class XII Physics

Q.1 The de-Broglie wavelength of a particle is λ. What will be the wavelength of particle if its kinetic energy is K/9?

A λ B 2λ C 3λ D 4λ

Q.2 Which of the following statement is incorrect?

A Electromagnetic waves cannot be deflected by any field.

B The velocity of light in a medium is $v = \frac{1}{\sqrt{\mu\varepsilon}}$, thus it depends on both the electric and magnetic properties of medium.

C The constant velocity of EM waves in vaccume is used to define a standard of time

D The direction of propagation vector k describes the direction of propagation of the wave.

Q.3 The instantaneous magnetic flux linked with a coil is given by $\phi = (5t^2 - 100t + 300)$ Wb. The emf induced in the coil at time $t = 2$s is.

A -40V B 40V C 140V D 300V

Q.4 In Rutherford's α particle scattering experiment. What will be the correct angle for a scattering for an impact parameter $b = 0$

A 90° B 27° C 0° D 180°

Q.5 Two coils can be arranged in any of the three situations as shown in the figure. Their mutual induction will be.

A Maximum in situation I

B Maximum in situation II

C Maximum in situation III

D Same in all situations

Q.6 Match the Column I with Column II

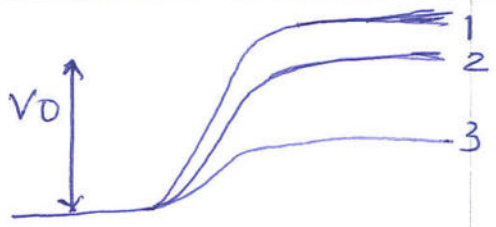
Column I	Column II
A Smaller the resistance greater the current	1 If the voltage is applied
B Greater or smaller the resistance, the current is same	2 If the same current is passed
C Greater the resistance, smaller the Power	3 When resistances are connected in series
D Greater the resistance greater the Power	4 When resistances are connected in parallel.

Codes

	A	B	C	D
a	1	4	3	2
c	4	3	1	2

	A	B	C	D
b	2	3	4	1
d	1	2	3	4

Q.7 In figure V_0 is the Potential barrier across a p-n junction. When no battery is connected across the junction then.



A 1 and 3 both correspond to forward bias of junction

B 3 corresponds to forward bias of junction and 1 corresponds to reverse bias of junction

C 1 corresponds to forward bias and 3 corresponds to reverse bias of junction

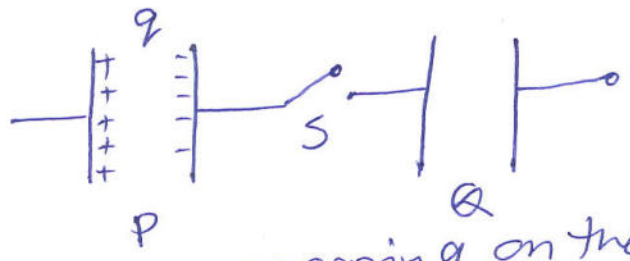
D 3 and 1 both corresponds to reverse bias of junction.

Q8 Biot-savart law indicates that the moving electrons (velocity v) produce a B magnetic field such that

A $B \perp V$ B $B \parallel V$ C it obeys inverse square law

D It is along with line joining the electrons and point of observation.

Q9 Consider the situation shown in figure. The Capacitor P has charge (q) on it where as Q is uncharged. The charge appearing on the the capacitor Q a long time after switch S is closed, is



A zero B q C $q/2$ D $2q$

Q10 Ampere circuital law is given by

a $\int H \cdot dl = \mu_0 I_{enclosed}$ b $\int B \cdot dl = \mu_0 I_{enclosed}$

c $\int H \cdot dl = \mu_0 I$ d $\int B \cdot dl = \mu_0 I$

Q11 There are two long co-axial solenoids of same length l. The inner and outer coils have radii r_1 and r_2 and number of turns per unit length n_1 and n_2 respectively.
The ratio of mutul inductance to the self-inductance of the inner coil is

a $\frac{n_2}{n_1} \cdot \frac{r_1}{r_2}$ b $\frac{n_2}{n_1} \frac{r_2^2}{r_1^2}$ c $\frac{n_2}{n_1}$ d $\frac{n_1}{n_2}$

Q11 The ground stati energy of hydrogen atom is -13.6 ev what is the potential energy of the electron in the state ?

a 0ev b -27.2 ev c 1 ev d 2ev

Q12 A long magnet of plole strength q_m is cut into two parts such that the ratio of their length is 1:3 The ratio of pole strength of these pieces is

a 1:3 b 3:1 c 1:6 d 1:1

Directions : for questions 13 to 16 two statements are given one labelled Assestion (A) and other labelled Reason(R) Select the correct answer of these questions from the codes (a) (b) (c) and (d) as given below.

a if both (A) and (R) are true and (R) is correct explaination of (A)

b if (A) and (R) bothe are true but (R) is not correct explaination of (A)

c (A) is true (R) is false

d (A) ~~is~~ ~~false~~ and (R) both are false.

Q13 (A) Current is a scalar quanlity.

(B) Electric current arises due to continuous flow of charged particles or ions.

Q.14 (A) At resonance L-C-R series circuit have a zero current—
(R) At Resonance in LCR series circuit the current and emf are 180° out of phase with each other.

Q.15 (A) Electric field lines of force never cross each other
(R) Electric field at a point superimpose to give one resultant Electricfield.

Q.16 (A) The image of a point object situated at the centre of hemispherical lens is also at centre
(R) For hemisphere Snell's law is not vaild.

Q.17 The electrical conductivity of a semiconductor increases when electromagnetic radiation of a wavelength shorter than 2480 nm is incident on it. find band gap in (eV) for the semiconductor.

Q.18 An equiconvex lens of focal length f is cut into two equal halves in thickness. What is the focal length of each half? Explain your Answer.

(OR)

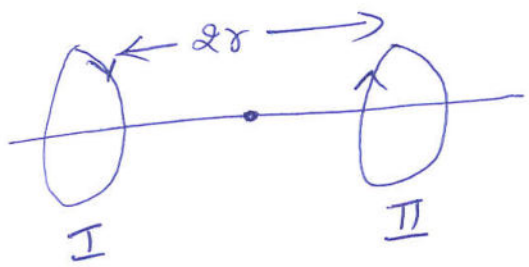
When monochromatic light travels from a rare to a denser medium explain the following giving reason.

a Is the frequency of reflected and refracted light same as the frequency of incident light?

b Does the decrease in speed imply a reduction in the energy carried by light wave.

Q19 Draw the energy band diagrams of conductors and insulators

Q20 Two identical circular loops P and Q each of radius 'r' and carrying equal currents kept in the parallel planes having a common axis passing through O The direction of current in P is clockwise and in Q is anti-clockwise as seen from O which is equidistant from the loops P and Q Find the magnitude of net magnetic field at O



Q21 Work function of a certain metal is 2ev. When light of frequency 5×10^{15} Hz is incident on the metal Surface emission of electrons take place. find (i) maximum kinetic energy emitted electrons and ii stopping potential.

Q22 a write ~~three~~ Four characteristic properties of nuclear force.

b Draw a plot of potential energy of a pair of nucleons as a function of their separation.

Q.23 Two point charges 3.4μC and −2.0μC are placed 5.0 cm apart on x axis At what points on x-axis electric potential is zero.

Q.24 The oscillating electric field is $E_y = 30 \sin[2\times10^{11} t + 3\pi x)$ V m^{-1} a obtain the value of wavelength of the EM wave b write down the expression for oscillating magnetic field.

