C.B.S.E. CLASS - XII BOARD - 2014

PHYSICS

SET- 2

Time allowed: 3 hours **Maximum Marks: 70**

General Instructions :

(i) *All questions are compulsory.*

(ii) *There are **30** questions in total. Question numbers **1** to **8** are very short answer type questions and carry **one** mark each.*

(iii) *Question numbers **9** to **18** carry two marks each. Question numbers **19** to **27** carry **three** marks each and question numbers **28** to **30** carry **five** marks each.*

(iv) ***One** of the questions carrying **three** marks weightage is value based question.*

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

(vi) *Use of calculators is **not** permitted. However, you may use log tables if necessary.*

(vii) *You may use the following values of physical constant 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 mA^{-1}
$\frac{1}{4\pi\varepsilon_o} = 9 \times 10^9$ Nm^2 C^{-2}
$M_e = 9.1 \times 10^{-31}$ kg

1. Define the term 'electrical conductivity' of a metallic wire. Write its S.I. unit. **[1]**

Ans. By Ohm's law:

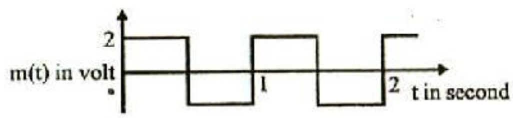
$$\vec{j} = \sigma\vec{E} \text{ and } \sigma = \frac{j}{E}$$

S.I. unit for conductivity = $\dfrac{\dfrac{(\text{amp})/\text{m}^2}{\text{kg m}}}{\text{s}^2(\text{amp})\text{s}} = \dfrac{(\text{amp})^2 \times \text{s}^3}{\text{kg m}^3}$

2. The carrier wave is represented by

$C(t) = 5\sin(10\pi t)$ volt

A modulating signal is a square wave as shown. Determine modulation index.



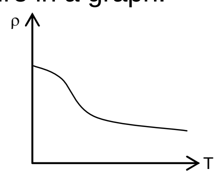
[1]

Ans. Modulation index = $\dfrac{\text{Amplitude of Modulating Signal}}{\text{Amplitude of Carrier Wave}}$

$= \dfrac{2}{5} = 0.4$

3. Show variation of resistivity of Si with temperature in a graph. **[1]**

Ans. Variation of resistivity of Si with temperature.

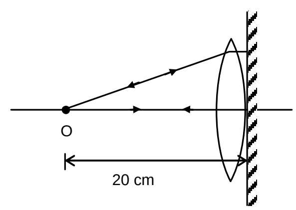


4. A convex lens is placed in contact with a plane mirror. A point object at a distance of 20 cm on the axis of this combination has its image coinciding with itself. What is the focal length of the lens? **[1]**

Ans. ∵ Image coincides with object therefore rays after lens is parallel and then return back to O by retrace the path.

∴ O the focus of lens.

∴ $f_L = 20$ cm



Alternate solution

The focal length of combination of (lens and mirror) is given by

$$\frac{1}{f} = \frac{1}{f_m} - \frac{2}{f_L}$$

$f = -10$ cm

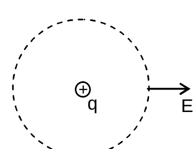
$f_m = +\infty$ cm [plane mirror]

$f_L = ?$

$f_L = 20$ cm.

5. "For any charge configuration, equipotential surface through a pint is normal to the electric field." Justify. **[1]**

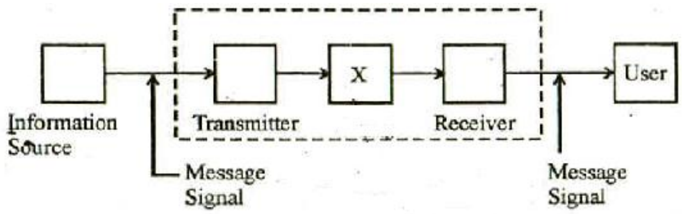
Ans. Equipotential surface is spherical. Where as electric field is radial hence E is perpendicular to equipotential surface.



