Class XII | Session 2026-27
Subject - Physics
Sample Question Paper - Set 2

General Instructions:

1. There are 33 questions in all. All questions are compulsory.
2. This question paper has five sections: Section A, Section B, Section C, Section D and Section E.
3. All the sections are compulsory.
4. **Section A** contains sixteen questions, twelve MCQ and four Assertion Reasoning based of 1 mark each, **Section B** contains five questions of two marks each, **Section C** contains seven questions of three marks each, **Section D** contains two case study based questions of four marks each and **Section E** contains three long answer questions of five marks each.
5. There is no overall choice. However, an internal choice has been provided in one question in Section B, one question in Section C, one question in each CBQ in Section D and all three questions in Section E. You have to attempt only one of the choices in such questions.
6. Use of calculators is not allowed.

Section A

1. Which of the following is the weakest kind of bonding in solids? **[1]**

   a) Ionic
   b) Metallic
   c) Van der Waals
   d) Covalent

2. In a hydrogen discharge tube, the number of protons drifting across a cross section per second is 1.0×10^{18}, while the number of electrons drifting in the opposite direction across the same cross section is 2.7×10^{18} per second. Find the current flowing in the tube: **[1]**

   a) 3.420 A
   b) 0.592 A
   c) 5.092 A
   d) 0.342 A

3. How will the image formed by a convex lens be affected if the central portion of the lens is wrapped in a black paper? **[1]**

   a) Central portion of the image will be absent
   b) Full image will be formed but will be less bright
   c) Two images will be formed
   d) No image is formed by the remaining portion of the lens

4. Magnetism in substances is caused by **[1]**

   a) orbital motion of electrons only
   b) hidden magnets

c) spin motion of electrons only

d) due to spin and orbital motions of electrons both

5. The electric potential at a point (x, y, z) is given by V = -x^2y - xz^3 + 4. The electric field $\vec{E}$ at that point is: **[1]**

a) $\vec{E} = \hat{i}2xy + \hat{j}\left(x^2 + y^2\right) + \hat{k}\left(3xz - y^2\right)$

b) $\vec{E} = \hat{i}\left(2xy - z^3\right) + \hat{j}xu^2 + \hat{k}3z^2x$

c) $\vec{E} = \hat{i}z^3 + \hat{j}xyz + \hat{k}z^2$

d) $\vec{E} = \hat{i}\left(2xy + z^3\right) + \hat{j}x^2 + \hat{k}3xz^2$

6. When a charged particle enters in a uniform magnetic field, its kinetic energy. **[1]**

a) remains constant

b) decreases

c) increases

d) becomes zero

7. The self inductance L of a solenoid of length l and area of crosssection A, with a fixed number of turns N increases as **[1]**

a) Both l and A decrease

b) l increases and A decreases

c) l and A increase

d) l decreases and A increases

8. According to Gauss's law for magnetism, **[1]**

a) $\int \vec{B}.\overrightarrow{ds} = \mu_0$

b) $\int \vec{B}.\overrightarrow{ds} = 0$

c) $\oint \vec{B}.\overrightarrow{ds} = \mu_0$

d) $\oint \vec{B}.\overrightarrow{ds} = 0$

9. The penetration of light into the region of geometrical shadow is called **[1]**

a) Diffraction

b) Refraction

c) Polarisation

d) Interference

10. A ring of charge with radius 0.5 m has $0.002\pi\ m$ gap. If the ring carries a charge +1C, the electric field at the center is: **[1]**

