Class 12 Physics — Practice Set

Board Exam Pattern | Theory Paper

Maximum Marks: 70 **Time Allowed: 3 Hours**

General Instructions

1. There are 33 questions in all. All questions are compulsory.
2. The paper has five sections: A, B, C, D and E.
3. Section A has 16 questions of 1 mark each; Section B has 7 questions of 2 marks each; Section C has 5 questions of 3 marks each; Section D has 2 case-based questions of 4 marks each; Section E has 3 questions of 5 marks each.
4. There is no overall choice. Internal choice is provided in some questions — attempt only one of the choices in such questions.
5. Use of calculators is not permitted. You may use log tables if necessary.
6. This is a practice set for self-assessment; always cross-check the latest pattern with your board's official sample paper.

SECTION A

Questions 1 to 16 carry 1 mark each. (Multiple choice / Assertion-Reason)

1. The SI unit of electric flux is (a) N/C (b) $N \cdot m^2/C$ (c) C/m^2 (d) $V \cdot m$

2. The capacitance of a parallel-plate capacitor increases when (a) the plate separation is increased (b) a dielectric slab is inserted between the plates (c) the plate area is decreased (d) the charge is decreased

3. The drift velocity of free electrons in a metallic conductor carrying a steady current is of the order of (a) 10^6 m/s (b) 10^2 m/s (c) 10^{-4} m/s (d) 10^8 m/s

4. The magnetic field at the centre of a circular loop of radius r carrying a steady current I is (a) $\mu_0 I/2r$ (b) $\mu_0 I/4\pi r$ (c) $\mu_0 I/2\pi r$ (d) $\mu_0 I/r$

5. Lenz's law is a direct consequence of the conservation of (a) charge (b) momentum (c) energy (d) mass

6. The power factor of an ideal (purely) inductive AC circuit is (a) 1 (b) 0.5 (c) 0 (d) infinite

7. Electromagnetic waves are produced by (a) stationary charges (b) charges moving with uniform velocity (c) accelerating charges (d) charges at rest in a magnetic field

8. Total internal reflection of light can occur only when light travels from (a) a rarer to a denser medium (b) a denser to a rarer medium (c) any medium to vacuum (d) vacuum to any medium

9. In Young's double-slit experiment, the fringe width is directly proportional to (a) the slit separation (b) the wavelength of light (c) the frequency of light (d) the slit width

10. The work function of a metal is the (a) maximum kinetic energy of emitted electrons (b) minimum energy required to eject an electron from the metal surface (c) energy of the incident photon (d) total energy of a free electron

11. According to Bohr's model, the radius of the n^{th} orbit of a hydrogen atom is proportional to (a) n (b) n^2 (c) $1/n$ (d) $1/n^2$

12. In an unbiased p-n junction, the depletion region is formed mainly due to (a) diffusion of majority charge carriers across the junction (b) an applied external voltage (c) heating of the junction (d) drift of photo-generated carriers

13. The energy equivalent of 1 atomic mass unit (1 u) is approximately (a) 1 MeV (b) 93.15 MeV (c) 931.5 MeV (d) 9315 MeV

14. The equivalent resistance of two resistors of 6 Ω and 3 Ω connected in parallel is (a) 9 Ω (b) 2 Ω (c) 18 Ω (d) 4.5 Ω

15. Assertion (A): In the steady state, a capacitor blocks direct current. Reason (R): The reactance of a capacitor is inversely proportional to the frequency of the applied voltage.
(a) Both A and R are true and R is the correct explanation of A (b) Both A and R are true but R is not the correct explanation of A (c) A is true, R is false (d) A is false, R is true

16. Assertion (A): The resistance of a pure semiconductor decreases with a rise in temperature. Reason (R): The number of charge carriers in a semiconductor increases with temperature.
(a) Both A and R are true and R is the correct explanation of A (b) Both A and R are true but R is not the correct explanation of A (c) A is true, R is false (d) A is false, R is true

SECTION B

Questions 17 to 23 carry 2 marks each.

17. State Gauss's law in electrostatics and write its mathematical expression.

18. Define the mobility of a charge carrier. Write its SI unit.

19. A wire of resistance R is stretched uniformly so that its length is doubled. Find the resistance of the stretched wire.

20. Write any two points of difference between diamagnetic and paramagnetic substances.

21. State the working principle of an AC generator. Name the law on which it is based.

22. Write two differences between the interference and the diffraction of light.

23. Define the terms "threshold frequency" and "stopping potential" as used in the photoelectric effect.

SECTION C

Questions 24 to 28 carry 3 marks each.

24. Derive an expression for the electric field at a point on the axial line of an electric dipole.

25. Using Kirchhoff's rules, obtain the balance condition of a Wheatstone bridge.

26. Derive an expression for the force per unit length between two long, straight, parallel conductors carrying steady currents. Hence define the ampere.

27. Draw a labelled ray diagram of a compound microscope when the final image is formed at the near point, and write the expression for its magnifying power.

28. Explain the formation of energy bands in solids. On this basis, distinguish between a conductor, an insulator and a semiconductor.

SECTION D

Questions 29 and 30 are case-based questions carrying 4 marks each. Read the passage and answer the parts that follow.

29. Capacitor with a dielectric. A parallel-plate capacitor has plates of area A separated by a distance d in vacuum. A dielectric slab of dielectric constant K and thickness equal to d is then inserted, completely filling the space between the plates, while the capacitor remains connected to a battery of constant voltage V.
(i) Write the expression for the capacitance before the slab is inserted.
(ii) How does the capacitance change after the slab is inserted? (iii) What happens to the charge stored on the plates? (iv) How does the energy stored in the capacitor change?

30. Electromagnetic induction. A rectangular conducting loop is pulled with a constant velocity v out of a uniform magnetic field B directed into the plane of the loop. The side of the loop perpendicular to v has length L.
(i) Write the expression for the magnitude of the EMF induced in the loop.
(ii) State the direction of the induced current in the loop. (iii) Name the law that gives the direction of this current. (iv) What is the source of the electrical energy dissipated in the loop?

SECTION E

Questions 31 to 33 carry 5 marks each. Internal choice is provided in each question.

31. (a) Derive the lens maker’s formula for a thin convex lens.
(b) An object is placed 30 cm in front of a convex lens of focal length 20 cm. Find the position, nature and magnification of the image.
OR (a) Using Huygens’ principle, prove the laws of refraction of light at a plane surface. (b) Define the refractive index of a medium in terms of the speed of light.

32. (a) Derive an expression for the impedance of a series LCR circuit connected to an AC source, and state the condition for resonance.
(b) A series LCR circuit has R = 30 Ω, X_L = 40 Ω and X_C = 40 Ω. Find the impedance and the power factor of the circuit.
OR (a) With a labelled diagram, explain the working of a step-up transformer and write its transformation ratio. (b) State any two sources of energy loss in a real transformer.

33. (a) State Bohr’s postulates for the hydrogen atom. Hence derive an expression for the energy of the electron in the n^{th} orbit.
(b) Calculate the energy required to excite the electron in a hydrogen atom from the ground state (n = 1) to the first excited state (n = 2). [Take the ground-state energy as −13.6 eV]
OR (a) Draw the circuit diagram of a half-wave rectifier and explain its working with input and output waveforms. (b) State one advantage of a full-wave rectifier over a half-wave rectifier.