CBSE
Class XII Physics
Sample Paper 1

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

General Instructions:
1. All questions are compulsory. There are 33 questions in all.
2. This question paper has five sections: Section A, Section B, Section C, Section D and Section E.
3. Section A contains ten very short answer questions and four assertion reasoning MCQs of 1 mark each, Section B has two case based questions of 4 marks each, Section C contains nine short answer questions of 2 marks each, Section D contains five short answer questions of 3 marks each and Section E contains three long answerquestions of 5 marks each.
4. There is no overall choice. However internal choice is provided. You have to attemptonly one of the choices in such questions
5. You may use the following values of physical constants wherever necessary.

$c = 3 \times 10^{8}$ m / s

$h = 6.63 \times 10^{-34}$ Js

$e = 1.6 \times 10^{-19}$ C

$\mu_{o} = 4\pi \times 10^{-7}$ T m A^{-1}

$\varepsilon_{0} = 8.854 \times 10^{-12}$ C^{2} N^{-1} m^{-2}

$\dfrac{1}{4\pi\varepsilon_{0}} = 9 \times 10^{9}$ N m^{2} C^{-2}

$m_{e} = 9.1 \times 10^{-31}$ kg

mass of neutron $= 1.675 \times 10^{-27}$ kg

mass of proton $= 1.673 \times 10^{-27}$ kg

Avogadro's number $= 6.023 \times 10^{23}$ per gram mole

Boltzmann constant $= 1.38 \times 10^{-23}$ JK^{-1}

Section A

1. A proton projected towards the east is deflected towards the north by a magnetic field. The field is in which direction? (1)

OR

Identify which among the parallel and anti-parallel currents shows attraction and repulsion?

2. Out of Proton, electron He^+ and Li^+ Identify the particle which has minimum frequency of revolution when projected perpendicular to the magnetic field with the same velocity. (1)

3. What kind of phenomenon is light: wave, particle or both? (1)

OR

Which among the following is true for a total internal reflection.
Light travels from rarer to denser medium or Light travels from denser to rarer medium.

4. Coherent sources are used to produce waves of_____. (1)

OR

How much phase difference does a light wave suffers on reflection from a denser medium.

5. What is the relation between n_p and n_e in intrinsic semiconductor. (1)

6. What is the direction of drift current in a p–n junction. (1)

OR

What is name of the region without free electrons and holes in a p-n junction?

7. Wavelength is minimum for which of the following transitions? (1)
(a) n=5 to n=4
(b) n=4 to n=3
(c) n=3 to n=2
(d) n=2 to n=1

8. What is the general formula for orbital angular momentum of the electron in a hydrogen atom? (1)

9. What would be the net electric force on the dipole in a uniform electric field? (1)

10. What would happen to the electric potential energy of the charges if the distance between two charges increases? (1)

For question numbers 11, 12, 13 and 14, two statements are given-onelabelled Assertion (A) and the other labelled Reason (R). Select thecorrect answer to these questions from the codes (a), (b), (c) and (d)as given below.
(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 and R is also false

11. Assertion: The resistivity of a semiconductor increases with temperature.
    Reason: At higher temperature atoms start vibrating at higher amplitude and hence its
    resistivity increases. (1)

12. Assertion: Energy of the electron hydrogen atom in first exited state is -3.4eV
    Reason: Energy of electron of hydrogen atom in nth orbit is given by E=-13.6/n^2 (1)

13. Assertion: Light shows the phenomenon of interference, diffraction and Polarisation.
    Reason: Because of particle nature of light (1)

14. Assertion: Conductors having equal positive charge and volume, must also have same
    potential. (1)
    Reason : Potential depends only on charge and volume of conductor.

Section B

**Questions 15 and 16 are Case Study based questions and are compulsory. Attempt
any 4 sub parts from each question. Each question carries 1 mark.**

15. Coulomb measured the force between two point charges and found that it varied
    inversely as the square of the distance between the charges and was directly
    proportional to the product of the magnitude of the two charges and acted along the
    line joining the two charges. Thus, if two point charges q1 q2are separated by a distance
    r in vacuum, the magnitude of the force (F) between them is given by $F = \dfrac{kq_1q_2}{r^2}$ .Consider
    three charges q1,q2,q3 each equal to q at the vertices of an equilateral triangle of side l.
    A charge of magnitude Q and polarity same as other charges is placed at the centroid of
    the triangle. (4)
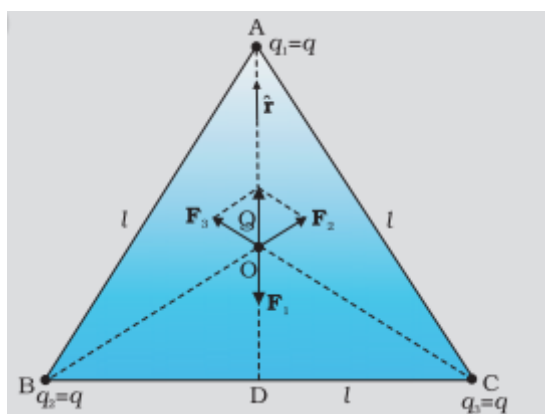
a) Force exerted on Q by each charge present on the vertices of the triangle
   i.   Zero
   ii. Equal
   iii. $F_A > F_B > F_C$
   iv. $F_A < F_B < F_C$
b) The magnitude of Force on Q by charge q present on A is

