Brilliant Public School

Seepat Road Bahatarai, Bilaspur (C.G.)
1st Pre-Board Examination, 2017-18
Class – XII
Subject - Physics

TIME: 3:00Hrs. M.M.70
Date: 07 Dec. 2017 Thursday

General Instruction :

1. *All questions are compulsory. There are 26 questions in all.*
2. *This questions paper has five sections : Section A, Section B, Section C, Section D and Section E.*
3. *Section A contains five questions of one mark each, Section B contains five questions of two marks each, Section C contains twelve questions of three marks each, Section D contains one value based question of four marks and Section E contains three questions of five marks each.*
4. *You may use the following values of physical constants wherever necessary :*

$c = 3 \times 10^8$ m/s
$h = 6{\cdot}63 \times 10^{-34}$ Js
$e = 1{\cdot}6 \times 10^{-19}$ C
$\mu_0 = 4\pi \times 10^{-7}$ T m A^{-1}
$\varepsilon_0 = 8{\cdot}854 \times 10^{-12}$ $C^2N^{-1}m^{-2}$
$\frac{1}{4\pi\varepsilon_0} = 9 \times 10^9$ N m^2 C^{-2}
$m_e = 9{\cdot}1 \times 10^{-31}$ kg.
mass of neutron = $1{\cdot}675 \times 10^{-27}$ kg
mass of proton = $1{\cdot}673 \times 10^{-27}$ kg
Avogadro's number = $6{\cdot}023 \times 10^{23}$ per gram mole
Boltzmann constant = $1{\cdot}38 \times 10^{-23}$ JK^{-1}

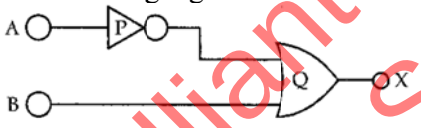
(Section – A)

1. Two wires one of copper and other of manganin have same resistance and equal length. Which wire is thicker and why?

2. The power factor of an a.c. is 0.5.What is the phase difference between voltage and current in the circuit?

3. In which situation is there a displacement current, but no conduction current?

4. Name the logic gates marked P and Q in the given logic circuit.



5. Define the term 'relaxation time' in a conductor.

SECTION B

6. What do you mean by electrostatic shielding? How is the property used in actual practice? What is the potential inside the cavity of the charged conductor?

7. State two properties of electromagnetic waves. How can we show that em waves carry momentum?

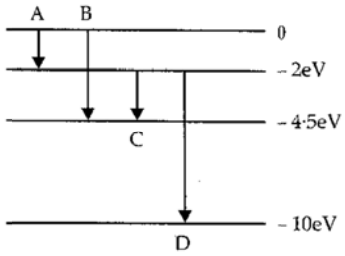
8. Write the principle used in Davison – Germer experiment to verify wave nature of electrons. What would be the de-Broglie wavelength of an electron with K.E. 120 eV?

9. Write the function of (i) tranceducer and (ii) repeater in communication system.

10. In the ground state of hydrogen atom, its Bhor radius is given as 5.3 x 10^{-11} m. The atom is excited such that the radius becomes 21.2 x 10^{-11}m.Find the value of principal quantum number and the total energy of the atom in the excited state.

Or

The energy level of a hypothetical atom are shown below. Which of the transitions will result in the emission of photon of wavelength 275 nm?



SECTION C

11. Derive an expression for the electric field intensity at a point on the equatorial line of an electric dipole of dipole moment P and length 2a. What would be the direction of the field?

12. (a) A parallel plate capacitor (C_1) of charge Q is connected, to an identical uncharged capacitor C_2 in series. What would be the charge accumulated on the capacitor C_2?
(b) Three identical capacitors each of capacitance 3μF are connected, in turn, in series and in parallel to the cmmon source of V volt. Find out the ratio of the energies stored in the two configurations.

13.(a)Plot a graph showing the variation of photo current with collector potential for three different intensities $I_1 > I_2 > I_3$, two of which(I_1 and I_2) have the same frequency n and the third has frequency $n_1 > n$.
(b)Explain the nature of the curves on the basis of Einstein's equation.

14. (i) Explain the working of Light Emitting Diode.
(ii) Name the semiconductors used to make LEDs and why?
(iii) Give two advantages of using LEDs over incandescent lamps.

15. A capacitor of unknown capacitance, a resistor of 100 W and an inductor of self inductance L= (4/p2) henry are connected in series to an ac source of 200V and 50 Hz. Calculate the value of the capacitance and impedance of the circuit when the current is in phase with the voltage. Calculate the power dissipated in the circuit.