6. Write the expression, in a vector form, for the Lorentz magnetic force $\vec{F}$ due to a charge moving with velocity $\vec{V}$ in a magnetic field $\vec{B}$. What is the direction of the magnetic force? **[1]**

Ans. $\vec{F} = q(\vec{v} \times \vec{B})$, direction of magnetic force is $\perp$ to plane containing $\vec{v}$ and $\vec{B}$ according to the cross product of $\vec{v}$ and $\vec{B}$.

7. The figure given below shows the block diagram of a generalized communication system. Identify the element labelled 'X' and write its function. **[1]**

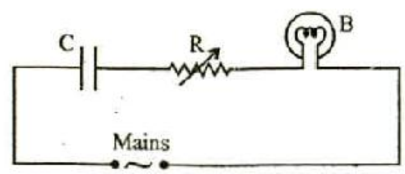


Ans. Communication channel.

8. Two spherical bobs, one metallic and the other of glass, of the same size are allowed to fall freely from the same height above the ground. Which of the two would reach earlier and why? **[1]**

Ans. From Lenz law, induced current in metallic ball and its magnetic force is opposite to $\vec{g}$ but in glass ball there is no induced current. The effective value of acceleration for metal is less than the glass hence the glass ball reaches the ground first.

9. A capacitor 'C', a variable resistor 'R' and a bulb 'B' are connected in series to the ac mains in circuit as shown. The bulb glows with some brightness. How will the glow of the bulb change if (i) a dielectric slab is introduced between the plates of the capacitor, keeping resistance R to be the same; (ii) the resistance R is increased keeping the same capacitance? **[2]**



Ans. If the dielectric inserts the value of C increase and more current passed through circuit hence the bulb glow brighter. $Z = \sqrt{R^2 + R_B^2 + \left(\frac{1}{\omega C}\right)^2}$.

If the resistance increase the current from the circuit is decrease hence the bulb becomes less bright.

10. An electric dipole of length 2 cm, when placed with its axis making an angle of 60° with a uniform electric field, experiences a torque of $8\sqrt{3}$ Nm. Calculate the potential energy of the dipole, if it has a charge of $\pm$ 4nC. **[2]**

Ans. $\frac{\tau}{U} = \frac{Eqd \sin\theta}{-pE\cos\theta} \quad -\tan\theta$

$\Rightarrow U = \frac{\tau}{-\tan\theta} = \frac{8\sqrt{3}}{\sqrt{3}}$

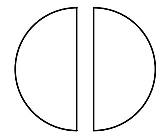
$\Rightarrow$ – 8 joule.

11. Out of the two magnetic materials, 'A' has relative permeability slightly greater than unit while 'B' has less than unity. Identify the nature of the materials 'A' and 'B'. Will their susceptibilities be positive or negative? **[2]**

Ans. A will be paramagnetic in nature while B will be diamagnetic.
Susceptibility A will be positive
Susceptibility B will be negative

12. State the underlying principle of a cyclotron. Write briefly how this machine is used to accelerate charged particles to high energies. **[2]**

Ans. Magnetic force cannot change speed of the charged particle only electric force can charge speed of the charged particle. This is the under lying principle of a cyclotron.

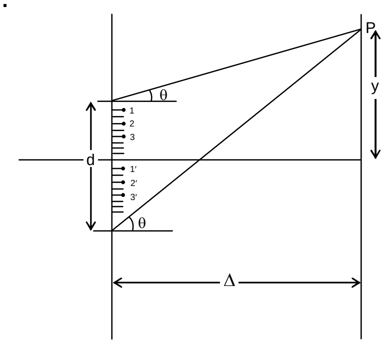


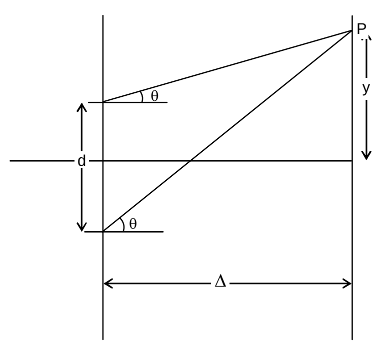
Electric force accelerates and increases speed of the charge particle while magnetic force rotates the charge particle. If frequency of rotation of charge particle matches with the frequency of electric field direction (changing then speed of charge particle keeps on changing. When required speed is achieved then particle exist from the exist tunnels at the top of the cyclotron.

