Code No. : 042

PRE-BOARD EXAMINATION-I (NOVEMBER-2019)

CLASS: XII | **PHYSICS** | **Time: 3 hrs.**

MAX. MARKS: 70

General Instruction :

(i) All questions are compulsory. There are 37 questions in all.
(ii) This question paper has four sections Section A, Section B, Section C and Section D.
(iii) Section A contains twenty questions of one mark each, Section B contains seven questions of two marks each. Section C contains seven questions of three marks each and section D contains three questions of five marks each.
(iv) There is no overall choice. However, internal choices have been provided in two questions of one mark each, two questions of two marks, one question of three marks and three questions of five marks weightage. You have to attempt only one of the choices in such questions.
(v) 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}

$\boldsymbol{\varepsilon}_0 = 8.854 \times 10^{-12}$ $C^2 N^{-1} m^{-2}$

$\frac{1}{4\pi\varepsilon_0} = 9 \times 10^{9}$ N $m^2 C^{-2}$

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

mass of neutron = 1.675×10^{-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

Directions (Q1-Q10) Select the most appropriate option from those given below each question.

1) Charge on a conducting metal sphere present at : - 1
(a) On the surface of sphere (b) Inside the sphere
(c) Outside the sphere (d) both inside and outside of sphere

2) To convert a moving coil galvanometer into an ammeter of given range, we must connect: 1
(a) A suitable low resistance in series (b) A suitable low resistance in parallel
(c) A suitable high resistance in parallel (d) A suitable high resistance in series

3) If distance between two current- carrying wires is doubled, then force between them is 1
(a) halved (b) doubled (c) tripled (d) quadrupled

4) The domain formation is a necessary feature of 1
(a) diamagnetism (b) paramagnetism (c) ferromagnetism (d) all of these

5) A metallic cylinder is held vertically and then or small magnet is dropped along its axis. It will fall with- 1
(a) acceleration a>g (b) acceleration a<g (c) acceleration a=g (d) constant velocity a=0

6) High voltage transmission line is preferred as 1
(a) Its appliances are less costly (b) Thin power cables are required
(c) Idle current very low (d) Power loss is very less

7) What is wavelength of signal weather frequency of 300 megahertz? 1
(a) 2m (b) 20m (c) 10m (d) 1m.

8) When diameter of objective of an astronomical telescope is doubled ,its limit of resolution is 1
(a) doubled (b) one fourth (c) halved (d) unaffected

9) Optical fibres are based on the phenomenon of 1
(a) reflection (b) refraction (c) dispersion (d) total internal reflection.

10) In a Young's double slit experiment, the separation between the slits is 0.1 mm, the wavelength of light used is 600nm and the interference pattern is observed on a screen 1m away. Find the separation between bright fringes. 1
(a) 6.6 mm (b) 6.0 mm (c) 6 m (d) 60 cm

Directions (Q11 –Q15) Fill in the blanks with appropriate answer.

11) The phase difference between two waves in ______ interference is given as an even multiple of π. 1

OR

During reflection or refraction of light, _________ remains unchanged.

12) In photoelectric effect, saturation current is not affected on decreasing the ……………of incident radiation provided its intensity remains unchanged. 1

13) A radioactive isotope of silver has half life of 20 minutes. The fraction of the original activity that remain after one hour is ________________. 1

14) Isotones are the nuclides which contain________________ 1

15) The angle of scattering θ for zero value of impact parameter b is _____________. 1

Directions (Q16 –Q20)Answer the following :

16) Calculate the de-Broglie wavelength associated with an electron when it is accelerated through a potential difference of 100 V 1

17) Zener diode is used in reverse bias. How does the thickness of the depletion layer change when its reverse bias is increased? 1

18) What is the output frequency of the signal in full wave rectifier if the input frequency is 50 Hz? 1

19) What is the reason for the formation of depletion region in P-N junction diode 1

