SURE SHORT QUESTIONS FOR CLASSXII (PHYSICS)

2 MARKS QUESTIONS

1

A point charge is placed at the centre of spherical Gaussian surface. How will electric flux ϕ_E change if

(i) The sphere is replaced by a cube of same or different volume,

(ii) A second charge is placed near, and outside, the original sphere,

(iii) A second charge is placed inside the sphere, and

(iv) The original charge is replaced by an electric dipole?

Ans. (i) doesn't change . ϕ_E independent of shape / size

(ii) doesn't change ,

(iii) change ,

(iv) zero

2

A parallel plate capacitor with plates of area A and separation *d* is charged to a potential difference V and the battery used to charge is disconnected. A dielectric slab of thickness *d* and dielectric constant K is now placed between the plates. Explain changes, if any, in the charge, potential difference, capacitance, electric field and energy stored in the capacitor.

Ans. (i) q remains unchanged

(ii) V decreases

(iii) C increases $C \propto \frac{1}{V}$

(iv) $E = \frac{V}{d}$, decreases

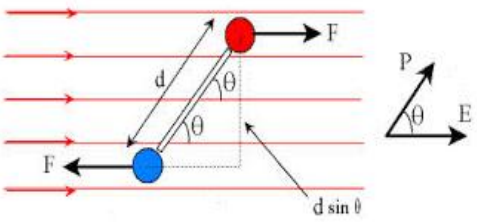
(v) $U = \frac{1}{2} qV^2$, decreases

3

An electric dipole is held in uniform electric field

(i) Show that no translator force acts on it.

(ii) Derive an expression for he torque acting on it



Ans. Force on +q charge=qE along direction of E

Force on –q charge =qE opposite to E

F_{net}=qE-qE =0

The forces are equal in magnitude, opposite in direction acting at different points, therefore they form a couple which rotates the dipole.

Torque $\tau = F \times perp.distance$

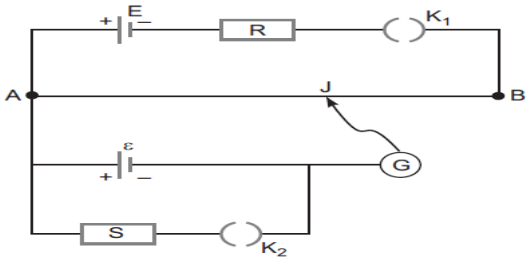
$\tau = F \times dsin\theta = qE \times dsin\theta = (qd)Esin\theta$

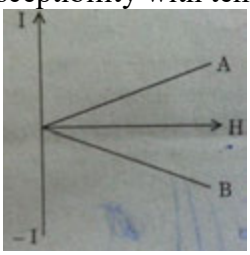
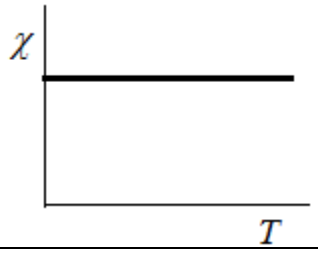
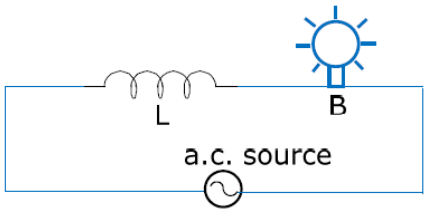
$[\tau = pEsin\theta \; Or \; \vec{\tau} = \vec{p} \times \vec{E}]$

4

1. How does the resistivity of (i) a conductor and (ii) a semiconductor vary with temperature? Give reasons.

Ans: $\rho = \frac{m}{ne^2\tau} \Rightarrow \rho \propto \frac{1}{n}$ **and** $\rho \propto \frac{1}{\tau}$