$$T = \frac{2\pi m}{qB} \quad ; \quad f = \frac{qB}{2\pi m} = f_{ac}$$

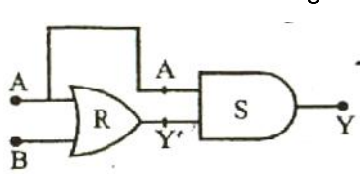
13. For a single slit of width "a", the first minimum of the interference pattern of a monochromatic light of wavelength λ occurs at an angle of $\frac{\lambda}{a}$. At the same angle of $\frac{\lambda}{a}$, we get a maximum for two narrow slits separated by a distance "a". Explain. **[2]**

Ans. For single slit diffraction if $\frac{d\theta}{2} = \frac{\lambda}{2}$ $\left(\text{for minima, } \Delta x = (2n+1)\frac{\lambda}{2}\right)$ we get a minima because slit 1 will cancel from slit 1′ and 2′ will cancel from 2′ and so on. But in double slit experiment we assume only two slits hence $d\theta = \lambda$ $[\Delta x = n\lambda]$ is condition for maxima.



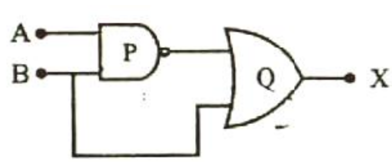


14. Write the truth table for the combination of the gates shown. Name the gates used.

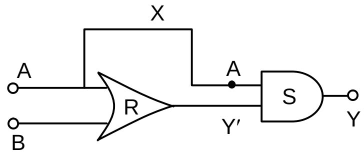


OR

Identify the logic gates marked 'P' and 'Q' in the given circuit. Write the truth table for the combination. **[2]**



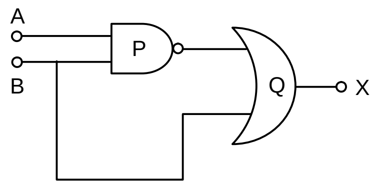
Ans. (a)



R + S OR gate
S is AND gate

Input		Output
A	B	Y
0	0	0
1	0	1
0	1	0
1	1	1

(b)



R + S OR gate
S is AND gate

Input		Output
A	B	Y
0	0	1
1	0	1
0	1	1
1	1	1

15. A proton and an alpha particle are accelerated through the same potential. Which one of the two has (i) greater value of de-Broglie wavelength associate with it and (ii) less kinetic energy. Give reasons to justify your answer. **[2]**

Ans. (i) de-Broglie wavelength

$$\lambda = \frac{h}{mv}$$

$$qV = \frac{1}{2}mv^2 = \frac{P^2}{2m}$$

$$P = \sqrt{2m\,qV} \quad ; \quad \lambda = \frac{h}{\sqrt{2mqV}} \quad ; \quad \lambda \propto \frac{1}{\sqrt{mq}}$$

For proton m = 1 amu ; q = 1 unit
For alpha particle m = 4 amu ; q = 2 unit
Hence, $\sqrt{mq}$ is more for alpha particle than proton.

$\therefore$ de-Broglie wavelength of proton is more than α-particle.

(ii) Kinetic energy = qV
Since, charge of α-particle is more than charge of proton. $\therefore$ kinetic energy of α-particle is more than kinetic energy of proton.

16. Given a uniform electric field $\vec{E} = 2 \times 10^3 \hat{i}$ N/C, find the flux of this field through a square of side 20 cm, whose plane is parallel to the y-z plane. What would be the flux through the same square, if the plane makes an angle of 30^o with the x-axis? **[2]**

Ans. $\vec{E} = 2 \times 10^3\ \hat{i}\ (N/C)$

Flux = $\vec{E} \cdot \vec{S} = ES\cos\theta$

When plane is parallel to the Y-Z plane θ = 0
Flux = ES = $2 \times 10^3 \times (20 \times 10^{-2})^2$
= $2 \times 10^3 \times 4 \times 10^{-2} = 80$

When plane makes angle of 30° with the x-axis

$\theta = 60°$

Flux = $2 \times 10^3 \times (20 \times 10^{-2})^2 \times \cos 60° = 40$

17. State Kirchhoff's rules. Explain briefly how theses rules are justified. **[2]**

Ans. **Kirchoff's rule:** refer NCERT Book (3:13)

18. (i) Monochromatic light of frequency 6.0×10^{14} Hz is produced by a laser. The power emitted is 2.0×10^{-3} W. Estimate the number of photons emitted per second on an average by the source.