20) From the information of energy band gaps of diodes, how do you decide which can be light emitting diodes? 1

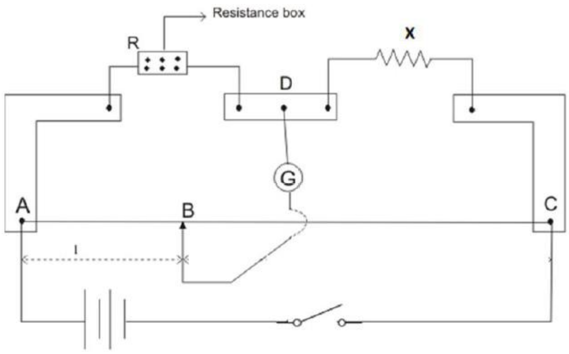
OR

Give any one advantage of LEDs over conventional incandescent low power lamps

SECTION B

21) Draw a plot showing the variation of (i) electric field (E) and (ii) electric potential (V) with distance r due to a point charge Q. 2

22) Following circuit was set up in a meter bridge experiment to determine the value X of an unknown resistance. 2



(a) Write the formula to be used for finding X from the observations.
(b) If the resistance R is increased, what will happen to balancing length?

23) (a) What is the importance of a radial magnetic field and how is it produced? 2

(b) Why is it that while using a moving coil galvanometer as a voltmeter a high resistance in series is required whereas in an ammeter a shunt is used ?

24) The susceptibility of a magnetic material is $- 2.6 \times 10^{-5}$. Identify the type of magnetic material and state its two properties. 2

OR

A circular coil of N turns and radius R carries a current I. It is unwound and rewound to make another coil of radius R/2, current I remaining the same. Calculate the ratio of the magnetic moments of the new coil and the original coil.

25) When an ideal capacitor is charged by a dc battery, no current flows. However, when an ac source is used, the current flows continuously. Howdoes one explain this, based on the concept of displacement current ? 2

26) The work function of Cs is 2.14eV.Find (a) threshold frequency for Cs (b) Wavelength of incident light if the photo current is brought to zero by stopping potential of 0.6 V. 2

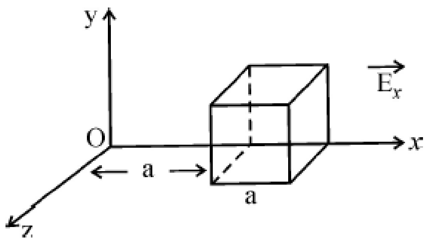
27) Derive an expression for the radius of n^{th} Bohr's orbit in Hydrogen atom. 2

OR

Energy of electron in first excited state in Hydrogen atom is -3.4eV. Find KE and PE of electron in the ground state.

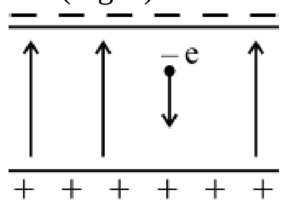
SECTION C

28) Define electric flux and write its SI unit. The electric field components in the figure shown are : $E_x = \alpha x$, $E_y = 0$, $E_z = 0$ where $\alpha = 100$ N/Cm . Calculate the charge within the cube, assuming a = 0.1m. 3



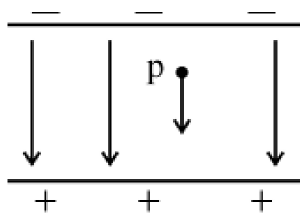
OR

An electron falls through a distance of 1.5 cm in a uniform electric field of magnitude 2.0×10^4 N/C (Fig. a)



(a)

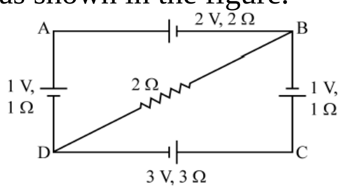
Calculate the time it takes to fall through this distance starting from rest.