Q25 a Define self induction. Write its SI Unit

b Derive expression for self-inductance of a long solenoid of length l, cross-sectional area A having N number of turns.

(OR)

The current through two inductors of self inductance 12 mH and 30 mH is increasing with time at the same rate. Draw graphs showing the Variation of the (a) emf induced with the rate of change of current in each inductor (b) energy stored in each inductor with the current flowing through it.

Q26 a State Gauss's law for electrostatics.

b Prove Gauss's law for spherically symmetric surface.

Q27 a Draw and explain the output wave form across the load resistor R, if the input wave form is as shown

b Why is a semiconductor damaged by strong current

Q.28 Using the relevant Bohr's postulate derive the expression for the (a) radius of n^{th} orbit of electron in H-atom (b) velocity of electron in n^{th} orbit

Case based questions

Direction - Question no. 29 and 30 are case study based questions. Read the following paragraph and answer the questions that follow.

Q29 In an n type semiconductor the concentration of electrons is more than that of holes. Similarly in a P-type semiconductor, the concentration.

of holes is more than that of electrons. During the formation of P-n junction and due to concentration gradient across P- type and n type, holes diffuse from P-type to n-type and electrons diffuse from n-type to P-type

i) The expected energy of electrons at absolute zero is called
a) fermi energy b) emission energy
c) work function d) potential energy.

ii) In the depletion region of unbiased P-n junction diode there are
a) only electrons b) only holes
c) both electrons and holes
d) only fixed ions.

iii) An n-type semiconductor is
a) Positively charged. b) negatively charged
c) electrically neutral d) None.

iv) A reverse biased diode is
a) 

b) 

c) 

d) 

OR

iv) The P-n junction diode is used as
a) ~~amplifier~~ b) ~~are~~
a) rectifire b) amplifier c) oscillator
d) modulator

Q.30 Unstable $^{232}_{92}U$ often decay as,

$^{236}_{92}U \rightarrow {}^{140}_{54}Xe + {}^{94}_{38}Sr$ + (other Particles)

Reaction is energetically allowed as smaller nuclei have higher binding energy per nucleon. Inside the nucleus strong nuclear force is charge independent

i As BE per nucleon of products is more than B.E per nucleon of reactants that means

a energy is required to carry the reaction in forward direction

b reaction is endothermic

c reaction cannot occur spontaneously

d reaction is exothermic

ii In above reaction other particles are

a α particle b two protons c one proton one neutron d two neutrons

iii A proton and a neutron both are shot towards a $^{12}_{6}C$ nucleus with a speed 100 m/s then mark correct option

a both particles are likely to be absorbed

b Proton has a higher propability of being absorbed.

c The neutron has higher probability of being absorbed

d neigher of particles will be absorbed.

Q.3) i) An alternating emf $E = E_0 \sin\omega t$ is applied as an input to a ~~ckt~~ purely resistive circuit of resistance R.

a) What is the current in circuit ?

b) What is phase difference between E and I

c) Draw graphical representation of emf and current with time

d) Draw a phasor diagram for this circuit

ii) A resistance of 10Ω is connected to an AC rated 110V, 50 Hz then find rms current

OR

a) Draw a diagram of AC generator

b) Write it's working Principle

c) Derive expression for emf induced in generator. when angular velocity of coil ω is ω.

Q.32. a) Find an expression for torque acting on dipole placed in uniform electric field.

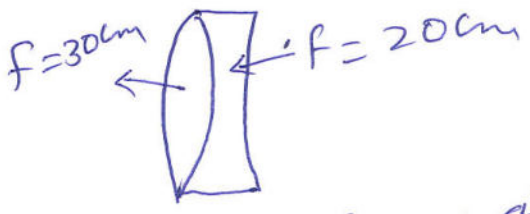
b) a system of two charges $q_A = 2.5^- \times 10^{-7}$ C and $q_B = -2.5^- \times 10^{-7}$ C located at points A(0, 0, -15$^-$) and B (0, 0, +15$^-$) cm respectively find electric dipole moment and torque acting on it when placed in uniform electric field 5×10^4 N/C making an angle 30° ~~with~~ with z axis.

OR

A capacitor C is fully charged by connecting it to a battery of emf E It is then disconnected from battery. If the separation between the plates is doubled what will happen to

a Capacitance b charge stored
c potential difference d field strength
e energy stored.

Q-33 a Derive lens maker's formula
b what is the focal length of lens combination



c This system is converging or diverging.

OR.

a Draw ray diagram of compound microscope when image is formed at least distance of distinct vision

b Derive expression for its magnification

Class: XII

EXAM-SESSION : 2024-25
SUBJECT: PHYSICS

Maximum Marks: 70 Marks **Time Allowed**: 3 hours.

General Instructions:
(1) There are 33 questions in all. All questions are compulsory.
(2) This question paper has five sections: Section A, Section B, Section C, Section D and Section E.
(3) All the sections are compulsory.
(4) Section A contains sixteen questions, twelve MCQ and four Assertion Reasoning based of 1 mark each, Section B contains five questions of two marks each, Section C contains seven questions of three marks each, Section D contains two case study based questions of four marks each and Section E contains three long answer questions of five marks each.
(5) There is no overall choice. However, an internal choice has been provided in one question in Section B, one question in Section C, one question in each CBQ in Section D and all three questions in Section E. You have to attempt only one of the choices in such questions.

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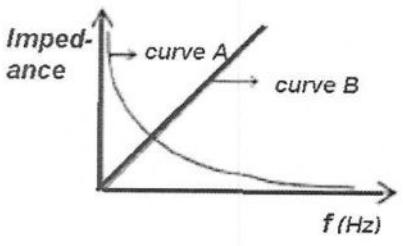
SECTION A

1. A 10 μC charge is divided into two parts and placed at 1 cm distance so that the repulsive force between them is maximum. The charges of the two parts are :
   a) 9 μC, 1 μC
   b) 5 μC, 5 μC
   c) 7 μC, 3 μC
   d) 8 μC, 2 μC
2. An electric dipole placed in an electric field of intensity 2×10^5 N/C at an angle of 30° experiences a torque equal to 4 Nm. The charge on the dipole of dipole length 2 cm is-
   a) 7 μC
   b) 8 mC
   c) 2 mC
   d) 5 mC
3. A metallic plate exposed to white light emits electrons. For which of the following colours of light, the stopping potential will be maximum?
   a) Blue
   b) Yellow
   c) Red
   d) Violet
4. . When alpha particles are sent through a thin gold foil, most of them go straight through the foil, because-
   a) alpha particles are positively charged
   b) the mass of an alpha particle is more than the mass of an electron
   c) most of the part of an atom is empty space
   d) alpha particles move with high velocity

