**Series HMJ/3** Set 5**5**/3/1 **SET-1**

Candidates must write the Code on the title page of the answer-book.

| | NOTE |
|---|---|
| (I) | Please check that this question paper contains 19 printed pages. |
| (II) | Code number given on the right hand side of the question paper should be written on the title page of the answer -book by the candidate. |
| (III) | Please ch eck that this question paper contains 37 questions. |
| (IV) | Please write down the Serial Number of the question in the answer -book before attempting it. |
| (V) | 15 minute t ime has been allotted to read this question paper. The question paper will be distributed at 10.15 a.m. From 10.15 a.m. to 10.30 a.m., the students will read the question paper only and will not write any answer on the answer -book during this period. |

# CBSE Physics Class 12 Question Paper 2020

PHYSICS (Theory)

collegedunia

Time allowed : 3 hours Maximum Marks : 70

General Instructions :

Read the following instructions very carefully and strictly follow them :

(i) This question paper comprises four Sections – A, B, C and D.

(ii) There are 37 questions in the question paper. All questions are compulsory.

(iii) Section A – Questions no. 1 to 20 are very short answer type questions, carrying one mark each.

(iv) Section B – Questions no. 21 to 27 are short answer type questions, carrying two marks each.

(v) Section C – Questions no. 28 to 34 are long answer type questions, carrying three marks each.

(vi) Section D – Questions no. 35 to 37 are also long answer type questions, carrying five marks each.

(vii) There is no overall choice in the question paper. However, an internal choice has been provided in 2 questions of 1 mark, 2 questions of 2 marks, 1 question of three marks and all the 3 questions of five marks. You have to attempt only one of the choices in such questions.

(viii) In addit ion to this, separate instructions are given with each section and question, wherever necessary.

(ix) Use of calculators and log tables is not permitted.

(x) You may use the following values of physical constants wherever necessary.

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

$h = 6 \cdot 63 \quad 10^{-34}$ Js

$e = 1 \cdot 6 \quad 10^{-19}$ C

$_0 = 4 \quad 10^{-7}$ T m $A^{-1}$

$_0 = 8 \cdot 854 \quad 10^{-12}$ $C^2$ $N^{-1}$ $m^{-2}$

$\frac{1}{4 \quad _0} = 9 \quad 10^{9}$ N $m^2$ $C^{-2}$

Mass of electron ($m_e$) = $9 \cdot 1 \quad 10^{-31}$ kg

Mass of neutron = $1 \cdot 675 \quad 10^{-27}$ kg

Mass of proton = $1 \cdot 673 \quad 10^{-27}$ kg

Avogadro' s number = $6 \cdot 023 \quad 10^{23}$ per gram mole

Boltzmann constant = $1 \cdot 38 \quad 10^{-23}$ $JK^{-1}$

## SECTION A

Note : Select the most appropriate option from those given below each question :

1. If a positive charge is displaced against the electric fie ld in which it was situated, then 1

(A) work will be done by the electric field on the charge.

(B) the intensity of the electric field decreases.

(C) energy of the system will decrease.

(D) energy will be provided by external source displacing the charge.

2. The electric flux emerging out from 1 C charge is 1

(A) $\frac{1}{0}$

(B) 4

(C) $\frac{4}{0}$

(D) 0

3. Two capacitors of capacitances $C_1$ and $C_2$ are connected in parallel. If a charge Q is given to the combination, the ratio of the charge on the capacitor $C_1$ to the charge on $C_2$ will be 1

(A) $\frac{C_1}{C_2}$

(B) $\sqrt{\frac{C_1}{C_2}}$

(C) $\sqrt{\frac{C_2}{C_1}}$

(D) $\frac{C_2}{C_1}$

4. The electrical resi stance of a conductor 1

(A) varies directly proportional to its area of cross -section.

(B) decreases with increase in its temperature.

(C) decreases with increase in its conductivity.

(D) is independent of its shape but depends only on its volume.

5. $m^2V^{-1}s^{-1}$ is the SI unit of which of the following ? 1

(A) Drift velocity

(B) M obility

(C) R esistivity

(D) P otential gradient

6. The element of a heater is rated (P, V). If it is connected across a source of voltage $\frac{V}{2}$, then the power consumed by it will be 1

(A) P

(B) 2P

(C) $\frac{P}{2}$

(D) $\frac{P}{4}$

7. In Bohr's model of hydrogen atom, the total energy of the electron in $n^{th}$ discrete orbit is proportional to 1

(A) n

(B) $\frac{1}{n}$

(C) $n^2$

(D) $\frac{1}{n^2}$

8. A zener diode has 1

(A) heavily doped p -side and lightly doped n -side.

(B) heavily doped n -side and lightly doped p -side.

