

AN ROINN OIDEACHAIS

LEAVING CERTIFICATE EXAMINATION, 1977

PHYSICS—ORDINARY LEVEL

WEDNESDAY, 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 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) Write down an expression for Newton's law of gravitation.
 (c) A boy of mass 45 kg and a man of mass 75 kg are both at rest on an ice skating-rink. If the boy pushes the man away and the velocity of the man becomes $\frac{1}{2} \text{ m s}^{-1}$, find the recoil velocity of the boy.
 (d) What does Brownian movement show?
 (e) What is meant by the specific heat capacity of a substance?
 (f) An object is placed inside the focus of a concave mirror; which of the following statements about the image are correct: (i) it is real, (ii) it is virtual, (iii) it is erect, (iv) it is reduced in size, (v) it is at the focus?
 (g) What is an absorption spectrum?
 (h) Complete the statement: The focal length of the objective of a telescope is _____ than that of a compound microscope.
 (i) State Ohm's law.

- (j) Find the effective resistance of the resistors in Fig. I.
 (k) What is the current flowing through the 10 ohm resistor in Fig. I?

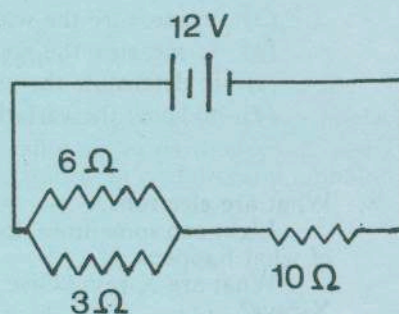


Fig. I

- (l) What is an electromagnet?
 (m) Why does a charged insulator lose its charge when it is passed just above a flame?
 (n) What is meant by the angle of dip?

- (o) Fig. II shows the radiations from a source containing radioactive substances. Identify the radiations A, B, C.

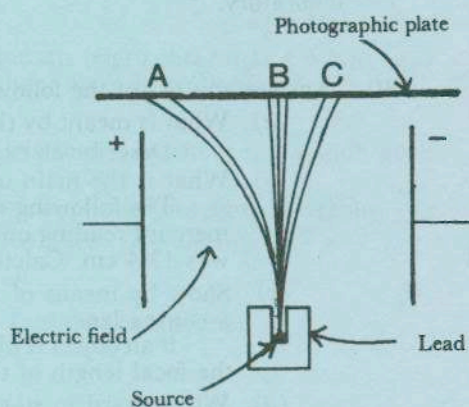


Fig. II

- (p) Complete the nuclear reaction: ${}_{92}^{235}\text{U} \longrightarrow {}_{90}^{231}\text{Th} +$

2. What is meant by (i) velocity (ii) kinetic energy?

A force of 5 newtons is applied to a body of mass 10 kg. If the body starts from rest, how far will the force move it in 20 seconds? Calculate the kinetic energy of the body at the end of the 20 seconds period.

3. State (i) Boyle's law, (ii) Avogadro's law.

Describe an experiment to verify Boyle's law.

Give the assumptions on which the kinetic theory of gases is based. Show how the equation

$$p = \frac{1}{3} \frac{nm\bar{c}^2}{v}$$

is related to (i) Boyle's law, (ii) Avogadro's law (where p = the pressure of a gas in a container of volume v , m = the mass of a molecule, n = the number of molecules and \bar{c}^2 = the mean square velocity).

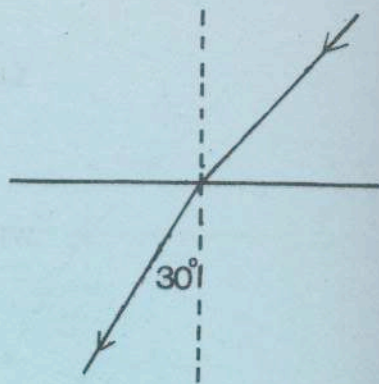
[P.T.O.]

4. What is meant by refractive index?

Describe an experiment to measure the refractive index of glass.

The diagram shows a ray of light passing from air to water (refractive index $\frac{4}{3}$). Calculate the angle of incidence.

What is the relationship between the refractive index and the velocities of light in two media?



5. Explain the basic physical principles involved in any *four* of the following.
- A piece of metal can function as a temperature switch (thermostat).
 - In a dance hall or disco a "blueish-violet" light often causes some clothes to "glow".
 - A dog whistle cannot normally be heard by humans.
 - Magnets with curved pole pieces are often used in electric motors and meters.
 - The initial current through a tungsten filament lamp is larger than the normal current.

6. State the laws of electromagnetic induction.

Describe a simple experiment to demonstrate *one* of these laws.

Describe, with the aid of a diagram, a simple alternating current generator and explain how it works. How may such a generator be modified to produce direct current?

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

- to measure the wavelength of sodium light,
- to measure the resistance of a given resistor,
- to determine the electrochemical equivalent of copper,
- to show the variation of the current with the potential difference in a thermionic diode.

8. What are electrons?

Light can sometimes liberate electrons from certain metals. Name this phenomenon and give an account of what happens.

What are X-rays? Give their principal properties. What part is played by electrons in the production of X-rays?

9. "The radioactive isotope cobalt-60 (^{60}Co), with a half-life of about five years, emits beta and gamma radiations during decay". Explain the underlined terms.

In a given sample of cobalt-60 what is the approximate percentage of the sample remaining after 10 years?

Mention some precautions that should be taken when working with radioactive substances in the laboratory.

10. Answer any *two* of the following.

- (a) What is meant by the statement "the acceleration due to gravity is 9.8 m s^{-2} "?

Describe an experiment to find the value of the acceleration due to gravity.

- (b) What is the main use of gas thermometers?

The following readings were taken from a constant volume gas thermometer: in ice water the mercury reading on the scale was 10.6 cm; in boiling water it was 14.6 cm and in a warm liquid it was 13.4 cm. Calculate the temperature of the liquid.

- (c) Show by means of a ray-diagram how a magnified real image of an object may be produced by a convex lens.

If an object is placed 15 cm from such a lens and a real image twice its size is produced, calculate the focal length of the lens.

- (d) With regard to standing waves, write down in terms of the wavelength, λ , the distance between (i) consecutive nodes, (ii) a node and an antinode.

Find the frequency of the fundamental note of a pipe closed at one end and having a length of 0.17 m (including end corrections) given that the speed of sound in air is 340 m s^{-1} .