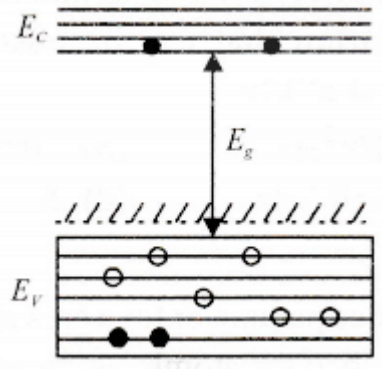
a) $7.5 \times 10^7 NC^{-1}$

b) $6.5 \times 10^7 NC^{-1}$

c) $6.2 \times 10^7 NC^{-1}$

d) $7.2 \times 10^7 NC^{-1}$

11. In the energy band diagram of a material as given below, the open circles and filled circles denote holes and electrons respectively. The material is a/an **[1]**



a) insulator

b) p-type semiconductor

c) n-type semiconductor

d) metal

12. The magnifying power of the telescope can be increased by **[1]**

a) increasing the distance of an object

b) fitting eye-piece of low power

c) increasing the focal length of eyepiece
d) fitting eye-piece of high power

13. **Assertion (A):** Photoelectric current increases with an increase in intensity of incident radiation, for a given frequency of incident radiation and the accelerating potential. **[1]**
Reason (R): Increase in the intensity of incident radiation results in an increase in the number of photoelectrons emitted per second and hence an increase in the photocurrent.

a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).
b) Both Assertion (A) and Reason (R) are true, but Reason (R) is **not** the correct explanation of the Assertion (A).
c) Assertion (A) is true, but Reason (R) is false.
d) Assertion (A) is false and Reason (R) is also false.

14. **Assertion:** Circuits containing high capacity capacitors, charged to high voltage should be handled with caution, even when the current in the circuit is switched off. **[1]**
Reason: When an isolated capacitor is touched by hand or any other part of the human body, there is an easy path to the ground available for the discharge of the capacitor.

a) Assertion and reason both are correct statements and reason is correct explanation for assertion.
b) Assertion and reason both are correct statements but reason is not correct explanation for assertion.
c) Assertion is correct statement but reason is wrong statement.
d) Assertion is wrong statement but reason is correct statement.

15. **Assertion (A):** Colours are seen in thin layers of oil on the surface of the water. **[1]**
Reason (R): White light is composed of several colours.

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 but R is false.
d) A is false but R is true.

16. **Assertion (A):** The dc and ac both can be measured by a hot wire instrument. **[1]**
Reason (R): The hot wire instrument is based on the principle of magnetic effect of current.

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 but R is false.
d) A is false but R is true.

Section B

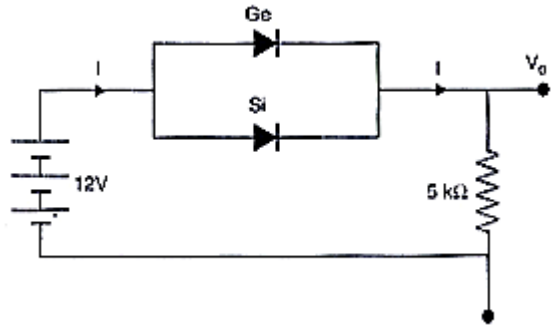
17. Light with an energy flux of 18 W/cm^2 falls on a non-reflecting surface at normal incidence. If the surface has an area of 20 cm^2, find the average force exerted on the surface during a 30-minute time span. **[2]**

18. Two magnetic poles, one of which is four times stronger than the other, exert a force of 5gf on each other when placed at a distance of 10 cm. Find the strength of each pole. **[2]**

OR

An iron rod of 0.2 cm^2 cross-sectional area is subjected to a magnetising field of 1200 Am^{-1}. The susceptibility of iron is 599. Find the permeability and the magnetic flux produced.

19. Calculate the value of V_o and I, if the Si diode and the Ge diode conduct at 0.7 V and 0.3 V respectively, in the circuit given in figure. If now Ge diode connections are reversed, what will be the new values of V_o and I. **[2]**



20. Draw the graph showing the variation of the number (N) of scattered alpha particles with scattering angle (θ) in Geiger - Marsden experiment. Infer two conclusions from the graph. **[2]**

21. Two infinitely long straight wires A_1 and A_2 carrying currents I and 2I flowing in the same direction are kept **d** distance apart. Where should a third straight wire A_3 carrying current 1.5 I be placed between A_1 and A_2 so that it experiences no net force due to A_1 and A_2? Does the net force acting on A_3 depend on the current flowing through it? **[2]**

Section C

22. i. You are required to select a carbon resistor of resistance $47k\Omega \pm 10\%$ from a large collection. What should be the sequence of colour bands used to code it? **[3]**
    ii. Write the characteristics of manganin which make it suitable for making standard resistance.