(C) heavily doped n -sid e as well as p -side.

(D) lightly doped n -side as well as p -side.

9. A region has a uniform magnetic field in it. A proton enters into the region with velocity making an angle of 45 with the direction of the magnetic field. In this region the proton will m ove on a path having the shape of a 1

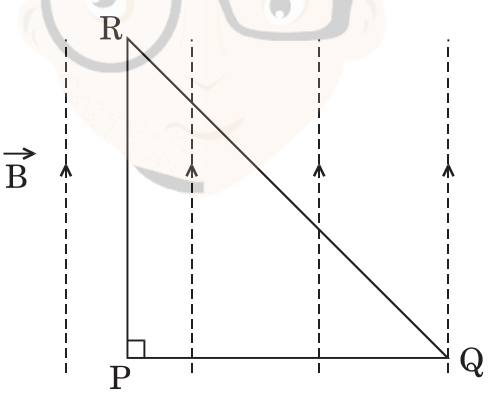
(A) straight line

(B) circle

(C) spiral

(D) helix

10. An isosceles right angled current carrying loop PQR is placed in a uniform magnetic field B pointing along PR. If the magnetic force acting on the arm PQ is F, then the magnetic force which acts on the arm QR will be 1




(A) F

(B) $\frac{F}{\sqrt{2}}$

(C) $\sqrt{2}$ F

(D) – F

Note : Fill in the blanks with appropriate answer :

11. The shape of the wavefront originating from a line source is __ _____ . 1

12. The refractive index of the material of a converging lens is 1·5. If air is replaced by a medium of refractive index 1·6, then the lens will now behave as a _____ lens. 1

13. In Young's double slit experiment, the separation between the two slits is halved. The new fringe width will be _____ times its initial value. 1

14. The value of Brewster's angle for air-glass interface is $\frac{}{3}$, hence the refractive index of glass is _____ . 1

15. In photoelectric effect, the number of emitted photoelectrons is proportional to _____ of incident light. 1

OR

Light of frequency $v$ is incident on a photosensitive surface of threshold frequency $v_0$ $(v > v_0)$. The value of kinetic energy of the emitted photoelectrons will be _____ . 1

Note : Answer the following :

16. An ac is passed through a series LCR circuit. What is the impedance of the circuit at resonance ? 1

17. Two identical coils, one of copper and the other of aluminium are rotated with the same angular speed in an external magnetic field. In which of the two coils will the induced current be more ? 1

18. In an ac circuit, the applied voltage and flowing current are $E = E_0 \sin t$ and $I = I_0 \sin ( t + \frac{}{2})$ respectively. What is the average power consumed in one cycle in this circuit ? 1

OR

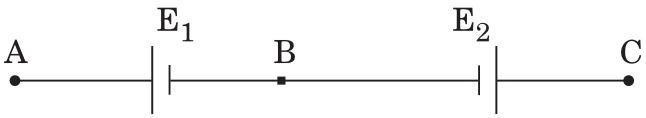
What happens when a block of metal is kept in a varying magnetic field ? 1

19. Mention the contribution of Indian physicist J.C. Bose in the production of electromagnetic waves. 1

20. Write one use of the electromagnetic waves of frequency range from $10^{16}$ Hz to $10^{20}$ Hz. 1

SECTION B

21. Two cells of emf $E_1$ and $E_2$ ($E_1 > E_2$) are connected as shown in the figure below. When a potentiometer is used to measure potential difference between the points A and B, the balancing length of the potentiometer wire is 300 cm. But the same potentiometer for the potential difference between points A and C, gives the balancing length 100 cm. Find $\frac{E_1}{E_2}$. 2




22. Two identical bars, one of paramagnetic material and other of diamagnetic material are kept in a uniform external magnetic field parallel to it. Draw diagrammatically the modifications in the magnetic field pattern in each case. 2

23. Two coplanar and concentric coils 1 and 2 have respectively the number of turns $N_1$ and $N_2$ and radii $r_1$ and $r_2$ ($r_2 >> r_1$). Deduce the expression for mutual inductance of this system. 2

24. How does an oscillating charge radiate an electromagnetic wave ? Give the relation between the frequency of radiated wave and the frequency of oscillating charge. 2

OR

(a) Explain briefly the fact that electromagnetic waves carry energy.

(b) Why do we not feel the pressure due to sunshine ? 2

25. A converging lens of focal length $f_1$ is placed coaxially in contact with a diverging lens of focal length $f_2$ ($f_1 > f_2$). Determine the power and nature of the combination in terms of $f_1$ and $f_2$. 2

OR

How is the resolving power of a compound microscope affected if (a) wavelength of light used is decreased, and (b) the diameter of its objective lens is increased ? Justify your answers. 2

26. Define the terms (a) threshold frequency, and (b) stopping potential. How were these terms incorporated in Einstein's photoelectric equation ? 2

27. A hydrogen atom is in its third excited state.

(a) How many spectral lines can be emitted by it before coming to the ground state ? Show these transitions in the energy level diagram.