i. $F = \dfrac{kqQ}{l^2}$

ii. $F = \dfrac{kqQ}{\left(\frac{1}{\sqrt{3}}\right)^2}$

iii. $F = \dfrac{kqQ}{\left(\frac{1}{2}\right)^2}$

iv. $F = \dfrac{kqQ}{\left(\frac{2l}{3}\right)^2}$

c) The magnitude and direction of force experienced by the charge Q due the charge present on the vertex C of the triangle

   i.   Zero

   ii. $F = \dfrac{kqQ}{\left(\frac{1}{\sqrt{3}}\right)^2}$ Along CO

   iii. $F = \dfrac{3kqQ}{l^2}$ Along CO

   iv. $F = \dfrac{kqQ}{\left(\frac{2l}{3}\right)^2}$ Along CO

d) What would be the direction of the Force experienced by the charge q present on vertex A of the triangle due to all other charges.

   i.   upwards

   ii. downwards

   iii. left

   iv. Right

e) What would be the Resultant force on Q if the polarity of charges present on the vertices in opposite to that of Q
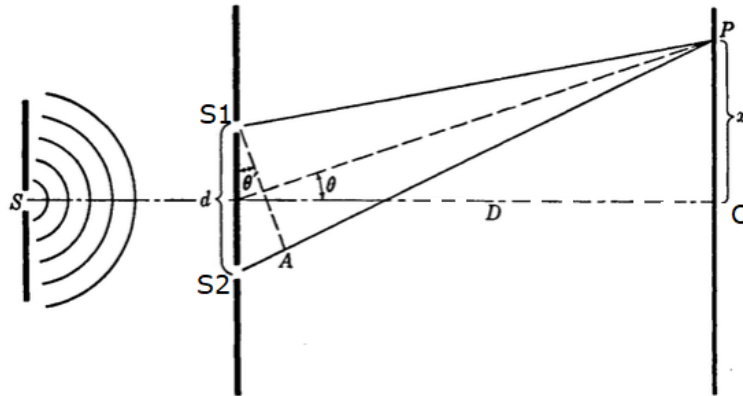
   i.   Zero

   ii. $F_R = \dfrac{-3kqQ}{\left(\frac{1}{\sqrt{3}}\right)^2}$

   iii. $F_R = \dfrac{-kqQ}{\left(\frac{1}{2}\right)^2}$

   iv. $F_R = \dfrac{-kqQ}{\left(\frac{2l}{3}\right)^2}$

16.

In Young's double slit experiment A monochromatic light is passed through a single narrow slit and falls on S1 and S2.These two slit acts as sources of light waves that interfere constructively and destructively at different points on the screen to produce a pattern of alternating bright and dark fringes. For constructive interference $x_n = \dfrac{n\lambda D}{d}$

whereas for destructive interference $x_n = (2n+1)\dfrac{\lambda D}{2d}$. What is the effect on the interference fringes in a Young's double-slit experiment due to each of the following operations (4)

a) When the screen is moved away from the plane of the slits
   i.   Separation of fringes increases.
   ii. Separation of fringes decreases.
   iii. Separation of fringes remains constant.
   iv. None of these

b) When the (monochromatic) source is replaced by another (monochromatic) source of shorter wavelength
   i.   Separation of fringes increases.
   ii. Separation of fringes decreases.
   iii. Separation of fringes remains constant.
   iv. None of these

c) When the separation between the two slits is increased
   i.   Separation of fringes increases.
   ii. Separation of fringes decreases.
   iii. Separation of fringes remains constant.
   iv. None of these

d) When the source slit is moved closer to the double-slit plane
   i.   Separation of fringes increases
   ii. Separation of fringes decreases.
   iii. Separation of fringes remains constant
   iv. None of these

e) When the width of the source slit is increased

i.   Separation of fringes increases
ii. Separation of fringes decreases
iii. Separation of fringes remains constant
iv. None of these

Section C

All questions are compulsory. In case of internal choices, attempt anyone.

17. An electron, alpha particle and proton have the same kinetic energy. Which of these particles has the shortest de Broglie wavelength? (2)

18. Is it correct to say that a potentiometer is equivalent to an ideal voltmeter? Explain Why? (2)

OR

The resistance of a platinum wire of a resistance at ice point is 5 ohm and at steam point is 5.23 ohm. When the thermometer is inserted in a hot bath, the resistance of the platinum wire is 5.795 ohms. Calculate the temperature of the bath.

19. What type of a charge is present on an n-type semiconductor? Why? (2)

20. Why are sky waves not used for transmission of TV signals? State two factors which can increase the range of transmission. (2)

21. State the conditions under which Ohm's law is not obeyed by a conductor. (2)

OR

A battery has an emf of 12 V. If the internal resistance of the battery is 0.4 ohm, what is the maximum current that can be drawn from the battery?

