AN ROINN OIDEACHAIS

LEAVING CERTIFICATE EXAMINATION, 1983

PHYSICS – ORDINARY LEVEL

WEDNESDAY, 22 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 force, i.e. the newton.

(*b*) Calculate the kinetic energy of a car of mass 1,000 kg when moving with a velocity of 5 m s^{-1}.

(*c*) State the principle of conservation of energy.

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

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

(*f*) What is the wavelength of a wave of frequency 20 Hz and of velocity 3 m s^{-1}?

(*g*) State Newton's law of gravitation.

(*h*) A negatively-charged rod is brought near the metal disc of an uncharged gold-leaf electroscope as shown in Fig. 1.
Copy the diagram, and indicate the nature of the charge on (i) the disc, (ii) the leaves, of the electroscope.

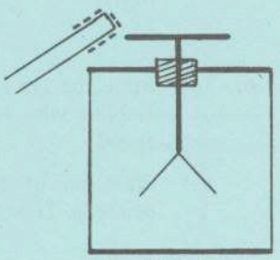

Fig. 1

(*i*) Write down an expression for Coulomb's law of force between electric charges.

(*j*) To measure the resistance of the bulb in the circuit in Fig. 2, two meters, meter X and meter Y, are inserted. Name the meter X and the meter Y.

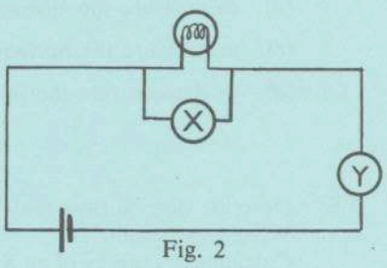

Fig. 2

(*k*) How may a moving-coil galvanometer be adapted in order that it may function as a voltmeter?

(*l*) Give one reason why an iron core is normally used in transformers.

(*m*) What are cathode rays?

(*n*) Fig. 3 represents the characteristic curve for a thermionic diode. What does (i) the vertical axis, (ii) the horizontal axis, represent?

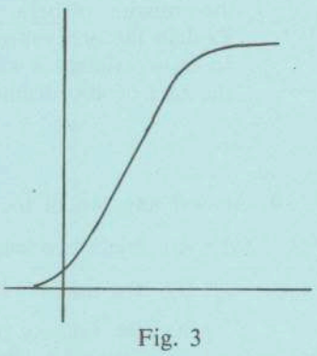

Fig. 3

(*o*) What is the photoelectric effect?

(*p*) Give two of the precautions which should be taken when working with radioactive materials.

2. Define velocity. State the law of conservation of momentum.
Describe briefly how the law of conservation of momentum may be demonstrated experimentally in the laboratory.
A body of mass 5 kg, moving with a velocity of 10 m s^{-1}, collides with a second body of mass 20 kg which is at rest. The two masses adhere on collision and move on together as a combined mass. Calculate the velocity of the combined mass.

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3. (*a*) Describe an experiment to demonstrate Brownian movement.
Explain any *two* of the following: evaporation, diffusion, viscosity, surface tension, capillarity, in terms of molecules and the forces between them.

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

4. (*a*) State the laws of refraction of light.
Describe an experiment to verify *one* of the laws in the laboratory.

(*b*) Explain the term: interference.
Describe a laboratory experiment to demonstrate interference of light waves *or* interference of sound waves.

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

(*a*) When one car is being towed by another car, there is a greater chance of the tow-rope breaking when the towing-car moves off suddenly rather than gradually.

(*b*) A Dewar (thermos) flask can be used to keep liquids cold as well as to keep liquids hot.

(*c*) A glass prism can sometimes be used instead of a plane mirror.

(*d*) Birds may perch on electric power lines without suffering electric shock.

(*e*) In most modern buildings lighting is provided by flourescent tubes rather than filament lamps of the same power.

6. (*a*) State the laws of electromagnetic induction.
Explain why an electric motor draws more current when starting from rest than when turning at its normal speed.

(*b*) State *one* of the factors upon which the heat generated by an electric current, flowing in a conductor, depends. Describe a laboratory experiment in support of your answer.

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

(*a*) to measure the focal length of a concave mirror,

(*b*) to measure the electrochemical equivalent of copper,

(*c*) to measure the horizontal component of the earth's magnetic flux density,

(*d*) to demonstrate the parallelogram of forces.

8. Describe how X-rays may be produced. Summarise the properties of X-rays.
What is a photon?
Calculate the energy of an X-ray photon of frequency 4×10^{18} Hz.
(Take Planck's constant, $h = 6{\cdot}6 \times 10^{-34}$ J s)

9. A radioactive isotope of potassium with an atomic mass 42 and with a half-life of 12·5 hours disintegrates with the emission of beta particles and gamma rays.
Explain the underlined terms.
In an experiment it was found that a radioactive substance which had a half-life of 40 minutes was decaying at the rate of 400 disintegrations per second. Calculate the rate of decay after 2 hours.

10. Answer any *two* of the following.

(*a*) An object is released from a height of 20 m and falls freely under gravity. Calculate

(i) the time it takes the object to reach the ground,

(ii) the velocity of the object on striking the ground.
(Take $g = 10\ m\ s^{-2}$)

(*b*) Use a ray-diagram to show how the final image is formed in an astronomical telescope.
What is the magnifying power of an astronomical telescope which has two lenses of focal lengths 20 cm and 100 cm?

(*c*) Describe a constant volume gas thermometer. State the main use of this type of thermometer.

(*d*) Give a brief account of the process of (i) nuclear fission, (ii) nuclear fusion.