(ii) Draw a plot showing the variation of photoelectric current versus the intensity of incident radiation on a given photosensitive surface. **[2]**

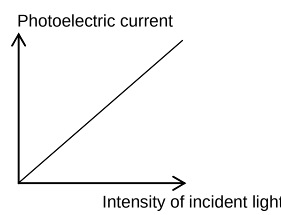
Ans. (i) $F = 6 \times 10^{14}$ Hz ; $P = 2 \times 10^{-3}$ W

$$\frac{dn}{dt} \times hf = P$$

$$\frac{dn}{dt} = \frac{P}{hf} = \frac{2 \times 10^{-3}}{6 \times 10^{14} \times 6.63 \times 10^{-34}}$$

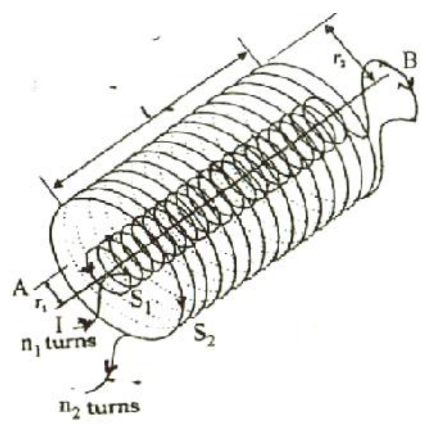
$$= \frac{10}{3 \times 6.63} \times 10^{16} = 5 \times 10^{15}$$

(ii) Refer NCERT



19. (a) State Ampere's circuital law, expressing it in the integral form.

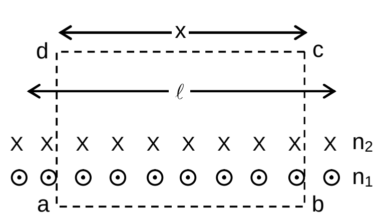
(b) Two long coaxial insulated solenoids, S_1 and S_2 of equal length are wound one over the other as shown in the figure. A steady current "I" flow through the inner solenoid S_1 to the other end B, which is connected to the outer solenoid S_2 through which the same current "I" flows in the opposite direction so as to come out at end A. If n_1 and n_2 are the numbers of turns per unit length, find the magnitude and direction of the net magnetic field at a point (i) inside on the axis and (ii) outside the combined system. **[3]**



Ans. (a) **Ampere's circuital law**

Refer NCERT

(b)



(i) n_1 and n_2 one number of turns per unit length applying ampere's circuital law along close loop abcda

$\int \vec{B} \cdot d\vec{\ell} = \mu_o \, i_{inclosed}$

$Bx = \mu_o (n_1 x I - n_2 x I)$

$B = \mu_o (n_1 - n_2) I$

(ii) Just outside magnetic field = 0.

20. A 12.9 eV beam of electrons is used to bombard gaseous hydrogen at room temperature. Upto which energy level the hydrogen atoms would be excited?
Calculate the wavelength of the first member of Paschen series and the first member of Balmer series. **[3]**

Ans. n = 4 as energy diff. between n = 1 and n = 4 is 12.75 eV.

For first wavelength of Balmer series

$$\frac{hc}{\lambda_1} = (13.6\text{ eV})\left\{\frac{1}{2^2} - \frac{1}{3^2}\right\}$$

For first wavelength of Paschen series

$$\frac{hc}{\lambda_1'} = (13.6\text{ eV})\left\{\frac{1}{3^2} - \frac{1}{4^2}\right\}$$

21. (i) Draw a labeled ray diagram showing the formation of a final image by a compound microscope at least distance of distinct vision.
(ii) The total magnification produced by a compound microscope is 20. The magnification produced by the eye piece is 5. The microscope is focused on a certain object. The distance between the objective and eye piece is observed to be 14 cm. If least distance of distinct vision is 20 cm, calculate the focal length of the objective and the eye piece. **[3]**

Ans. (i) Refer NCERT book page no. (9.9.2)
(ii) Total magnification M = 20

$M_e = 5$; L = 14 cm ; D = 20 cm

If image formed at infinity

$M_e = \frac{D}{f_e} = 5$; $f_e = \frac{D}{5} = \frac{20}{5}$ = 4 cm.