	(i) For a conductor, the density of free e's is almost independent of temperature but the frequency of collision of e's increases with increase in temperature. Therefore the relaxation time decreases. Hence the resistivity of a conductor increases with increase in temperature (conductivity decreases). (ii) On increasing the temperature of a semiconductor, the density of free e's increases and the relaxation time decreases. But the increase in 'n' is large than the decrease in 'τ'. Hence the resistivity of a semiconductor decreases with increase in temperature (conductivity increases).
5	Define the term resistivity and write its SI unit. Derive the expression for the resistivity of a conductor in terms of number density of free electrons and relaxation time. **A:** The resistivity of a material is equal to the resistance of the unit cube of that material. SI unit – ohm metre. $I = neAv_d$ ---------- (1) $\qquad V_d = \frac{eE}{m}\tau = \frac{eV}{ml}\tau$ ---------(2) Putting the value of v_d in (1), $I = \frac{ne^2 A\tau}{ml}V \Rightarrow R = \frac{V}{I} = \frac{m}{ne^2\tau}\frac{l}{A}$ -------- (3) Resistance R = $\rho\frac{l}{A}$ ------ (4), comparing (3) & (4), $\rho = \frac{m}{ne^2\tau}$
6	Two students 'X' and 'Y' perform an experiment on potentiometer separately using the circuit given. Keeping other parameters unchanged, how will the position of the null point be affected it (i) 'X' increases the value of resistance R in the set-up by keeping the key K_1 closed and the key K_2 open? (ii) 'Y' decreases the value of resistance S in the set-up, while the key K_2 remain open and the key K_1 closed? Justify.  A: (*i*) By increasing resistance *R* the current through *AB* decreases, so potential gradient decreases. Hence a greater length of wire would be needed for balancing the same potential difference. So the null point would shift towards *B*. (*ii*) By decreasing resistance *S*, the current through *AB* remains the same, potential gradient does not change. As K_2 is open so there is no effect of *S* on null point.
7	Define the term magnetic dipole moment of a current loop. Write the expression for the magnetic moment when an electron revolves at a speed '*v*', around an orbit of radius ' *r*' in hydrogen atom. Ans: Magnetic moment of a current loop: $M = NIA$ *i.e.*, magnetic moment of a current loop is the product of number of turns, current flowing in the loop and area of loop. Its direction is perpendicular to the plane of the loop. **Magnetic moment of Revolving Electron,** $M = evr/2$

8	The following figure shows the variation of intensity of magnetization I versus the applied magnetic field intensity H for two magnetic materials A and B. (1) Identify the materials A and B (2) Draw the variation of susceptibility with temperature for B.  Ans: 1) A is paramagnetic material. B is diamagnetic material. 2) 
9	How does the self induction of a coil change when? (1) The number of turns in a coil is decreased (2) An iron rod is introduced into it. Justify. Ans. (1) $L = \mu_0 n^2 lA$ When no. of turns decreases self induction will decrease. (2) When iron rod is introduced $L = \mu_0 n^2 lA\mu_r$ Since for iron $\mu r > 1$ Self induction will increase
10	An inductor L of reactance X_L is connected in series with a bulb B to an a.c. source as shown in the figure.  Briefly explain how does the brightness of the bulb change when (a) Number of turns of the inductor is reduced. (b) A capacitor of reactance $X_C = X_L$ is included in series in the same circuit.

	Ans. (a) Since $Z = \sqrt{R^2 + X_L^2}$ When number of turns of the inductor gets reduced X_L and Z decreases and in turn current increases Hence the bulb will grow more brightly (b) When capacitor is included in the circuit $Z = \sqrt{R^2 + (X_L - X_C)^2}$ But $X_L = X_C$ (given) $\Rightarrow Z = R$ (minimum) Hence brightness of the bulb will become maximum.
11	What are optical fibres? Give their one use? Ans. Optical fibres consist of thin and long strands of fine quality glass or quartz coated with a thin layer of material of refractive index less than the refractive index of strands. They work on the principle of total internal reflection so they do not suffer any loss. **Uses** The optical fibres are used in medical investigations i.e. one can examine the inside view of stomach and intestine by a method called endoscopy.
12	In young's double slit experiment how is the fringe width change when (a) Light of smaller frequency is used (b) Distance between the slits is decreased? Ans. $\beta = \frac{D\lambda}{d}$ If light of smaller frequency is of higher wavelength is used the fringe width will increase. (b) If distance between the slits is decreased i.e $\beta \alpha \frac{1}{d}$. Fringe width will increase.
13	Suppose the electric field part of an electromagnetic wave is given by $\vec{E} = (3.1\ N/C)\ \cos[(1.8\ rad/m)\ y + (5.4 \times 10^6\ rad/s)\ t]\ i$ (i) What is the direction of propagation? (ii) what is the wavelength λ ? (iii) what is the frequency ν ? (iv) what is the amplitude of the magnetic field part of the wave ? Ans. (i) - j (ii) $\lambda = 3.5$ m (iii) $\nu = 86 \times 10^6$ Hz (iv) $B = 10^{-11} \cos[(1.8\ rad/m)\ y + (5.4 \times 10^6\ rad/s)\ t]$

14 Write two points of difference between interference and diffraction?

Ans.

S. No.	Interference	Diffraction
1	Interference occurs due to superposition of light coming from two coherent sources.	It is due to the superposition of the waves coming from different parts of the same wavefront.
2	All bright fringes are of equal intensity	The intensity of bright fringes decreases with increasing distance from the central bright fringes.

15 How the angular separation and visibility of fringes in Young will's double slit experiment change when (i) screen is moved away from the plane of the slits, and (ii) width of the source slit is increased?

Ans. (i) Angular separation = $\beta/D = \lambda/d$ It is independent of *D*; therefore, angular separation remains unchanged if screen is moved

away from the slits. But the actual separation between fringes $\beta = D\lambda/d$ increases, so visibility of fringes increases.

