CBSE **Class** 1 2 Physics Question Paper 2020
Set 5 **5**/5 /1

Series : HMJ/5

SET – 1

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

NOTE

(I) Please check that this question paper contains 23 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 check 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 time 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

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PHYSICS (Theory)

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 : Q. no. 1 to 20 are very short-answer type questions carrying 1 mark each.

(iv) Section B : Q. no. 21 to 27 are short-answer type questions carrying 2 marks each.

(v) Section C : Q. no. 28 to 34 are long-answer type questions carrying 3 marks each.

(vi) Section D : Q. no. 35 to 37 are also long answer type questions carrying 5 marks each.

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

(viii) However, 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

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

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

$_{0} = 4 \quad 10^{-7}$ T m A^{-1}

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

$\frac{1}{4 \quad _{0}} = 9 \quad 10^{9}$ N m^{2} C^{-2}

Mass of electron (m $_{e}$) = $9.1 \quad 10^{-31}$ kg

Mass of neutron = 1.675×10^{-27} kg

Mass of proton = 1.673×10^{-27} kg

Avogadro's number = 6.023×10^{23} per gram mole

Boltzmann constant = 1.38×10^{-23} JK^{-1}

SECTION : A

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

1. The relationship between Brewester angle ' ' and the speed of light ' v' in the denser medium is –

(a) v tan = c (b) c tan = v

(c) v sin = c (d) c sin = v 1

2. Photo diodes are used to detect

(a) radio waves (b) gamma rays

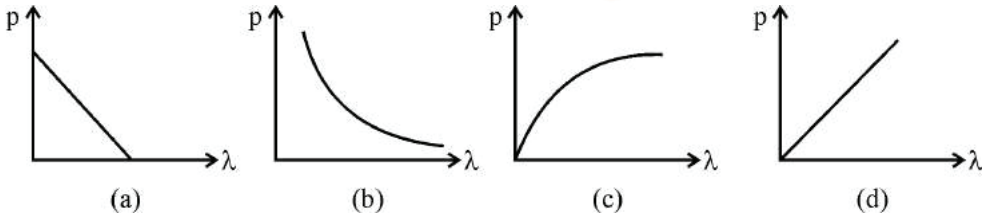
(c) IR rays (d) optical signals 1

3. The selectivity of a series LCR a.c. circuit is large, when

(a) L is large and R is large (b) L is small and R is small

(c) L is large and R is small (d) L = R 1

4. The graph showing the correct variation of linear momentum (p) of a charge particle with its de-Broglie wavelength ( ) is –



1

5. The wavelength and intensity of light emitted by a LED depend upon

(a) forward bias and energy gap of the semiconductor

(b) energy gap of the semiconductor and reverse bias

(c) energy gap only

(d) forward bias only 1

6. A charge particle after being accelerated through a potential difference 'V' enters in a uniform magnetic field and moves in a circle of radius r. If V is doubled, the radius of the circle will become

(a) 2r (b) $\sqrt{2}$ r

(c) 4r (d) r/$\sqrt{2}$ 1

7. The electric flux through a closed Gaussian surface depends upon

(a) Net charge enclosed and permittivity of the medium

(b) Net charge enclosed, permittivity of the medium and the size of the Gaussian surface

(c) Net charge enclosed only

(d) Permittivity of the medium only 1

8. If photons of frequency v are incident on the surfaces of metals. A & B of threshold frequencies v/2 and v/3 respectively, the ratio of the maximum kinetic energy of electrons emitted from A to that from B is

(a) 2 : 3 (b) 3 : 4

(c) 1 : 3 (d) $\sqrt{3}$: $\sqrt{2}$ 1

9. The power factor of a series LCR circuit at resonance will be

(a) 1 (b) 0

(c) 1/2 (d) 1/$\sqrt{2}$ 1

10. A biconcave lens of power P vertically splits into two identical plano concave parts. The power of each part will be

(a) 2P (b) P/2

(c) P (d) P/$\sqrt{2}$ 1

Note : Fill in the blanks with appropriate answer.

11. The physical quantity having SI unit NC $^{-1}$ m is _____. 1

12. A copper wire of non-uniform area of cross-section is connected to a d.c. battery. The physical quantity which remains constant along the wire is _____ 1

13. A point charge is placed at the centre of a hollow conducting sphere of internal radius 'r' and outer radius '2r'. The ratio of the surface charge density of the inner surface to that of the outer surface will be _____. 1

14. The _____ , a property of materials C, Si and Ge depends upon the energy gap between their conduction and valence bands. 1

15. The ability of a junction diode to _____ an alternating voltage, is based on the fact that it allows current to pass only when it is forward biased. 1

Note : Answer the following :

16. Define the term 'current sensitivity' of a moving coil galvanometer. 1

17. Depict the fields diagram of an electromagnetic wave propagating along positive X-axis with its electric field along Y-axis. 1