If image is formed at lest distance of distinct vision.

$M_e = 1 + \frac{D}{f_e} = 5$; $\frac{D}{f_e} = 4$

$f_e = \frac{D}{4} = \frac{20}{4}$ = 5 cm.

$M = M_o M_e$

$20 = \frac{L}{f_o} \times 5$; $f_o = \frac{L \times 5}{20}$ = 3.5 cm

22. Answer the following
(a) Name the em waves which are used for the treatment of certain forms of cancer. Write their frequency range.
(b) Thin ozone layer on top of stratosphere is crucial for human survival. Why?
(c) Why is the amount of the momentum transferred by the em waves incident on the surface so small? **[3]**

Ans. (a) X-rays are sometimes used for the treatment of certain forms of cancer.
Various types of em waves one used depending on the type, stage and location of the cancer and the condition of the patient.

Wavelength range – 10^{-8} M to 10^{-13} M
Frequency range – 10^{16} to 10^{20}

Gamma rays are used in medicine to destroy cancer cells
Wavelength range – 10^{-10} M to 10^{-14} M
Frequency range – 10^{19} to 10^{23}

(b) Ozone layer absorbs 97 – 99% of the sun's medium frequency ultraviolet light which otherwise would potentially damage exposed life forms near the earth surface.

(c) Momentum associated with em wave is equal to $\frac{h}{\lambda}$. h is of the order of 10^{-34}, so momentum transferred with em waves is very small and hence momentum transferred by em waves incident on the surface is very small.

23. When Sunita a class XII student, came to know that her parents are planning to rent out the top floor of their house to a mobile company she protested. She tried hard to convince her parent that this move would be a health hazard.
Ultimately her parents agreed:
(1) In what way can the setting up of transmission tower by a mobile company in a residential colony prove to be injurious to health.
(2) By objecting to this move of her parents, what value did Sunita display?
(3) Estimate the range of e.m. waves which can be transmitted by an antenna of height 20 m. (Given radius of the earth = 6400 km) **[3]**

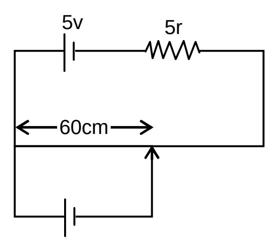
23. (1) From transmission tower em waves of high intensity are radiated which is harmful for human cells. If may cause cancer. So, setting up of transmission town by a mobile company in a residential colony is injurious to health.
(2) Sunita displayed an intelligent characted by objecting to this very more of her parents.
(3) R_e = 6400 km, h = 20 m

$$d = \sqrt{2hRe} = \sqrt{2\times 20\times 6400\times 10^3}$$
$$= \sqrt{4\times 64}\times 10^3$$
= 2 × 8 km
= 16 km

24. A potentiometer wire of length 1.0 m has a resistance of 15 Ω. It is connected to a 5 V battery in series with a resistance of 5 Ω. Determine the emf of the primary cell which gives a balance point at 60 cm. **[3]**

Ans. $I = \frac{5}{20} = \frac{1}{4}A$

$V = IR_1 = \frac{1}{4}\times 9$ = 2.25 volts



25. (a) Deduce the expression, $N = N_0 e^{-\lambda t}$, for the law of radioactive decay.
(b) (i) Write symbolically the process expressing the β^+ decay of $^{22}_{11}Na$. Also write the basic nuclear process underlying this decay.
(ii) Is the nucleus formed in the decay of the nucleus $^{22}_{11}Na$, an isotope or isobar? **[3]**

Ans. (a) $\frac{-dN}{dt} \propto N$; $\frac{dN}{dt} = -\lambda N$

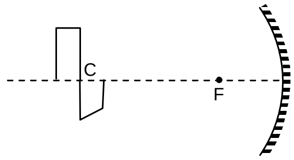
$$\int_{N_o}^{N} \frac{dN}{N} = -\lambda \int_{o}^{t} dt$$

$$\ln\left|\frac{N}{N_o}\right| = -\lambda t \quad ; \quad N = N_o e^{-\lambda t}$$