5. A An electron is moving along positive x-axis in a magnetic field which is parallel to the positive y-axis. In what direction will the magnetic force be acting on the electron?
   a) Along -x axis
   b) Along -z axis
   c) Along +z axis
   d) Along -y axis
6. The relative magnetic permeability of a substance X is slightly less than unity and that of substance Y is slightly more than unity, then –
   a) X is paramagnetic and Y is ferromagnetic
   b) X is diamagnetic and Y is ferromagnetic
   c) X and Y both are paramagnetic
   d) X is diamagnetic and Y is paramagnetic
7. An ammeter of resistance 0.81 ohm reads up to 1 A. The value of the required shunt to increase the range to 10 A is-
   a) 0.9 ohm
   b) 0.09 ohm
   c) 0.03 ohm
   d) 0.3 ohm
8. Three magnetic materials are listed below-
   i) paramagnetic ii) diamagnetic iii) ferromagnetic.
   Choose the correct order of increasing of magnetic susceptibility.
   a) i,ii,iii b)ii,i,ii c)ii,i,iii d)ii,iii,i
9. The large scale transmission of electrical energy over long distances is done with the use of transformers. The voltage output of the generator is stepped-up because of –
   a) reduction of current
   b) reduction of current and voltage both
   c) power loss is cut down
   d) (a) and (c) both
10. Which physical quantity remains same for X rays ,red light and radio waves when travelling through a medium?
   a) wavelength
   b) speed
   c) frequency
   d) momentum
11. In the graph for curve A and B-
   a) $A=X_C$,$B=R$
   b) $A=X_L$, $B=Z$
   c) $A=X_C$,$B=X_L$
   d) $A= X_L$, $B= R$



12. The energy of an electron in nth orbit of hydrogen atom is $E_n = -\frac{13.6}{n^2}\ eV$. The negative sign of energy indicates that-

a) electron is free to move.

b) electron is bound to the nucleus.

c) kinetic energy of electron is equal to potential energy of electron.

d) atom is radiating energy.

For Questions 13 to 16, two statements are given –one labelled Assertion (A) and other labelled Reason (R). Select the correct answer to these questions from the options as given below. a) If both Assertion and Reason are true and Reason is correct explanation of Assertion. b) If both Assertion and Reason are true but Reason is not the correct explanation of Assertion. c) If Assertion is true but Reason is false. d) If both Assertion and Reason are false.

11. Assertion (A): For the radiation of a frequency greater than the threshold frequency, photoelectric current is proportional to the intensity of the radiation.

Reason (R) : Greater the number of energy quanta available, greater is the number of electrons absorbing the energy quanta and greater is number of electrons coming out of the metal.

12. Assertion (A) : Putting p type semiconductor slab directly in physical contact with n type semiconductor slab cannot form the pn junction.

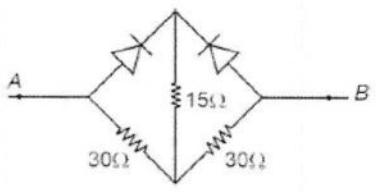
Reason (R) : The roughness at contact will be much more than inter atomic crystal spacing and continuous flow of charge carriers is not possible.

13. Assertion (A) : An electron has a higher potential energy when it is at a location associated with a negative value of potential and has a lower potential energy when at a location associated with a positive potential.

Reason (R) : Electrons move from a region of higher potential to a region of lower potential.

14. Assertion (A) : Propagation of light through an optical fibre is due to total internal reflection taking place at the core-cladding interface.

Reason (R): Refractive index of the material of the cladding of the optical fibre is greater than that of the core.

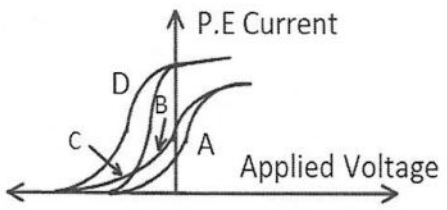


SECTION-B

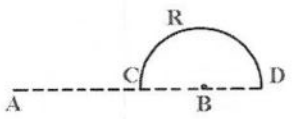
17. a) Draw the circuit diagram of full wave rectifier.

b). If A is at higher potential than B, then calculate the equivalent resistance (in Ω) across AB.

18.Identify the pairs of curves that corresponds to different material but same intensity of radiation.



19. A ray of monochromatic light passes through an equilateral glass prism in such a way that the angle of incidence is equal to the angle of emergence and each of these angles is 3/4 times the angle of the prism. Determine the angle of deviation and the refractive index of the glass prism.



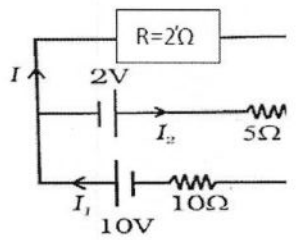
20 Define the term ' mobility ' of charge carriers in a current carrying conductor .

Obtain the relation between mobility and relaxation time.

21 Derive mirror formula for a convex mirror.

OR

Derive lens makers formula.



SECTION-C

22. A given coin has a mass of 3.0 g. Calculate the nuclear energy that would be required to separate all the neutrons and protons from each other. For simplicity assume that the coin is entirely made of 29Cu 63 atoms (of mass 62.92960 u). Given mp = 1.007825u and mn = 1.008665u.

23. Charges (+q) and (–q) are placed at the points A and B respectively which are a distance 2L apart. C is the midpoint between A and B. What is the work done in moving a charge +Q along the semicircle CRD.

24. Give two important characteristics of the nuclear force.

25.Two cells of voltage 10V and 2V and internal resistances 10Ω and 5Ω respectively, are connected as shown in figure. Calculate equivalent emf of combination of cells and equivalent internal resistance.

26. Derive expression for magnetic field due to a straight current carrying conductor

27. Identify the part of the electromagnetic spectrum which:

a) produces heating effect,

b) is absorbed by the ozone layer in the atmosphere,

c) is used for studying crystal structure.

Write any one method of the production of each of the above radiations.

28. a. Define mutual inductance and write its SI unit.

b. Two circular loops, one of small radius r and other of larger radius R, such that R >> r, are placed coaxially with centres coinciding. Obtain the mutual inductance of the arrangement.

OR

Two long straight parallel current carrying conductors are kept 'a' distant apart in air. The direction of current in both the conductors is same. Find the magnitude of force per unit length and direction of the force between them. Hence define one ampere.

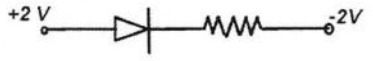
SECTION-D

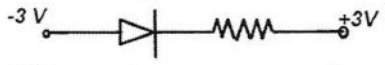
Case Study Based Questions

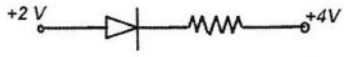
29. Read the following paragraph and answer the questions that follow. A semiconductor diode is basically a pn junction with metallic contacts provided at the ends for the application of an external voltage. It is a two terminal device. When an external voltage is applied across a semiconductor diode such that p-side is connected to the positive terminal of the battery and n-side to the negative terminal, it is said to be forward biased. When an external voltage is applied across the diode such that n-side is positive and p-side is negative, it is said to be reverse biased. An ideal diode is one whose resistance in forward biasing is zero and the resistance is infinite in reverse biasing. When the diode is forward biased, it is found that beyond forward voltage called knee voltage, the conductivity is very high. When the biasing voltage is more than the knee voltage the potential barrier is overcome and the current increases rapidly with increase in forward voltage. When the diode is reverse biased, the reverse bias voltage produces a very small current about a few microamperes which almost remains constant with bias. This small current is reverse saturation current.