(b)

If the direction of the field is reversed (fig. b) keeping its magnitude unchanged, calculate the time taken by a proton to fall through this distance starting from rest.

29) Using Kirchhoff's rules, calculate the potential difference between B and D in the circuit diagram as shown in the figure. 3

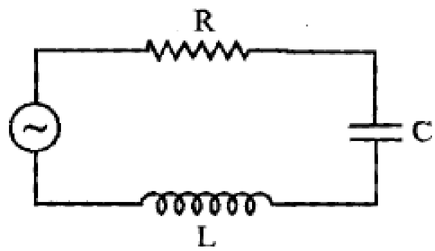


30) The figure shows a series LCR circuit with L = 5.0 H, C = 80 μF, R = 40 Ω connected to a variable frequency 240Vsource. Calculate 3

(i) The angular frequencyof the source which drives the circuit at resonance.

(ii) The current at the resonating frequency.

(iii)The rms potential drop across the capacitor at resonance.



31) (a) Write two points to distinguish between interference and diffraction fringes. 3

(b) In a Young's double slit experiment, fringes are obtained on a screen placed a certain distance away from the slits. If the screen is moved by 5 cm towards the slits, the fringe width changes by 30 μm. Given that the slits are 1 mm apart, calculate the wavelength of the light used.

32) a) When an unpolarized light of intensity I_o is passed through a polaroid, what is the intensity of the linearly polarized light ? Does it depend on the orientation of the polaroid ? Explain your answer. 3

b) A plane polarized beam of light is passed through a polaroid. Show graphically the variation of the intensity of the transmitted light with angle of rotation of the polaroid in complete one rotation.

33) Show that ${}_{92}U^{238}$ cannot spontaneously emit a proton. Given ${}_{92}U^{238}$ = 238.05079u, ${}_{92}Pa^{238}$ = 237.05121u ${}_{1}H^{1}$ = 1.00783u 3

34) Suggest an idea to convert a full wave bridge rectifier to a half wave rectifier by changing the connecting wire/s. Draw the diagram and explain your answer. 3

SECTION D

35) (a) Use Gauss' law to derive the expression for the electric field (**E**) due to a straight uniformly charged infinite line of charge density λ C/m. 5

(b) Draw a graph to show the variation of E with perpendicular distance r from the line of charge.

(c) Find the work done in bringing a charge q from perpendicular distance r_1 to r_2 ($r_2 > r_1$).

OR

a) Define the term drift velocity.

b) On the basis of electron drift, derive an expression for resistivity of a conductor in terms of number density of free electrons and relaxation time. On what factors does resistivity of a conductor depend ?

c) Why alloys like constantan and manganin are used for making standard resistors ?

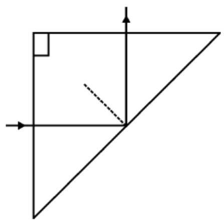
36) (i) In Young's double slit experiment, deduce the condition for (a) constructive, and (b) destructive interference at a point on the screen. Draw a graph showing variation of intensity in the interference pattern against position 'x' on the screen. 5

OR

(i) Plot a graph to show variation of the angle of deviation as a function of angle of incidence for light passing through a prism. Derive an expression for refractive index of the prism in terms of angle of minimum deviation and angle of prism.

(ii) What is dispersion of light ? What is its cause ?

(iii) A ray of light incident normally on one face of a right isosceles prism is totally reflected as shown in fig. What must be the minimum value of refractive index of glass ? Give relevant calculations.



37) Write working principle of cyclotron and with a suitable diagram explain its working. Give any two applications of cyclotron. 5

OR

(a) State the principle of working of a transformer.

(b) Define efficiency of a transformer.

(c) State any two factors that reduce the efficiency of a transformer.

(d) Calculate the current drawn by the primary of a 90% efficient transformer which steps down 220 V to 22 V, if the output resistance is 440 Ω.