(b) (i) $^{22}_{11}Na \rightarrow ^{22}_{10}Ne + _{+1}e^{o} + \nu$
Basic process:
$P \rightarrow n + e^+ + \nu$
(ii) Isobar

26. (a) A mobile phone lies along the principle axis of a concave mirror. Show, with the help of a suitable diagram, the formation of its image. Explain why magnification is not uniform.
(b) Suppose the lower half of the concave mirror's reflecting surface is covered with an opaque material. What effect this will have on the image of the object? Explain. **[3]**

Ans. (a)

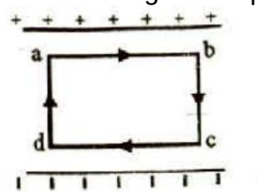


As, $m = \frac{V}{u}$

V and u are different.

(b) Intensity of image will reduce because only upper half portion of mirror reflects the rays. But its magnification and image type are unaffected.

27. (a) Obtain the expression for the energy stored per unit volume in a charged parallel plate capacitor.
(b) The electric field inside a parallel plate capacitor is E. Find the amount of work done in moving a charge q over a closed rectangular loop a b c d a. **[3]**



OR

(a) Derive the expression for the capacitance of a parallel plate capacitor having plate area A and plate separation d.
(b) Two charged spherical conductors of radii R_1 and R_2 when connected by a conducting wire acquire charges q_1 and q_2 respectively. Find the ratio of their surface change densities in terms of their radii.

Ans. (a) dw = vdQ

$dw = \frac{Q}{C} dQ$

$\int dw = U = \frac{1}{C}\frac{Q^2}{2}$

$U = \frac{Q^2}{2C}$

(b) $W = qV_{ab} + qV_{bc} + qV_{cd} + qV_{da}$

As, $V_{ab} = 0$, $V_{dc} = 0$

and $V_{ad} = -V_{bc}$

W = 0

OR

Ans. (a) $V_B - V_A = -\int E d\ell$

$= -\int \frac{\sigma}{\varepsilon_o} d\ell$

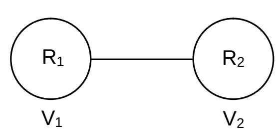
$V_B - V_A = \frac{\sigma}{\varepsilon_o} d$

$C = \frac{Q}{V_A - V_B} = \frac{\sigma A}{\frac{\sigma d}{\varepsilon_o}}$

$C = \frac{A\varepsilon_o}{d}$

(b) $V_1 = V_2$

$\frac{Q_1}{4\pi\varepsilon_o R_1} = \frac{Q_2}{4\pi\varepsilon_o R_2}$



$$\frac{R_1Q_1}{4\pi R_1^2\varepsilon_o} = \frac{R_2Q_2}{4\pi R_2^2\varepsilon_o}$$

$R_1\sigma_1 = R_2\sigma_2$

$$\frac{\sigma_1}{\sigma_2} = \frac{R_2}{R_1}$$

28. (a) Describe a simple experiment (or activity) to show that the polarity of emf induced in a coil is always such that it tends to produce a current which opposes the change of magnetic flux that produces it.

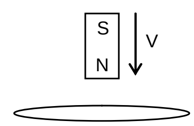
(b) The current flowing through an inductor of self inductance L is continuously increasing. Plot a graph showing the variation of
(i) Magnetic flux versus the current
(ii) Induced emf versus dI/dt
(iii) Magnetic potential energy stored versus the current. **[5]**

OR

(a) Draw a schematic sketch of an ac generator describing its basic elements. State briefly its working principle. Show a plot of variation of
(i) Magnetic flux and
(ii) Alternating emf versus time generated by a loop of wire rotating in a magnetic field.

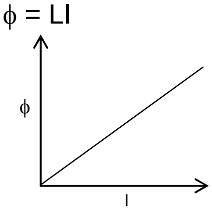
(b) Why is choke oil needed in the use of fluorescent tubes with ac mains?