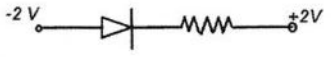
i. Electron conduction in a semiconductor takes place due to :
   a) electrons only
   b) holes only
   c) both
   d) none

ii. The forward biased diode is :

a) 

b) 

c) 

d) 

iii. In an n type semiconductor , the donor energy lies-

a) At the centre of energy gap
b) just below the conduction band
c) just above the valence band
d) in the conduction band

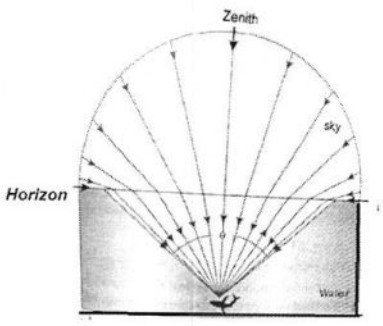
iv)In an p type semiconductor , the donor energy lies-

a) At the centre of energy gap
b) just below the conduction band
c) just above the valence band
d) in the conduction band

OR

iv. For a p-type semicondutor , which of following statement is true ?

a) Electrons are the majority carriers and trivalent atoms are the dopants
b) holes are the majority and trivalent atoms are the dopants
c) holes are the majority carriers and pentavalent atoms are the dopants
d) electrons are the majority carriers and pentavalent atoms are the dopants



30. Read the following paragraph and answer the questions that follow.

Total internal reflection is the optical phenomenon in which when the light travels from an optically denser medium to a rarer medium at the interface, it is partly reflected back into the same medium and partly refracted to the second medium. A similar effect can be observed by opening one's eye while swimming just below the water surface. If the water is calm, the surface outside the critical angle (measured from vertical)appears mirror like reflecting objects below. The region above the water cannot be seen except overhead where the hemispherical field of view is compressed into a conical field known as Snell's window whose angular diameter is twice the critical angle.

i) . Nowadays optical fibers are extensively used for transmitting audio and video signals through long distances. The optical fibers work on-

a) Double refraction
b) Refraction
c) Total internal reflection
d) Reflection

ii) If a wave gets refracted into a denser medium, then which of the following is true?

a) Wavelength, speed and frequency decreases
b) Wavelength increases, speed decreases and frequency remains constant
c) Wavelength and speed decreases but frequency remains constant
d) Wavelength, speed and frequency increases to a rarer medium?

iii. Which of the following is not due to total internal reflection?

a) Brilliance of diamond
b) Working of optical fiber
c) Difference between apparent and real depth of a pond
d) Mirage on hot summer days

iv)If refractive index $n = \frac{2}{\sqrt{3}}$, the Critical angle of that medium :

a) 30°
b) 60°
c) 45°
d) 15°

OR

Two transparent media A and B are separated by a plane boundary. The speed of light in those media are $1.5 \times 10^8\ m/s$ $and\ 2 \times 10^8\ m/s$, respectively. The critical angle for a ray of light for these two media is –

a) $sin^{-1}(0.5)$
b) $sin^{-1}(0.75)$
c) $tan^{-1}(0.5)$
d) $tan^{-1}(0.75)$

31.i)Obtain the expression for the electric field intensity due to a uniformly charged spherical shell of radius R at a point distant r from the centre of the shell outside it.

(ii) Draw a graph showing the variation of electric field intensity E with r, for r > R and r < R. (5)

OR

i)Define electric flux. Write its S I unit.

ii) Derive an expression for the electric field intensity due to a charged infinitely long straight conductor. Also draw a graph to show its variation with distance from conductor. 5

32. State the working of ac generator with the help of a labelled diagram.

The coil of an ac generator having N turns , each of area A ,is rotated with a constant angular velocity ω.Deduce the expression for the alternating emf generated in the coil.

What is the source of energy generation in this device? 5

OR

i) Define the term ' mutual inductance ' and write its S.I. unit.

ii) Show that in an a.c. circuit containing a pure inductor , the voltage is ahead of current by $\frac{\pi}{2}$ $in\ phase.$ 5

33.State Huygen's principle of wave construction. Draw suitable diagrams.

Explain the law of refraction i.e. Snell's law for a light going rarer to denser medium. 5

OR

a) Explain the working of an astronomical telescope with necessary ray diagram.

b) Write two drawbacks of astronomical telescope in comparison with reflecting type telescope. 5

Delhi Public School - Risali - Bhilai

Sample Paper- 2024'25

Sub: Physics | Marks : 70
Class : XII | Time : 3hrs

General Instructions:

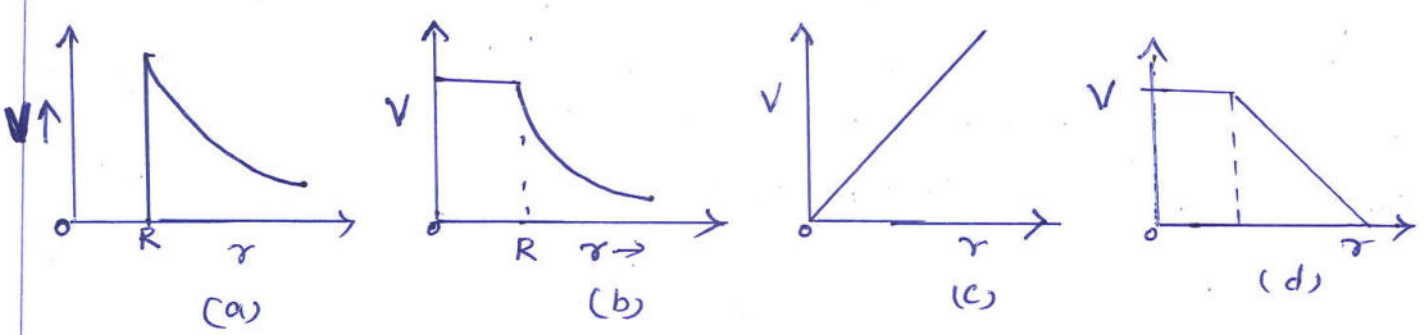
1. There are 33 questions in all. All questions are compulsory.
(ii) Section A consist of twelve MCQ's and four Assertion and reasoning questions of 1 mark each. Section B contains five questions of 2 marks each. Section C contains Seven question of 3 marks each. Section D contains two Case study question of 4 marks each. Section E contains three 5 marks question.
(iii) An internal choice is provided in sections B, C and D.
(iv) All the three question in section E has internal choice.
(v) Use of calculator is not allowed.

Section A

1. Two point charges Placed in a medium of dielectric constant 5 are at a distance 'r' between them, Experience an electrostatic force 'F'. The electric force between them in vacuum at the same distance r will be

(a) 5F (b) F (c) F/2 (d) F/5

2. In the case of a charged metallic sphere of radius R Potential (V) changes with respect to distance (r) from the centre as.



3. Two equal resistances when Connected in series to a battery Consumes electric power of 60W. If these resistances are now connected in parallel Combination to the same battery, the electric power Consumed will be.

(a) 60W (b) 30W (c) 120W (d) 240W

12. Carbon, silicon and germanium have four valance electrons each. These are characterised by valance and conduction band separated by energy gap given by $(E_g)_C$, $(E_g)_{Si}$ and $(E_g)_{Ge}$. Which of the following statement is true?

(a) $(E_g)_{Si} < (E_g)_{Ge} < (E_g)_C$ (b) $(E_g)_C < (E_g)_{Ge} > (E_g)_{Si}$

(c) $(E_g)_C > (E_g)_{Si} > (E_g)_{Ge}$ (c) $(E_g)_C = (E_g)_{Si} = (E_g)_{Ge}$.

For the questions 13 to 16 two statements are given one labelled as Assertion (A) and other labelled as Reason (R). Select the correct answer to these ~~option~~ questions from the options.

(a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

(b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

(c) Assertion is true but Reason is false.

(d) Both Assertion and Reason are false.

13. Assertion : A pure semiconductor has negative temperature coefficient of resistance.
Reason : As temperature increases, more charge carriers are released, conductance increases.

14. Assertion : Balmer series lies in the visible region of E.M. spectrum.
Reason : $\frac{1}{\lambda} = R\left(\frac{1}{3^2} - \frac{1}{n^2}\right)$.