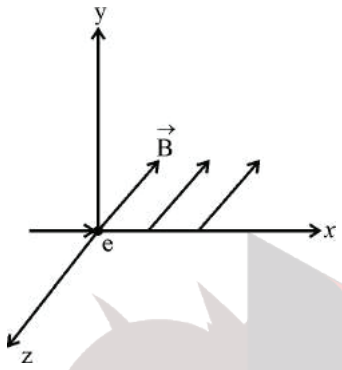
18. Write the conditions on path difference under which (i) constructive (ii) destructive interference occur in Young's double slit experiment. 1

19. Plot a graph showing variation of induced e.m.f. with the rate of change of current flowing through a coil. 1

OR

A series combination of an inductor (L), capacitor (C) and a resistor (R) is connected across an ac source of emf of peak value E_0 and angular frequency ( ). Plot a graph to show variation of impedance of the circuit with angular frequency ( ). 1

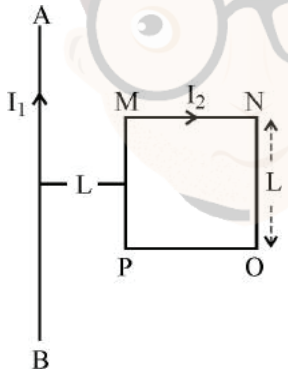
20. An electron moves along + x direction. It enters into a region of uniform magnetic field B directed along –z direction as shown in fig. Draw the shape of trajectory followed by the electron after entering the field.



1

OR

A square shaped current carrying loop MNOP is placed near a straight long current carrying wire AB as shown in the fig. The wire and the loop lie in the same plane. If the loop experiences a net force F towards the wire, find the magnitude of the force on the side 'NO' of the loop.



1

SECTION : B

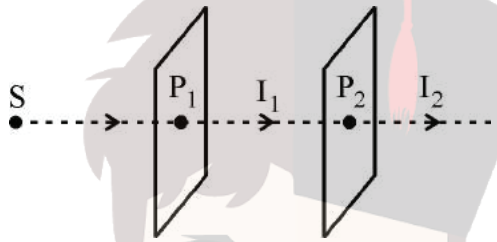
21. Derive the expression for the torque acting on an electric dipole, when it is held in a uniform electric field. Identify the orientation of the dipole in the electric field, in which it attains a stable equilibrium. 2

OR

Obtain the expression for the energy stored in a capacitor connected across a dc battery. Hence define energy density of the capacitor. 2

22. Gamma rays and radio waves travel with the same velocity in free space. Distinguish between them in terms of their origin and the main application. 2

23. Light from a sodium lamp (S) passes through two polaroid sheets P_1 and P_2 as shown in fig. What will be the effect on the intensity of the light transmitted (i) by P_1 and (ii) by P_2 on rotating polaroid P_1 about the direction of propagation of light ? Justify your answer in both cases.

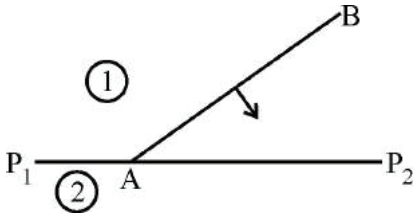


2

OR

Define the term 'wave front of light'. A plane wave front AB propagating from denser medium (1) into a rarer medium (2) is incident on the surface P_1P_2 separating the two media as shown in fig.

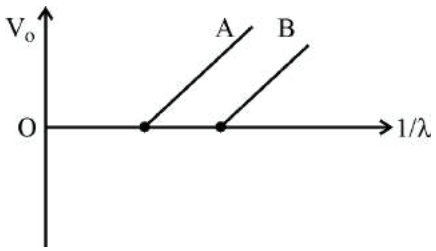
Using Huygen's principle, draw the secondary wavelets and obtain the refracted wave front in the diagram.



2

24. A heavy nucleus P of mass number 240 and binding energy 7.6 MeV per nucleon splits in to two nuclei Q and R of mass numbers 110, 130 and binding energy per nucleon 8.5 MeV and 8.4 MeV, respectively. Calculate the energy released in the fission. 2

25. Figure shows the stopping potential (V_0) for the photo electron versus ($1/\lambda$) graph, for two metals A and B, λ being the wavelength of incident light.



(a) How is the value of Planck's constant determined from the graph ?

(b) If the distance between the light source and the surface of metal A is increased, how will the stopping potential for the electrons emitted from it be effected ? Justify your answer. 2

26. Use Bohr's model of hydrogen atom to obtain the relationship between the angular momentum and the magnetic moment of the revolving electron. 2

27. In a single slit diffraction experiment, the width of the slit is increased. How will the (i) size and (ii) intensity of central bright band be affected ? Justify your answer. 2

SECTION : C

28. (a) Differentiate between electrical resistance and resistivity of a conductor.

(b) Two metallic rods, each of length L, area of cross A_1 and A_2, having resistivities ρ_1 and ρ_2 are connected in parallel across a d.c. battery. Obtain the expression for the effective resistivity of this combination. 3

29. Calculate the de-Broglie wavelength associated with the electron revolving in the first excited state of hydrogen atom. The ground state energy of the hydrogen atom is –13.6 eV. 3

30. (a) Define the term decay constant of a radioactive substance.