Ans. (a) Consider a bar magnet falling freely. It will increase the number magnetic field lines through the coil in downward direction, As $e = -\frac{d\phi}{dt}$.
Hence, the upper face of the coil will become north pole, which will oppose the motion of magnet. Similarly lower will become south pole.

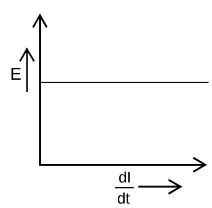


(b) $\phi = LI$

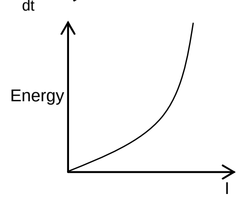
(i)



(ii) $e = \left|\frac{LdI}{dt}\right| \Rightarrow$

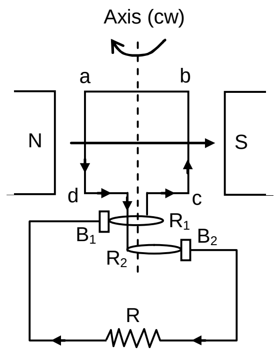


(iii) Energy = $\frac{1}{2}LI^2 \Rightarrow$



OR

Ans. (a)

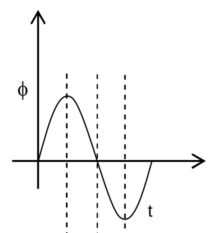


Abcd → Armature
N, S → Field magnet
R_1, R_2 → Slip rings
Brushes or sliding contact → B_1, B_2

Principle: Whenever in a closed ckt, the magnetic flux changes, an induced e.m.f. is produced.

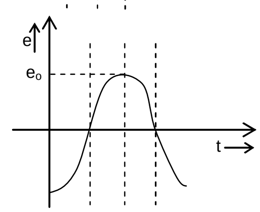
$$E = -\frac{d\phi}{dt}$$

(i) Magnetic flux:
$\phi = \phi_o \sin \omega t$



(ii) Alternating e.m.f.

$$e = \frac{-d\phi}{dt} = -\phi_o w \cos \omega t$$



(b) We have to reduce the value of current in ac circuit by introducing chock coil because chock coil has high impedance.

29. (a) State briefly the process involved in the formation of p-n junction explaining clearly how the depletion region is formed.
(b) Using the necessary circuit diagrams, show how the V-I characteristics of a p-n junction are obtained in
(i) Forward biasing
(ii) Reverse biasing
How are these characteristics made use of in rectification? **[5]**

OR

(a) Differentiate between three segments of a transistor on the basis of their size and level of doping.
(b) How is the transistor biased to be in active state?
(c) With the help of necessary circuit diagram, describe briefly how n-p-n transistor in CE configuration amplifies a small sinusoidal input voltage. Write the expression for the ac current gain.

29. Refer to NCERT book.

30. (a) (i) 'Two independent monochromatic sources of light cannot produce a sustained interference pattern'. Give reasons.

(ii) Light waves each of amplitude "a" and frequency "ω", emanating from two coherent light sources superpose at a point. If the displacements due to these waves is given by $y_1 = a\cos\omega t$ and $y_2 = a\cos(\omega t + \phi)$ where ϕ is phase difference between the two, obtain the expression for the resultant intensity at the point.

(b) In Young's double slit experiment, using monochromatic light of wavelength λ, the intensity of light at a point on the screen where path different is λ is K units. Find out the intensity of light at a point where difference is $\lambda/3$. **[5]**

OR

(a) How does one demonstrate, using a suitable diagram that unpolarised light when passed through a Polaroid gets polarized.

(b) A beam of unpolarised light is incident on a glass-air interface. Show, using a suitable ray diagram, that light reflected from the interface is totally polarized, when $\mu = \tan i_B$, where μ is the refractive index of glass with respect to air and i_B is the Brewster's angle.

Ans. (a) (i) Because thee sources are incoherent means their phase difference is not constant, so their amplitude of the resultant wave is varying with time.