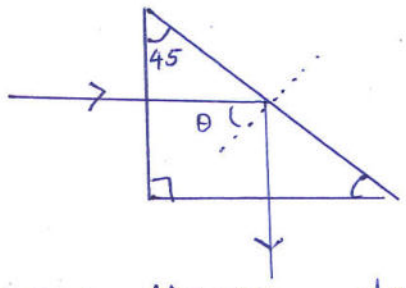
15. Assertion : Photoelectric effect demonstrate the wave nature of light
Reason : The number of photoelectrons is proportional to the frequency of light.

16. Assertion : Magnetic field interacts with moving charges and not with a stationary charge.
Reason : Moving charge produce magnetic field.

Section B

17. State Biot-Savart law. A long wire with a small current element of length 1cm is placed at the origin and carries a current of 10 A along the X axis. Find the magnitude and the

right isoscales prism is totally reflected as shown in the figure. What must be the minimum value of refractive index of the glass? Give relevent Calculations.



(3)

25. On the basis of Huygen's wave theory derive the law of refraction of light.

(OR)

(a) Write the conditions for sustained interference.
(b) A plane wavefront incident on (i) a Prism (ii) a convex lens. draw the refracted wave front. (3)

26. Hydrogen atoms are excited with an electron beam of energy 12.5eV. Find (i) The heighest energy level upto which the hydrogen atoms will be excited. (ii) Calculate the H_d line in the Balmer Series. $[R = 1.097 \times 10^7\ m^{-1}]$. (3)

27. The susceptibility of a magnetic material is -0.085. Identify the magnetic type of the substance. A Specimen of this material is kept in a uniform magnetic field. Draw the modified field pattern. How does the susceptibility of the material get affected by changing the temperature? Show it graphically. (3)

28. What is a rectifier? With the help of a neat Circuit diagram Explain the working of a fullwave rectifier draw its input and output wave forms (3)

Section -D

29. **Case study : Conversion of Galvanometer in to an ammeter and Voltmeter :**

A galvanometer is a device used to detect current in an electric circuit. It Can't be used as an ammeter because it is a sensitive device and it gives fullscale deflection for a current of few μA. We can connect a small resistance called shunt resistance in paralled with the galvanometer to Convert it to an ammeter. This can be Converted in to a

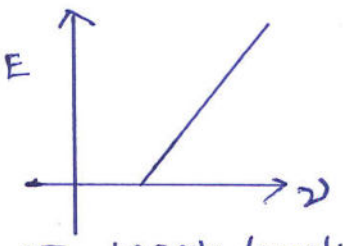
called Photo electric effect. The ejected electrons Contribute Photoelectric current. The variation of Photo electric current with various factors such as intensity of incident radiation, frequency of incident radiations were studied. But wave theory failed to explain this effect. Einstein explain this effect based on photon picture of radiation and the Photoelectric effect is due to the interaction of matter with Photon of energy $h\nu$.

1. Green light causes emission of photo electron from a surface, but not the yellow light. Emission of photo electrons will occur if the surface is illuminated by

(a) micro waves (b) red rays (c) UV rays (d) IR rays.

2. The graph of KE of emitted electrons with foequency of incident radiation is plotted as shown. The slope of the curve is

(a) $\frac{h}{\nu}$ (b) h (c) hc (d) h/e

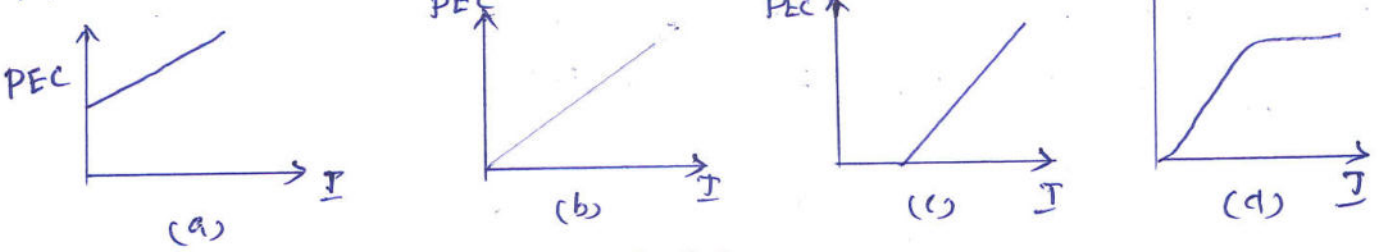


3. The Stopping potential when a metal with work function 0.6 ev is illuminated with light of energy 2ev will be

(a) 1.4 V (b) 2.8 eV (c) 4.2 eV (d) 0.7 V

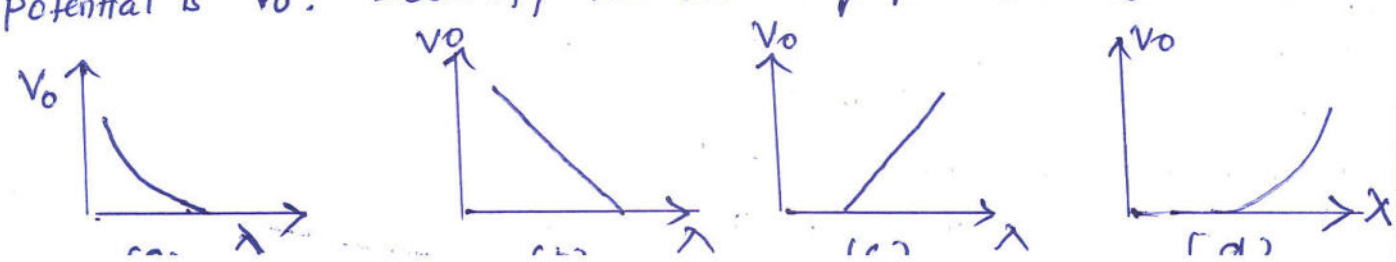
4. The graph between intensity of light (I) falling on a metallic Plate with the Photo electric current is

(i)



(OR)

(ii) For a Photon of wave length λ incident on a surface the stopping potential is V_0. Identify the Correct graph for V_0 (Vs) λ.



33. (a) Define the term resistivity of a Conductor. Give its SI unit. Show that the resistance of the conductor is $R = \frac{m l}{n A e^2 \tau}$.

(b) Draw a plot showing the variation of resistivity of a (i) metal (ii) Semi conductor with rise of temperature.