(b) In which of the above transitions will the spectral line of shortest wavelength be emitted ? 2

## SECTION C

28. (a) Differentiate between the random velocity and the drift velocity of electrons in an electrical conductor. Give their order of magnitudes.

(b) A conductor of uniform cross -sectional area is connected across a dc source of variable voltage. Draw a graph showing variation of drift velocity of electrons ($v_d$) as a function of current density (J) in it. 3

29. A series LCR ac circuit has L = 2·0 H, C = 32 F and R = 10 .

(a) At w hat angular frequency of ac will it resonate ?

(b) Calculate the Q value of the circuit. 3

OR

An ideal inductor of $\frac{5}{}$ H inductance is connected to a 200 V, 50 Hz ac supply.

(a) Calculate the rms and peak value of current in the indu ctor.

(b) What is the phase difference between current through the inductor and the applied voltage ? How will it change if a small resistance is connected in series with this inductor in the circuit ? 3

30. (a) Using the necessary ray diagram, derive the mirror formula for a concave mirror.

(b) In the magnified image of a measuring scale (with equidistant markings) lying along the principal axis of a concave mirror, the markings are not equidistant. Explain. 3

31. (a) The density of the nuclear matter is t remendously larger than the physical density of the material. Explain.

(b) The nuclear forces are not coulomb forces between nucleons. Explain.

(c) Draw a plot of the potential energy between a pair of nucleons as a function of distance between them inside a nucleus. 3

32. What do you mean by wave nature of an electron ? How wa s quantisation of angular momentum of the orbiting electron in Bohr's model of hydrogen atom explained by de Broglie hypothesis ? 3

33. Name the diode which can act as a voltage regulator. Explain its working with the help of its labelled circuit diagram . Draw its V – I characteristic. 3

34. (a) Why is an intrinsic semiconductor deliberately converted into an extrinsic semiconductor by adding impurity atoms ?

(b) Explain briefly the two processes that occur in p -n junction region to create a potential ba rrier. 3

SECTION D

35. (a) An electric dipole of dipole moment p is placed in a uniform electric field E at an angle with it. Derive the expression for torque ( ) acting on it. Find the orientation of the dipole relative to the electric field for which torque on it is (i) maximum, and (ii) half of maximum.

(b) Two point charges $q_1 = +1$ C and $q_2 = +4$ C are placed 2 m apart in air. At what distance from q $_1$ along the line joining the two charges, will the net electric field be zero ? 5

OR

(a) Derive an expression for the energy stored in a parallel plate capacitor of capacitance C when charged up to voltage V. How is this energy stored in the capacitor ?

(b) A capacitor of capacitance 1 F is charged by connecting a battery of negligible internal resistance and emf 10 V across it. Calculate the amount of charge supplied by the battery in charging the capacitor fully. 5

36. (a) Derive the expression for the force acting per unit length between two long straight parallel current carrying conductors. Hence define one ampere.

(b) Two long parallel straight conductors are placed 12 cm apart in air. They carry equal currents of 3 A each. Find the magnitude and direction of the magnetic field at a point midway between them (drawing a figure) when the currents in them flow in opposite directions. 5

OR

(a) Draw the schematic sketch of a cyclotron. Explain the shape of the path on which charged particle moves when the particle is accelerated by it.

(b) To convert a given galvanometer into a voltmeter of ranges 2 V, V and $\frac{V}{2}$ volt, resistances $R_1$, $R_2$ and $R_3$ ohm respectively, are required to be connected in series with the galvanometer. Obtain the relationship between $R_1$, $R_2$ and $R_3$. 5

37. (a) What is meant by plane polarised light ? An unpolarised light is incident at an angle on the surface of glass of refractive index . If the reflected and refracted rays are perpendicular to each other, then obtain the relationship between and .

(b) Two polaroids $P_1$ and $P_2$ are placed in a crossed position. Unpolarised light of intensity $I_0$ is incident on $P_1$. If $P_2$ is rotated through an angle about the direction of propagation of light, keeping $P_1$ fixed, plot the graph of intensity of light for $0 < < 360$ which is (i) transmitted by $P_1$, and (ii) transmitted by $P_2$. 5

OR

(a) Briefly describe the Young's double slit experiment of interference of light. Drive the expression for fringe width in the pattern.

(b) Monochromatic light of wavelength 588 nm is incident from air to water interface. Find the wavelength and speed of the refracted light. The refractive index of water is $\frac{4}{3}$. 5