23. Red light, however bright it is, cannot produce the emission of electrons from a clean zinc surface. But even weak ultraviolet radiation can do so. Why? **[3]**
    Electrons are emitted from the cathode of negligible work function, when photons of wavelength λ are incident on it. Derive the expression for the de Broglie wavelength of the electrons emitted in terms of the wavelength of the incident light.

24. Write any two distinguishing features between conductors, semiconductors and insulators on the basis of energy band diagrams. **[3]**

25. Obtain the binding energy of the nuclei $^{56}_{26}Fe$ and $^{209}_{83}Bi$ in units of MeV from the following data: **[3]**
    m ($^{56}_{26}Fe$) = 55.934939 u
    m ($^{209}_{83}Bi$) = 208.980388 u

26. Write down the expression for the radii of orbits of the hydrogen atom. Calculate the radius of the smallest orbit. **[3]**

27. A plane wavefront of light of wavelength λ is incident normally on a narrow slit of width **a** and a diffraction pattern is observed on a screen at a distance **D** from the slit. **[3]**
    a. Depict the intensity distribution in the pattern observed.
    b. Obtain the expression for the first maximum from the central maximum.

28. Derive the expression for the magnetic energy stored in a solenoid in terms of magnetic field B, area A and length l of the solenoid carrying a steady current I. How does this magnetic energy per unit volume compare with the electrostatic energy density stored in a parallel plate capacitor? **[3]**

OR

a. A toroidal solenoid with an air core has an average radius of 0.15 m, area of cross section $12 \times 10^{-4} m^2$ and 1200 turns. Obtain the self inductance of the toroid. Ignore field variation across the cross section of the toroid.
b. A second coil of 300 turns is wound closely on the toroid above. If the current in the primary coil is increased from zero to 2.0 A in 0.05 s, obtain the induced emf in the secondary coil.

Section D

29. **Read the text carefully and answer the questions:** **[4]**

Maxwell showed that the speed of an electromagnetic wave depends on the permeability and permittivity of the medium through which it travels. The speed of an electromagnetic wave in free space is given by c = $\frac{1}{\sqrt{\mu_0 \varepsilon_0}}$. The fact led Maxwell to predict that light is an electromagnetic wave. The emergence of the speed of light from purely electromagnetic considerations is the crowning achievement of Maxwell's electromagnetic theory. The speed of an electromagnetic wave in any medium of permeability μ and permittivity ε will be $\frac{c}{\sqrt{K\mu_r}}$ where K is the dielectric constant of the medium and μ_r is the relative permeability.

(a) The dimensions of $\frac{1}{2}\varepsilon_0 E^2$ (ε_0 : permittivity of free space; E = electric field) is

a) ML^2T^{-2} b) MLT^{-1}

c) ML^2T^{-1} d) $ML^{-1}T^{-2}$

(b) Let $[\varepsilon_0]$ denote the dimensional formula of the permittivity of the vacuum. If M = mass, L = length, T = time and A = electric current, then

a) $[\varepsilon_0] = MLT^{-2}A^{-2}$ b) $[\varepsilon_0] = ML^2T^{-1}$

c) $[\varepsilon_0] = M^{-1}L^{-3}T^4A^2$ d) $[\varepsilon_0] = M^{-1}L^{-3}T^2A$

(c) An electromagnetic wave of frequency 3 MHz passes from vacuum into a dielectric medium with permittivity ε = 4. Then

a) wavelength is doubled and the frequency becomes half

b) wavelength and frequency both remain unchanged

c) wavelength is doubled and the frequency remains unchanged

d) wavelength is halved and the frequency remains unchanged.