(OR)

(a) Two cells of emf E_1 and E_2 and internal resistances r_1 and r_2 are connected in parallel. Derive the expression for equivalent emf and equivalent internal resistance of the combination

(b) A storage battery of emf 8.0 V and internal resistance 0.5 Ω is being charged by a 120 V dc supply using a series resistor of 15.5 Ω. What is the terminal voltage of the battery during charging? (5)

DELHI PUBLIC SCHOOL, BHILAI

CLASS : XII | **SAMPLE PAPER** | **SUBJECT – PHYSICS** | **Time : 3 Hrs.** | **Max. Marks : 70**

General Instructions :

(1) There are 33 questions in all. All questions are compulsory.
(2) This question paper has five sections : Section A, Section B, Section C, Section D and Section E.
(3) All the sections are compulsory.
(4) **Section A** contains sixteen questions, twelve MCQs and four Assertion and Reasoning based of 1 mark each. **Section B** contains five questions of two marks each, **Section C** contains seven questions of three marks each, **Section D** contains two case study based questions of four marks each and Section E contains three long answer questions of five marks each.
(5) There is no overall choice. However, an internal choice has been provided in one question in Section B, one question in Section C, one question in each CBQ in Section D and all three question in Section E. You have to attempt only one of the choices in such questions.
(6) Use of calculator is not allowed.
(7) You may use the following values of physical constants wherever necessary.
   i. $c = 3 \times 10^8 m/s$
   ii. $m_e = 9.1 \times 10^{-31} kg$
   iii. $e = 1.6 \times 10^{-19} C$
   iv. $\mu_0 = 4\pi \times 10^{-4}\ TmA^{-1}$
   v. $h = 6.63 \times 10^{-34} JS$
   vi. $\varepsilon_0 = 8.854 \times 10^{-12} C^2 N^{-1} m^{-2}$

SECTION – A

1. The angle between the electric field lines and the equipotential surface is-
   (a) 0^0 (b) 45^0 (c) 90^0 (d) 180^0 (1)
2. If the charge on the capacitor is increased by 2C, the energy stored in it increases by 44%. The original charge on the capacitor is-
   (a) 10C (b) 20C (c) 30C (d) 40C (1)
3. Two parallel, long wires are kept 0.20m apart in vacuum, each carrying current of x A in the same direction. If the force of attraction per metre of each wire is 2×10^{-6} N, then the value of x is nearly-
   (a) 1 (b) 2.4 (c) 1.4 (d) 2 (1)
4. To convert a galvanometer in to ammeter, we must connect a,
   (a) Low resistance in series. (b) High resistance in parallel.
   (c) Low resistance in parallel. (d) High resistance in series. (1)
5. A circular loop of area $0.01m^2$carrying a current of 10A, is held perpendicular to a magnetic field of intensity 0.1T. the torque acting on the loop is-
   (a) zero (b) 0.001 Nm (c) 0.01 Nm (d) 0.8Nm (1)
6. Unit of Magnetic dipole moment is
   (a) amp-m^2 (b) amp/m^2 (c) wb/m (d) wb-m^2 (1)
7. Which of the following characteristics is not associated with ferromagnetic material?
   (a) It is strongly attracted by a magnet.
   (b) Its origin is the spin of electrons.
   (c) It tends to move from a region of strong to weak magnetic field.
   (d) Above the Curie temperature, it exhibits Paramagnetic Property. (1)
8. The magnetic flux linked with the coil (in weber) is given by the equation $\emptyset = 5t^2 + 3t + 16$. The induced EMF in the coil at time t=4s will be-
   (a) -27V (b) -43V (c) -108V (d) 210V (1)
9. Which of the following relation is correct?
   (a) $\sqrt{\varepsilon_o E_o} = \sqrt{\mu_o B_o}$ (b) $\sqrt{\mu_o \varepsilon_0} = \frac{B_o}{E_o}$ (c) $E_o = \sqrt{\mu_o \varepsilon_o B_o}$ (d) $\sqrt{\mu_o E_o} = \sqrt{\varepsilon_o B_o}$ (1)
10. The threshold frequency for a photosensitive metal is 3.3×10^{14}Hz. if light of frequency 8.2×10^{14}Hz is incident on this metal, the cut-off voltage for the photoelectric emission is nearly- (1)
    (a) $5V$ (b) $1V$ (c) $2V$ (d) $3V$
11. In Rutherford's α particle scattering experiment, what will be the correct angle of scattering for an impact parameter b=0
    (a) 90° (b) 180° (c) 0° (d) 270° (1)
12. if r_1 and r_2 are the radii of the atomic nuclei of mass number 4 and 32 respectively, then the ratio r_1/r_2 is-
    (a) 1 : 2 (b) 1 : 3 (c) 1 : 4 (d) 1 : 5 (1)

For Questions 13 to 16, Two statements are given – one labelled Assertion (A) and other labelled Reason (R). Select the correct answer from the options given below:

(a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.
(b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
(c) Assertion is true but Reason is false.
(d) Both Assertion and Reason are false.

13. **Assertion (A):** The 200W bulb glows brighter than 100W bulb.

Reason (R): A 100W bulb has more resistance than a 200W bulb. (1)

14. **Assertion (A):** The de-Broglie equation has significance for any microscopic or sub-microscopic particle.
Reason (R): The de-broglie wavelength is inversely proportional to the mass of the object if velocity is constant. (1)

15. **Assertion (A):** In insulators, the forbidden gap is very large.
Reason (R): The valence electrons in an atom of an insulator are very tightly bound to the nucleus. (1)

16. **Assertion (A):** Critical angle of light passing from glass to air is minimum for violet colour.
Reason (R): The wavelength of violet light is greater than the light of other colours. (1)

SECTION – B

17. Define the term 'mobility' of charge carriers in a current carrying conductor. Obtain the relation for mobility in terms of relaxation time. (2)

OR

Define the term 'drift velocity' of electrons in a current carrying conductor. Obtain the relationship between the current density and the drift velocity of electrons. A potential difference 'V' is applied across conductor of length 'l '. How is the drift velocity affected when 'V' is doubled and 'l ' is halved? (2)

18. What is a rectifier? Draw a neat circuit diagram of a full wave rectifier. Draw the input and output wave forms. How is it different from half wave rectifier? (2)

19. State Kirchhoff's rules. Use them to obtain the condition of balance for a Wheatstone Bridge. (2)

20. Draw a neat labeled diagram of image formation by a astronomical telescope in normal adjustment. Write the formula for magnification in this adjustment. (2)

OR

Draw a neat labeled diagram of image formation by a compound microscope in near point adjustment. Write the formula for magnification in this adjustment.

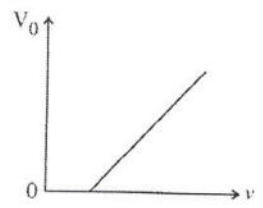
21. Define total internal reflection. Find the relation between critical angle and refractive index of the media.(2)

SECTION – C

22. (a) The electric field of an em wave passing through vacuum is represented as $E_x = E_0 \sin(kz - \omega t)$. Identify the parameter which is related to the (i) wavelength and (ii) the frequency of the wave in the above equation.
(b) Write two properties of a medium that determines the velocity of light in that medium. (3)

23. Define nuclear Binding Energy. Plot a graph between binding energy per nucleon and mass number. How does this curve explain the release of energy both in the processes of nuclear fission and fusion ? (3)

24. What do you understand by stopping potential. The figure shows the variation of stopping potential Vo with frequencies of incident monochromatic beam for a metal. Explain how, using Einstein's photoelectric equation and the graph, you can obtain the value of (i) Planck's constant, and (ii) work function of the metal, given the charge on electron. (3)



25. State Gauss's Law. Using it deduce the expression for the electric field due to uniformly charged spherical conducting shell of radius R at a Point (i) outside and (ii) inside the shell. Plot a graph showing variation of electric field as a function of r > R and r < R (r being the distance from the centre of the shell). (3)

26 (a) Define mutual inductance. Write its SI unit.
(b) Write the expression for mutual inductance of long solenoid of length l having 'N' turns. (3)

OR

With the help of diagram explain principle and working of moving coil galvanometer. Hence explain how it can be converted to voltmeter.

27. State Biot-Savart law. Use it to derive an expression for the magnetic field due to a circular coil carrying current at a point along its axis. (3)

28. Using Bohr's postulates derive an expression for energy of n^{th} orbit of electron in Hydrogen atom. (3)

SECTION – D

Case Study Based Questions:

29. **Read the following paragraph and answer the questions that follow:** **(1x4=4)**

A lens is a transparent optical medium bounded by two surfaces, at least one of which should be spherical. Considering image formation by a single spherical surface successively at the two surfaces of a lens, Lens maker's formula is obtained. It is useful to design lenses of desired focal length. Lenses are used in different optical instruments, for example microscopes and telescopes.