(b) The half life of $^{238}_{92}U$ undergoing α decay is 4.5×10^9 years. Calculate the activity of 10 g sample of $^{238}_{92}U$. 3

31. What is a solar cell ? Draw its V-I characteristics. Explain the three processes involved in its working. 3

OR

Draw the circuit diagram of a full wave rectifier. Explain its working showing its input and output waveforms. 3

32. An optical instrument uses a lens of power 100 D for objective lens and 50 D for its eyepiece. When the tube length is kept at 25 cm. the final image is formed at infinity.

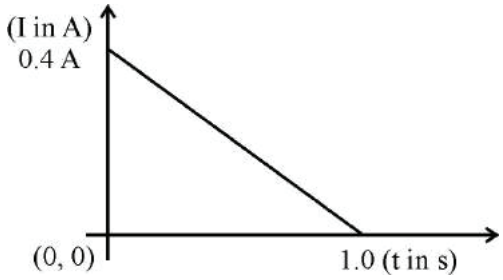
(a) Identify the optical instrument

(b) Calculate the magnification produced by the instrument. 3

33. (a) Two point charges q_1 and q_2 are kept at a distance of r_{12} in air. Deduce the expression for the electrostatic potential energy of this system.

(b) If an external electric field (E) is applied on the system, write the expression for the total energy of this system. 3

34. When a conducting loop of resistance 10 and area 10 cm^2 is removed from an external magnetic field acting normally, the variation of induced current in the loop with time is shown in the figure.



Find the

(i) total charge passed through the loop.

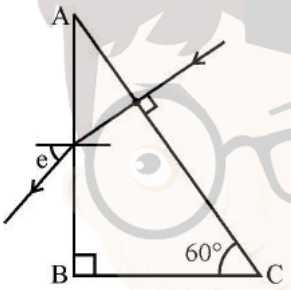
(ii) change in magnetic flux through the loop.

(iii) magnitude of the magnetic field applied. 3

SECTION : D

35. (a) Define the term 'focal length of a mirror'. With the help of a ray diagram, obtain the relation between its focal length and radius of curvature.

(b) Calculate the angle of emergence (e) of the ray of light incident normally on the face AC of a glass prism ABC of refractive index $\sqrt{3}$. How will the angle of emergence change qualitatively, if the ray of light emerges from the prism into a liquid of refractive index 1.3 instead of air ?



5

OR

(a) Define the term 'resolving power of a telescople'. How will the resolving power be effected with the increase in

(i) Wavelength of light used.

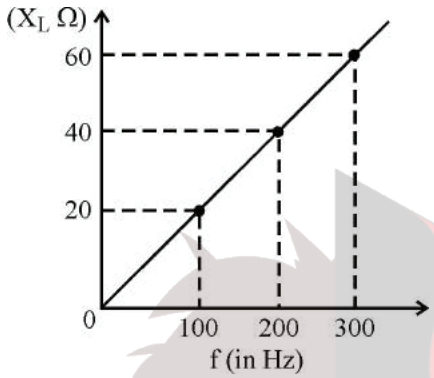
(ii) Diameter of the objective lens.

Justify your answers.

(b) A screen is placed 80 cm from an object. The image of the object on the screen is formed by a convex lens placed between them at two different locations separated by a distance 20 cm. Determine the focal length of the lens. 5

36. (a) Show that an ideal inductor does not dissipate power in an ac circuit.

(b) The variation of inductive reactance (X_L) of an inductor with the frequency (f) of the ac source of 100 V and variable frequency is shown in the fig.



(i) Calculate the self-inductance of the inductor.

(ii) When this inductor is used in series with a capacitor of unknown value and a resistor of 10 at 300 s^{-1}, maximum power dissipation occurs in the circuit. Calculate the capacitance of the capacitor. 5

OR

(a) A conductor of length ' l' is rotated about one of its ends at a constant angular speed ' ' in a plane perpendicular to a uniform magnetic field B. Plot graphs to show variations of the emf induced across the ends of the conductor with (i) angular speed and (ii) length of the conductor l.

(b) Two concentric circular loops of radius 1 cm and 20 cm are placed coaxially.

(i) Find mutual inductance of the arrangement.

(ii) If the current passed through the outer loop is changed at a rate of 5 A/ms, find the emf induced in the inner loop. Assume the magnetic field on the inner loop to be uniform. 5

37. (a) Write two important characteristics of equipotential surfaces.

(b) A thin circular ring of radius r is charged uniformly so that its linear charge density becomes . Derive an expression for the electric field at a point P at a distance x from it along the axis of the ring. Hence, prove that at large distances (x >> r), the ring behaves as a point charge. 5

OR

(a) State Gauss's law on electrostatics and derive an expression for the electric field due to a long straight thin uniformly charged wire (linear charge density) at a point lying at a distance r from the wire.

(b) The magnitude of electric field (in NC $^{-1}$) in a region varies with the distance r(in m) as

$$E = 10\,r + 5$$

By how much does the electric potential increase in moving from point at r = 1 m to a point at r = 10 m. 5