OR

The electromagnetic waves travel with

a) the speed of light c = 3×10^8 m s^{-1} in free space

b) the same speed in all media

c) the speed of light c = 3×10 m s^{-1} in solid medium

d) the speed of light c = 3×10^8 m s^{-1} in fluid medium.

(d) Which of the following are not electromagnetic waves?

cosmic rays, γ-rays, β-rays, X-rays

a) γ-rays b) β-rays

c) X-rays d) cosmic rays

30. Coulomb's law states that the electrostatic force of attraction or repulsion acting between two stationary point charges is given by **[4]**

F = $\frac{1}{4\pi\varepsilon_0}\frac{q_1 q_2}{r^2}$

where F denotes the force between two charges q_1 and q_2 separated by a distance r in free space, ε_0 is a constant known as the permittivity of free space. Free space is a vacuum and may be taken to be air practically. If free

space is replaced by a medium, then ε_0 is replaced by $(\varepsilon_0 k)$ or $(\varepsilon_0 \varepsilon_r)$ where k is known as dielectric constant or relative permittivity.

i. In coulomb's law, F = $k\frac{q_1 q_2}{r^2}$, then on which of the following factors does the proportionality constant k depends?

ii. What is the dimensional formula for the permittivity constant ε_0 of free space?

iii. What is the force of repulsion between two charges of 1 C each, kept 1m apart in vaccum?

iv. Two identical charges repel each other with a force equal to 10 mgwt when they are 0.6 m apart in air. (g = 10 m s^{-2}). Then find the value of each charge.

Section E

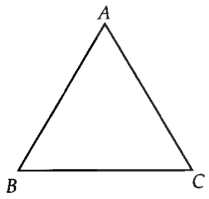
31. i. Draw a ray diagram showing refraction of a ray of light through a triangular glass prism. Hence, obtain the relation for the refractive index (μ) in terms of angle of prism (A) and angle of minimum deviation (δ_m). **[5]**

ii. The radii of curvature of the two surfaces of a concave lens are 20 cm each. Find the refractive index of the material of the lens if its power is -5.0 D.

OR

a. Write two points of difference between an interference pattern and a diffraction pattern.

b. i. A ray of light incident on face AB of an equilateral glass prism, shows minimum deviation of 30^o. Calculate the speed of light through the prism.



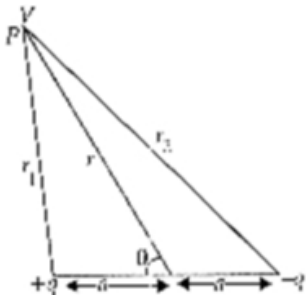
ii. Find the angle of incidence at face AB so that the emergent ray grazes along the face AC.

32. a. Derive an expression for the potential energy of an electric dipole in a uniform electric field. Explain conditions for stable and unstable equilibrium. **[5]**

b. Is the electrostatic potential necessarily zero at a point where the electric field is zero? Give an example to support your answer.

OR

Derive an expression for potential due to a dipole for distances large compared to the size of the dipole. How is the potential due to dipole different from that due to a single charge?



33. i. Draw a labelled diagram of a step-down transformer. State the principle of its working. **[5]**

ii. Express the turn ratio in terms of voltages.

iii. Find the ratio of primary and secondary currents in terms of turn ratio in an ideal transformer.

iv. How much current is drawn by the primary of a transformer connected to 220 V supply when it delivers power to a 110 V - 550 W refrigerator?

OR

A series LCR circuit with L = 0.12 H, C = 480 nF, R = 23 Ω is connected to a 230 V variable frequency supply.

a. What is the source frequency for which the current amplitude is maximum? Obtain this maximum value
b. What is the source frequency for which average power absorbed by the circuit is maximum? Obtain the value of this maximum power.
c. For which frequencies of the source is the power transferred to the circuit half the power at resonant frequency? What is the current amplitude at these frequencies?
d. What is the Q-factor of the given circuit?