(i) Which quantity of incident light remains unchanged after refraction?
(a) wavelength (b) frequency (c) intensity (d) amplitude

(ii) How does focal length of a convex lens change if monochromatic red light is used instead of violet light?
(a) Increases (b) decreases (c) remain unchanged (d) None of the above

(iii) For same angle of incidence, the angle of refraction in media P, Q *and* R are $35°$, $25°$ and $15°$ respectively. If V_P, V_Q and V_R are the speed of light in medium P, Q and R, then:
(a) $V_P = V_Q = V_R$ (b) $V_P = V_Q > V_R$
(c) $V_P > V_Q > V_R$ (d) $V_P = V_Q < V_R$

OR

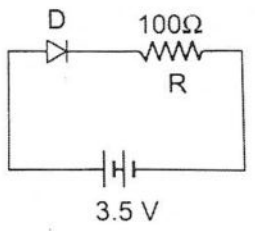
A small ink dot on a paper is seen through a glass slab of thickness 4 cm and refractive index 1.5. The dot appears to be raised by
(a) 1 cm (b) 2 cm (c) 3 cm (d) 1.33 cm

(iv) A planoconvex lens is made of refractive index 1.6. If the radius of curvature of the curved surface is 60 cm, then focal length of lens is
(a) 50cm (b) 100cm (c) 200cm (d) 400cm

30. **Read the following paragraph and answer the questions that follow :** **(1x4=4)**

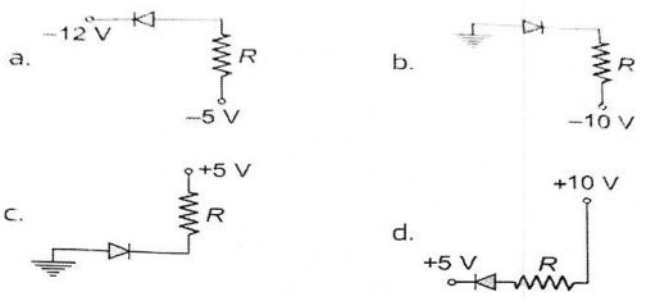
A Semiconductors diode is basically a p-n junction with metallic contacts provided at the ends for the application of an external voltage. It is two terminal device. When p side is connected to positive terminal of the battery and n side to negative terminal of the battery, it is said to be forward biased. If its p side is connected to negative terminal and n side to positive terminal of battery , it is said to be in reverse biased.

(i) In the given figure, a diode D is connected to an external resistance R=100□ and an emf of 3.5V. If the barrier potential developed across the diode is 0.5V, the current in the circuit will be-



(a) 40mA (b) 20mA (c) 35mA (d) 30mA

(ii) In which of the following figures, the p-n diode is reverse biased?



(iii) The formation of depletion layer in a p-n junction diode is due to
(a) movement of dopant atoms
(b) diffusion of both electrons and holes
(c) drift of electrons only
(d) drift of holes only

OR

If p-n junction diode is reverse biased,
(a) the potential barrier is lowered
(b) the potential barrier remains unaffected
(c) the potential barrier is raised
(d) the current is mainly due to majority carriers.

(iv) Barrier potential of p-n junction diode does not depend upon-
(a) diode design (b) temperature (c) forward bias (d) doping density

SECTION – E

31. (i) Define capacitance of a capacitor. Write its SI unit.
(ii) A dielectric slab of thickness 't' is kept between the plates of a parallel plate capacitor with plate separation d (t<d). Derive the expression for the capacitance.
(iii) A capacitor is charged to a potential V by connecting it to a battery. After some time, the battery is disconnected and a dielectric slab is introduced between the plates. How will the potential difference between the plates, and the energy stored in it be affected? Justify your answer.

(5)

OR

(i) Define Electric dipole moment. Write its SI unit.
(ii) Derive an expression for electric field due to a dipole.
(iii) A uniform electric field E of 500N/m is directed along +x axis.), B and A are three points in the field having x and y coordinates (in cm) (0,0), (4,0) and (0,3) respectively. Calculate the potential difference between the points (i) O and A, and (ii) O and B.

32. (i) In a series LCR circuit connected across an AC source of variable frequency, obtain the expression for its impedance and draw a plot showing its variation with frequency of the AC source.
(ii) What is the phase difference between the voltage across inductor and the capacitor at resonance in the LCR circuit?
(iii) When an inductor is connected to a 200V DC voltage, a current of 1 A flows through it. When the same inductor is connected to a 200V, 50Hz AC source, only 0.5A current flows. Explain, why?

(5)

OR

(a) You are given three circuit elements X, Y and Z. They are connected one by one across a given AC source. It is found that V and I are in phase for element X. V leads I by □/2 for element Y while I leads V by □/2 for element Z. Identify elements X, Y and Z.
(b) Establish the expression for impedance of circuit when X, Y and Z are connected in series to an AC source. Show the variation of current in the circuit with the frequency of the applied AC source.
(c) Obtain the conditions under which (i) impedance is minimum and (ii) wattless current flows in the circuit.

33 (i) With the help of neat ray diagram, derive lens maker's formula for a Convex lens.
(ii) Light from a point source in air falls on a convex spherical glass surface of refractive index 1.5 and radius of curvature 20cm. The distance of light source from the glass surface is 100cm. At what position is the image formed?

(5)

OR

(i) Define wave front. Using Huygens construction of secondary wavelets, draw a diagram showing the passage of a plane wave front from rarer to a denser medium. Using it verity Snell's Law.
(ii) Write two differences between interference pattern and diffraction pattern.

Sample Paper

Class XII 2024-25

Physics

Time: 3 Hours ***Max. Marks: 70***

General Instructions:

1. There are 33 questions in all. All questions are compulsory.
2. This question paper has five sections: Section A, Section B, Section C, Section D and Section E.
3. All the sections are compulsory.
4. Section A contains sixteen questions, twelve MCQ and four assertion reasoning based of 1 mark each, Section B contains five questions of 2 marks each, Section C contains seven questions of 3 marks each, Section D contains two case study based questions of 4 marks each and Section E contains three long questions of 5 marks each.
5. There is no overall choice. However, an internal choice has been provided in one question in Section B, one question in Section C, one question in each CBQ in Section D and all three questions in Section E. You have to attempt only one of the choices in such questions
6. Use of calculators is not allowed.

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SECTION A

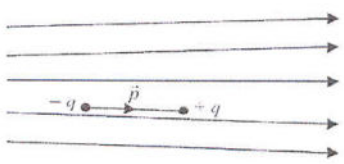
1.Figure shows electric field lines in which an electric dipole p is placed as shown. Which of the following statements is correct?

(a) The dipole will not experience any force.

(b) The dipole will experience a force towards right.

(c) The dipole will experience a force towards left.

(d) The dipole will experience a force upwards.



2.With increase in temperature the conductivity of
(a) metals increases and of semiconductor decreases.
(b) semiconductors increases and of metals decreases.
(c) in both metals and semiconductors increases.
(d) in both metal and semiconductor decreases.