16. (i) For a glass prism ($\mu = \sqrt{3}$) the angle of minimum deviation is equal to the angle of the prism. Calculate the angle of prism.
(ii) Draw a ray diagram when an incident ray falls normally on one of the two equal sides of a right angled isosceles prism of R.I.= $\sqrt{3}$.

17. Plot a graph showing the variation of binding energy per nucieon as a function of mass number. Which property of nuclear force explains the approximate constancy of binding energy in the range $30 < A < 170$? How does one explains the release of energy in both the processes of nuclear fission and fusion from the graph?

18. Draw a circuit diagram of a common emitter amplifier using n-p-n transistor. Obtain an expression for the current gain β.

19. (i)Name the phenomenon on which the working of an optical fibre is based.

(ii)What are its necessary conditions for it to occur?

(iii)Draw a labeled diagram for this phenomenon.

20. Draw the block diagram of detection of amplitude modulated wave. Also write the need for modulation.

21. Two harmonic waves of monochromatic light $y_1 = a\cos\omega t$ and $y_2 = a\cos(\omega t+\theta)$ are superimposed on each other. Show that maximum intensity in interference pattern is four times the intensity due to each slit. Hence write the conditions for constructive and destructive interference in terms of phase angle θ.

22. (i) Mention two properties of soft iron due to which it is preffered for making an electromagnet.

(ii) State Gauss's law in magnetism. How is it different from Gauss's law in electrostatics and why?

Or

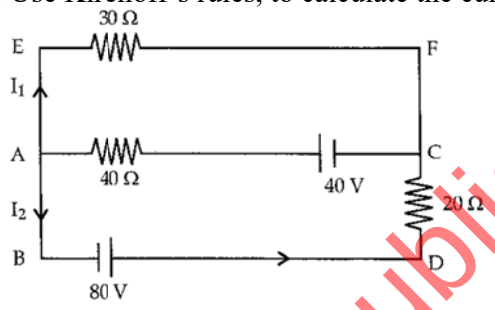
Derive an expression for the axial magnetic field of a finite solenoid of length $2l$ and radius r carrying surrent I. Under what condition does the field become equivalent to that produced by a bar magnet?

SECTION D

23. During a thunderstorm the live wire of the transmission line fell down on the ground. A group of boys passing through noticed it and some of them wanted to place the wire by the side. As they were approaching the wire and trying to lift it, Hari noticed iut and immediately pushed them away to prevent them from touching the wire. Two of them got hurt in the process. Hari took them to the doctor to get medical aid.
(i)Write two values displayed by Hari.
(ii)Why if a bird sits without any harm on live wire, but gets hurt if the same wire touches the ground?
(iii)Why long distance electric power transmission line are set on very high voltage?

SECTION E

24. (i) Use Kirchoff's rules, to calculate the current in the arm AC of the given circuit.



(ii) On what principle does the meter bridge work? Why are the metal strips used in the bridge?

Or

(i) State the principle and working of a moving coil galvanometer, with the help of labeled diagram. In this, what is the direction of magnetic field?
(ii) "Increasing the current sensitivity may not increase the voltage sensitivity of a galvanometer". Justify the statement,

25.(i)An ac source generating a voltage $V=V_0 \sin\omega t$ is connected to a capacitor of capacitance C. Find the expression for the current I flowing through it. Plot a graph of V and I versus ωt to show that the current is $\pi/2$ ahead of the voltage.

(ii) A resistor of 200 Ω and a capacitor of 15μF are connected in series to a 220V, 50Hz ac source. Calculate the current in the circuit and the rms voltage across the resistor and the capacitor. Why the algebraic sum of these voltages is more than the source voltage?

Or

(i)Derive the condition for the resonance to occur in LCR series circuit.

(ii)In a series L-R circuit, L= 35mH and R= 11Ω, V=V_0 sinωt OF V_{rms} = 220V and 50 Hz frequency are applied. Find the current amplitude in the circuit and phase of current with respect to voltage. Draw a graph of resistance versus frequency.

26. When a parallel beam of monochromatic source of light of wavelength λis incident on a single slit of width a, show how the diffraction pattern is formed at the screen by the interference of the wavelets from the slit.

Show that, besides the central maximum θ= 0, secondary maxima are observed at θ = $(n + 1/2)\lambda/a$ and the minima at θ = nλ/a.

Why do secondary maxima get weaker in intensity with increasing n?

Or

(i) Draw a ray diagram showing the formation of image at a point on principal axis and on the convex side of a spherical surface of radius of curvature R. Taking the rays as incident from a rarer medium of refractive indexμ_1 to a denser medium of refractive index μ_2, derive the relation

(ii) Explain how the focal length of a convex lens changes with increase in wavelength of incident light.

(iii)What happens to the focal length of convex lens when it is immersed in water?

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