(ii) The resultant displacement

$$y = y_1 + y_2 = a\cos\omega t + a\cos(\omega t + \phi)$$
$$= a\cos\omega t + a\cos\phi\cos\omega t - a\sin\phi\sin\omega t$$
$$= (a + a\cos\phi)\cos\omega t - a\sin\phi\sin\omega t$$
$$\therefore\ y = a(1 + \cos\phi)\cos\omega t - a\sin\phi\sin\omega t$$
$$= a\left[\sqrt{(1+\cos\phi)^2 + \sin^2\phi}\right]\left[\frac{1+\cos\phi}{\sqrt{2+2\cos\phi}}\cos\omega t - \frac{\sin\phi}{\sqrt{2+2\cos\phi}}\sin\omega t\right]$$
$$= a\,2\cos\frac{\phi}{2}\cos\left\{\omega t + \tan^{-1}\left(\frac{\sin\phi}{1+\cos\phi}\right)\right\}$$
$$= 2a\cos\frac{\phi}{2}\cos\left\{\omega t + \tan^{-1}\left(\frac{2\sin\phi/2\cos\phi/2}{2\cos^2\phi/2}\right)\right\}$$
$$y = 2a\cos\frac{\phi}{2}\cos\left(\omega t + \frac{\phi}{2}\right)$$

Resultant intensity $I \propto \left(\frac{2a\cos\phi}{2}\right)^2$

$$I \propto 4a^2\cos^2\left(\frac{\phi}{2}\right)$$

(b) Let I_o is the intensity of light at that point when one slit is open and other is closed.

$\therefore$ When both slits are open and $\Delta x = x$, intensity

$I = 4I_o = k$ units (given)

$\therefore$ When both slits are open and $\Delta x = \lambda/3$

$$\therefore\ \Delta\phi = k\Delta x = \frac{2\pi}{\lambda}\cdot\frac{\lambda}{3} = \frac{2\pi}{3}$$

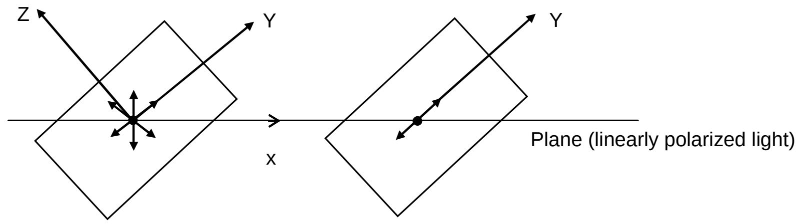
$\therefore$ Resultant amplitude $A = A_o\sqrt{2 + 2\cos\frac{2\pi}{3}}$

$$= A_o\sqrt{2(1+\cos 2\pi/3)}$$
$$= A_o\sqrt{2.2\cos^2\pi/3}$$
$$= 2A_o\sqrt{\frac{1}{2}} = A_o\sqrt{2}$$

$$\therefore\ I \propto 2A_0^2 \quad ; \quad \therefore\ I = 2I_o = \frac{4I_o}{2} = \frac{k}{2}\text{ units}$$

OR

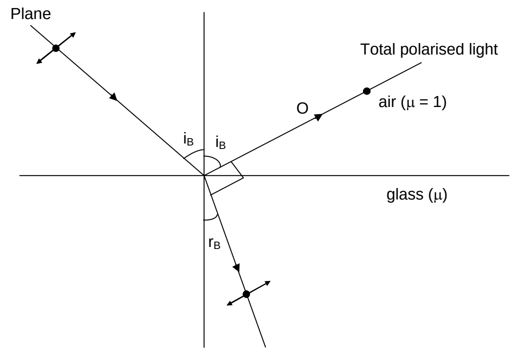
(a)



Unpolarised light propagates Along x-axis.

Polarizer is placed in the Y-z plane and long chain of hydrocarbons are parallel to z-axis and Y-axis is trans mission axis of polaroid.

(b)



▪ Indicate z-direction.

ê ì Indicate (X-Y) electric field is $\perp$ to incident ray.

From Snell's law

$1 \sin i_B = \mu \sin r_B$ … (1)

If reflected light and refracted light is $\perp$ to each other then reflected light is completely polarized light. This is known as Brewster's law.

$i_B + 90° + r_B = 180°$

$\therefore$ $r_B = 90° - i_B$

$\therefore$ From (1) $\sin i_B = \mu \sin (90° - i_B)$

$\sin i_B = \mu \cos i_B$

$\Rightarrow$ $\tan i_B = \mu$