermometers over gas thermometers.

A platinum resistance thermometer has a resistance of 3·5 ohms at 0°C and a resistance of 3·9 ohms at 100°C. Calculate the temperature which would cause it to have a resistance of 3·8 ohms.

4. Describe experiments, one in each case, to demonstrate (i) the transverse nature of light waves, (ii) interference of light waves.

In a Young's interference experiment two narrow slits 0·5 mm apart are illuminated by monochromatic light. The distance between fringes seen on a screen placed 0·5 m from the slits is $1{\cdot}5 \times 10^{-4}$ m. Calculate the wavelength of the light used.

5. Explain the basic physical principles involved in any *four* of the following.

(a) The real depth of a swimming pool filled with water is greater than its apparent depth.

(b) Current carrying coils are sometimes used instead of hooks on cranes for lifting certain materials in scrapyards.

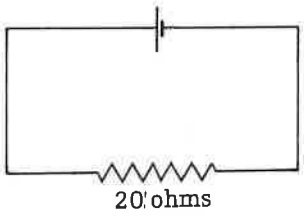
(c) A bicycle fitted with a dynamo produces less light as it slows down.

(d) It is possible when care is taken to float a needle in water.

(e) Beams of light can be used to trigger off burglar alarms.

6. *(a)* Describe, with the aid of a diagram, a moving-coil galvanometer and explain how it operates. Indicate how the galvanometer may be converted to a voltmeter.

(b) The cell shown in the diagram has an electromotive force (e.m.f.) of 2 volts and its internal resistance is 5 ohms. Calculate (i) the current which flows in the circuit, (ii) the potential difference across the 20 ohm resistor.



7. Describe how you would perform any *two* of the following experiments in the laboratory:

(a) to measure the value of the acceleration due to gravity, g,

(b) to measure the refractive index of glass,

(c) to measure the value of the resistance of a coil of wire using a resistor of known resistance,

(d) to measure the horizontal component of the earth's magnetic flux density.

8. List the principal properties of cathode rays and of X-rays.

Describe, with the aid of a diagram, how X-rays are produced.

Explain how (i) the penetrating power, (ii) the intensity, of the X-rays may be increased.

9. Neutrons are frequently used in the production of radioactive isotopes. What is meant by the underlined words?

Outline briefly the principles of (i) nuclear fission, (ii) nuclear fusion.

In the nuclear reaction ${}^{2}_{1}\mathrm{H} + {}^{2}_{1}\mathrm{H} \longrightarrow {}^{4}_{2}\mathrm{He}$ the mass of the reactants is greater than the mass of the product. How may the difference in the masses be explained?

10. Answer any *two* of the following.

(a) State Newton's law of gravitation.

Calculate the weight of a man on a planet if his mass is 66 kg and the mass of the planet is 6×10^{24} kg and the average radius of the planet is 6×10^{6} m. (Take $G = 6{\cdot}7 \times 10^{-11}$ N m^2 kg^{-2})

(b) State the basic assumptions on which the kinetic theory of gases is based.

Show how the kinetic theory equation $p = \frac{1}{3}\frac{nm\overline{c^2}}{v}$ is related to Boyle's law.

(c) Describe a laboratory experiment to demonstrate the reflection of sound.

Explain how (i) pitch, (ii) quality, (iii) loudness, of a musical note are related to the wave nature of sound.

(d) Outline the structure of a gold-leaf electroscope and indicate how it may be used to determine the sign of the charge on a charged body.

Describe an experiment which shows that the charge on a hollow conductor resides on the outer surface.