(ii) When width of source slit is increased, then the angular fringe width remains unchanged but fringes becomes less and less sharp; so visibility of fringes decreases. If the condition $s/S = \lambda/d$ is not satisfied, the interference pattern disappears.

16 Draw a labelled ray diagram of a reflecting telescope. Mention its two advantages over the refracting telescope.

Ans: Ray diagram

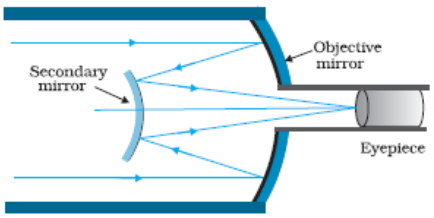


FIGURE 9.33 Schematic diagram of a reflecting telescope (Cassegrain).

Advantages:

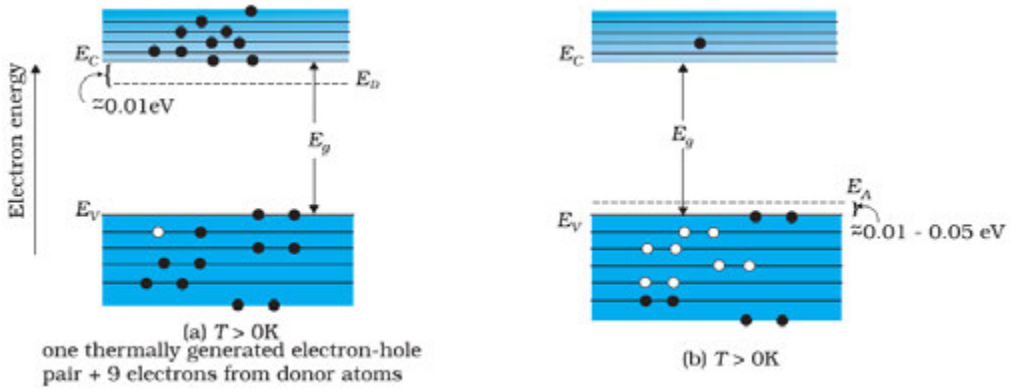
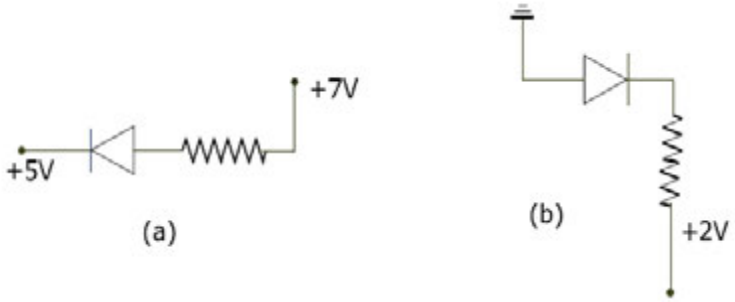
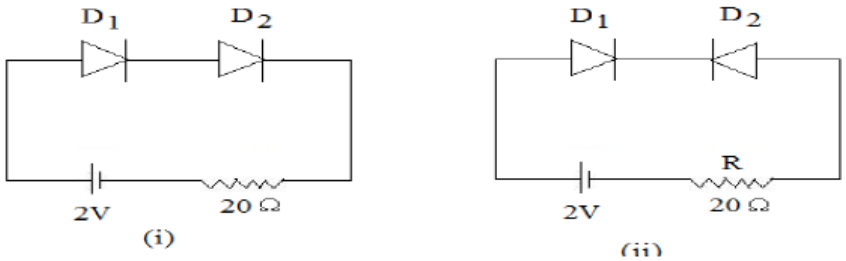
(*i*) It is free from chromatic and spherical aberrations.

(*ii*) Its resolving power is greater than refracting telescope due to larger aperture of mirror.

17 State the laws of photoelectric emission.

Ans. **Laws of photoelectric emission.** On the basis of the experimental results on photoelectric effect, Lenard and Millikan gave the following laws of photoelectric emission:

	1. For a given photosensitive material and frequency of incident radiation, (above the threshold frequency), the photoelectric current is directly proportional to the intensity of light. The saturation current is directly proportional to the intensity of incident radiation. 2. For a given photosensitive material, there exists a certain minimum cut off frequency below which no photoelectrons are emitted, howsoever high is the intensity of incident radiation. This frequency is called threshold frequency. 3. Above the threshold frequency, the stopping potential or equivalently the maximum kinetic energy of the photoelectrons is directly proportional to the frequency of incident radiation, but is independent of its intensity. 4. The photoelectric emission is an instantaneous process. The time lag between the incidence of light radiation and the emission of photoelectrons is very small, even less than 10^{-9} s.
18	Assume that the frequency of the radiation incident on a metal plate is greater than its threshold frequency. How will the following change, if the incident radiation is doubled? (1) Kinetic energy of electrons (2) Photoelectric current Ans. (1) If the frequency of the incident radiation is doubled $h\nu - h\nu_0$ is increased, hence kinetic energy is increased. (2) If the frequency of the incident radiation is doubled there will be no change in the number of photoectrons i.e. photo electronic current.
19	An electron and an alpha particle have the same De Broglie wavelength associated with them? How are their kinetic energies related to each other? Ans. $\lambda = \frac{h}{m\upsilon}$ or $m\upsilon = \frac{h}{\lambda}$ $K.E = \frac{P^2}{2m}$ $\Rightarrow K.E(E') = \frac{h^2}{2m\lambda^2} - - - - - (2)$ $\Rightarrow \frac{(K.E.)electron}{(K.E.)alpha} = \frac{m\alpha}{me}\left(\because \lambda = \frac{h}{P} \text{ is same}\right)$
20	State the limitations of Bohr's atomic model? Ans. (1) It does not give any indication regarding the arrangement and distribution of electrons in on atom. (2) It could not account for the wave nature of electrons.

21	A radioactive nucleus undergoes a series of decay according to the scheme $A \xrightarrow{\alpha} A_1 \xrightarrow{\beta-} A_2 \xrightarrow{\alpha} A_3 \xrightarrow{\gamma} A_4$ If the mass number and atomic number of A are 180 and 72 respectively, what are there number for A4? Ans. $^{180}_{72}A \xrightarrow{\alpha} {}^{176}_{70}A_1 \xrightarrow{\beta-} {}^{176}_{71}A_2 \xrightarrow{\alpha} {}^{172}_{69}A_3 \xrightarrow{\gamma} {}^{172}_{69}A_4$
22	For a extrinsic semiconductor, indicate on the energy band diagram the donor and acceptor levels Ans. 
23	In the following diagrams indicate which of the diodes are forward biased and which are reverse bias?  Ans. (a) forward bias (b) Reverse bias
24	Determine the currents through resistance R of the circuits (i) and (ii) when similar diodes D1 and D2 are connected as shown in the figure. 

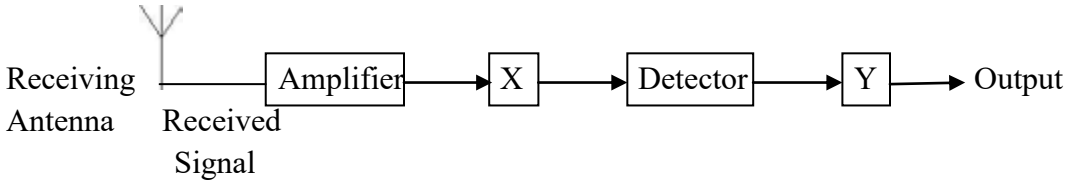
Ans. In figure (i) D_1 and D_2 are forward biased

$\Rightarrow I = V/R = 2/20 = 0.1A$

In figure (ii) D_1 is forward biased but D_2 is reverse biased due to which D_1 & D_2 offers infinite resistance

$\therefore I = 0$

25 In the given block diagram of a receiver identify the boxes labelled as X and Y also write their functions.



Ans: X is Intermediate frequency (IF) stage, Y is power amplifier

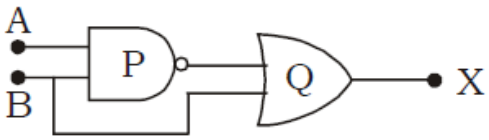
IF stage changes the high frequency of carrier wave curve into lower frequency and amplifier enhances the strength for the signals.

26. Write two factors justifying the need of modulation for transmission of a signal.

Ans: (i) The transmission of low frequency signal needs antenna of height 4-5 km which is impossible to construct. So there is need to modulate the wave in order to reduce the height of antenna to a reasonable height.

(ii)Effective power radiated by antenna for low wavelength or high frequency wave as $p\alpha(l/\lambda^2)$.

27. Identify the logic gates marked 'P' and 'Q' in the given circuit. Write the truth table for the combination.



Ans. P in NAND Gate and Q is OR Gate

Truth table :

A	**B**	$\overline{AB}$	$B + \overline{AB}$
0	0	1	1
0	1	1	1
1	0	1	1
1	1	0	1

28. State Kirchhoff s rules. Explain briefly how these rules are justified.

Sol. Kirchoff's Current (Junction) rule: At any junction, the sum of the currents entering the junction is equal to the sum of current leaving the junction.When currents are steady, there is no accumulation of charge at any junction or at any point in a line. This is based on the conservation of charge.

Kirchoff loop rule: The algebric sum of changes in potential difference across all the elements in any closed loop involving resistors and cells is zero. This law is based on the conservation of energy.