22. Find the maximum frequency and minimum wavelength of X-rays produced by 30keV electrons. (2)

23. Calculate the length of a half-wave dipole antenna at
i. 30 MHz
ii. 300 MHz
What inference do you draw from these results? (2)

24. A proton and an electron have same kinetic energy. Which one has greater de-Broglie wavelength and why? (2)

25. How is forward biasing different from reverse biasing in a p-n junction diode?

OR

Draw energy band diagram of n-type and p-type semiconductor at temperature T > OK. Mark the donar and acceptor energy level with their energies (2)

Section D

All questions are compulsory. In case of internal choices, attempt any one.

26.

i. Electron drift arises due to the force experienced by electrons in the electric field inside a conductor. A force causes acceleration in accordance with Newton's second law. Why then do the electrons acquire a steady average drift speed but no acceleration?

ii. What is the path of electrons along a straight line between successive collisions in the presence of an electric field? (3)

27. With the help of a labelled diagram, briefly describe the construction of a coaxial cable. What is the upper limit of frequency up to which a coaxial cable can be used? (3)

28. Two devices A and B are connected independently to a variable frequency alternating voltage source. The current in A leads the applied voltage, whereas the current in B lags the applied voltage.

i. Identify the circuit elements A and B.

ii. How will the current in these circuit elements change if the applied frequency is decreased? (3)

OR

An AC voltage $E = E_0 \sin \omega t$ is applied across a pure inductor of inductance L. Show mathematically that the current flowing through it lags behind the applied voltage by a phase angle of $\pi / 2$. (3)

29. Briefly explain the principle of the working of an AC generator. What is the maximum emf produced by it?

OR

When primary coil P is moved towards secondary coil S (as shown in the figure below), the galvanometer shows momentary deflection. What can be done to have larger deflection in the galvanometer with the same battery? (3)
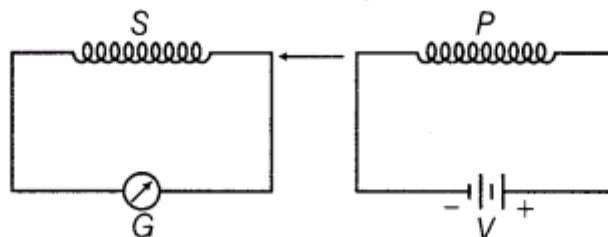
30. State five important characteristics of photons. (3)

Section E

All questions are compulsory. In case of internal choices, attempt any one.

31. State the essential condition for diffraction of light to take place.
Use Huygen's principle to explain diffraction of light due to a narrow single slit and the formation of a pattern of fringes obtained on the screen.
Sketch the pattern of fringes formed due to diffraction at a single slit showing variation of intensity with angle θ . (5)

OR

What are coherent sources of light? Why are coherent sources required to obtain a sustained interference pattern?
State three characteristic features which distinguish the interference pattern due to two coherently illuminated sources as compared to that observed in a diffraction pattern due to a single slit. (5)

32. State Biot–Savart law. Use it to obtain the magnetic field at an axial point at a distance x from the centre of a circular coil of radius carrying a current I. Compare the magnitude of the magnetic field at the centre of the coil and at an axial point for which $x = \sqrt{3}a$. (5)

OR

A) Figure shows a rectangular loop conducting PQRS in which the arm PQ is free to move. A uniform magnetic field acts in the direction perpendicular to the plane of the loop. Arm PQ is moved with a velocity v towards the arm RS. Assuming that the arms QR, RS and SP have negligible resistances and the moving arm PQ has the resistance r, obtain the expression for
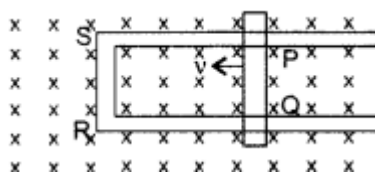
   (i)   the current in the loop
   (ii) the force and
   (iii) the power required to move the arm PQ.

B) A rectangular loop of wire of size 2 cm × 5 cm carries a steady current of 1 A. A straight long wire carrying 4 A current is kept near the loop as shown in the figure.If the loop and the wire are coplanar, find
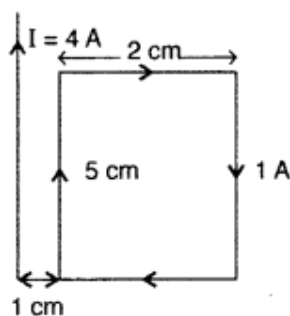
(i) the torque acting on the loop and

(ii) the magnitude and direction of the force on the loop due to the current carrying wire.

33. A transistor is used in the common emitter mode in an amplifier circuit. When a signal of 20 mV is added to the base–emitter voltage, the base current changes by 20 μA and the collector current changes by 2 mA. The load resistance is 5 $k\Omega$.

Calculate (a) factor β , (b) input resistance R_{BE}, (c) transconductance and (d) voltage gain. (5)

OR

With the help of a labelled circuit diagram, describe the working principle of a common emitter amplifier using a p–n–p transistor. Define the terms current gain and voltage gain and write their expressions.