3. A charged particle is moving on circular path with velocity v in a uniform magnetic field B, if the velocity of the charged particle is doubled and strength of magnetic field is halved, then radius becomes
(a) 8 times
(b) 4 times
(c) 2 times
(d) 16 times

4.A strong magnetic field is applied on a stationary electron. Then the electron
(a) moves in the direction of the field.
(b) remains stationary.
(c) moves perpendicular to the direction of the field.
(d) moves opposite to the direction of the field.

5.Which substance is attracted by the magnetic field ;

(a)Paramagnetic (b)Ferromagnetic (c)Diamagnetic (d)Ferrimagnetic

6.To reduce the resonant frequency in an series LCR circuit with a generator
(e) the generator frequency should be reduced.
(f) another capacitor should be added in parallel to the first.
(g) the iron core of the inductor should be removed.
(h) dielectric in the capacitor should be removed.

7.The part of the spectrum of the electromagnetic radiation used to cook food is
(i) ultraviolet rays
(j) cosmic rays
(k) X rays
(l) Microwaves

8.Which of the following statements is not correct?
(a) Whenever the amount of magnetic flux linked with a circuit changes, an emf is induced in the circuit.
(b) The induced emf lasts so long as the change in magnetic flux continues.
(c) The direction of induced emf is given by Lenz's law.
(d) Lenz's law is a consequence of the law of conservation of momentum.

9.Two slits in Young's double slit experiment have widths in the ratio 81: 1. The ratio of the amplitudes of light waves is
(a) 3: 1
(b) 3: 2
(c) 9: 1
(d) 6: 1

10.Electrons used in an electron microscope are accelerated by a voltage of 25 kv, if the voltage were increased to 100 kv then the de Broglie wavelength associated with electron would:
(a)decreases by two times (b)decreases by 4 times (c)increases by 4 times (d)increases by two times

11. The nuclear radius of a certain nuclei is 7.2 fm and it has the charge 1.28×10^{-17}C .Then the number of neutrons present in the nuclei are ;(Given empirical constant R_0=1.2fm)
(a) 136 (b) 142 (c) 140 (d) 132

12. The direction of transmission of electromagnetic wave is,
(a) Parallel to $\vec{E}$ (b) Parallel to $\vec{B}$ (c) Parallel to $\vec{B}\times\vec{E}$ (d) Parallel to $\vec{E}\times\vec{B}$

For Questions 13 to 16, two statements are given -one labelled Assertion (A) and other labelled Reason (R). Select the correct answer to these questions from the options as given below.

(a) If both Assertion and Reason are true and Reason is correct explanation of Assertion.

(b) If both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

(c) If Assertion is true but Reason is false.

(d) If both Assertion and Reason are false.

13.Assertion (A): The positively charged nucleus of an atom has a radius of almost 10^{-15} m. Reason

(R): In α-particle scattering experiment, the distance of closest approach for α-particles is 10^{-15} m.

14.Assertion (A): An alternating current shows magnetic effect.

Reason (R): Magnitude of alternating current varies with time.

15.Assertion (A): For best contrast between maxima and minima in the interference pattern of Young's double slit experiment, the intensity of light emerging out of the two slits should be equal.

Reason (R): The intensity of interference pattern is proportional to square of amplitude.

16.Assertion (A): Photosensitivity of a metal is high if its work function is small.

Reason (R): Work function $= hv_0$, where v_0 is the threshold frequency.

SECTION B

17.Name the parts of the electromagnetic spectrum which is

a)suitable for radar systems used in aircraft navigation.

b)used to treat muscular strain.

Write in brief, how these waves can be produced.

OR

What is Maxwell's displacement current ?Write its expression in terms of rate of change of electric flux .How Maxwell generalized the ampere circuital law in the light of displacement current ?

18.A galvanometer with a coil of resistance shows full scale deflection for a potential difference 25mV. What should be the value of resistance to convert the galvanometer into a voltmeter of range 0V to 5V. How should it be converted?

19.An object of 3 cm height is placed at a distance of 60 cm from a convex mirror of focal length 30 cm. Find the (i) nature, (ii) position and (iii) size of the image formed.

20.For producing a Fraunhofer diffraction fringe, a screen is placed 2m away from a single narrow slit. If the width of slit is 0.2 mm, it is found that first minimum lies 5 mm on either side of the central maximum. Find the wavelength of the incident light.

SECTION C

21.Derive an expression for force per unit length between the two long straight parallel conductors carrying current and hence define one ampere .

22. Show diagrammatically two different arrangements used for winding the primary and secondary coils in a transformer. Assuming the transformer to be an ideal one, write the expression for the ration of its:

(i) Output voltage to input voltage.

(ii) Output current to input current.

Mention two reasons for energy losses in an actual transformer.

23.A circuit is set up by connecting $L = 100\text{mH}$, $C = 5\mu\text{F}$ and $R = 100\Omega$ in series. An alternating emf of $150\sqrt{2}/\pi$ V, 500 Hz is applied across this series combination. Calculate

(a) The impedance of the circuit.

(b) The peak value of the current flowing in the circuit.

(c) The power factor of this circuit.

24.(a) An electron and a proton are accelerated through the same potential. Which one of the two has

(i) greater value of de-Broglie wavelength associated with it, and

(ii) lesser momentum? Justify your answer in each case.

(b) How is the momentum of a particle related with its de-Broglie wavelength? Show the variation on a graph.

OR

(a) Write Einstein's photoelectric equation . How we can determine the Plank's constant and the work function of a metal using this equation.

(b) The maximum kinetic energy of the photoelectrons gets doubled when the wavelength of light incident on the surface changes from λ_1 to λ_2. Derive the expressions for the threshold wavelength λ_0 and work function for the metal surface

25.The value of ground state energy of hydrogen atom is -13.6eV.

(i) Find the energy required to move an electron from the ground state to the first excited state of the atom.

(ii) Determine (a) the kinetic energy and (b) orbital radius in the first excited state of the atom. (Given the value of Bohr radius $= 0.53\text{Å}$).

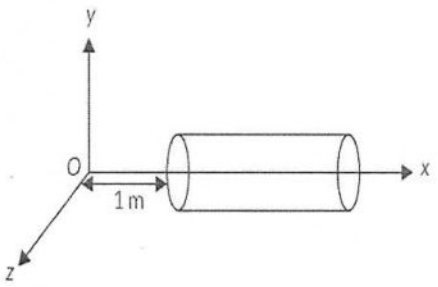
26.(i) Draw V-I characteristics of a $p-n$ junction diode.

(ii) Write the property of a junction diode which makes it suitable for rectification of ac voltages.

27.A hollow cylindrical box of length 1 m and area of cross-section 25 cm^2 is placed in a three dimensional coordinate system as shown in the figure. The electric field in the region is given by $\vec{E} = 50x\hat{\imath}$, where E is in NC^{-1} and x is in metres. Find

(i) net flux through the cylinder

(ii) charge enclosed by the cylinder.



28. i)Depict the behaviour of the magnetic field lines in the presence of a)paramagnetic and b) diamagnetic materials.

ii) The susceptibility of a magnetic material is $2x10^{-5}$. Nind type of magnetic material it represents.

SECTION D

Case Study Based Questions

29.Read the following paragraph and answer the questions that follow.

Optical fibre

An optical fibre is a thin tube of transparent material that allows light to pass through, without being refracted into the air or another external medium. It make use of total internal reflection. These fibres are fabricated in such a way that light reflected at one side of the inner surface strikes the other at an angle larger than critical angle. Even, if fibre is bent, light can easily travel along the length.

(i) Which of the following is based on the phenomenon of total internal reflection of light?

(a) Sparkling of diamond (b) Instrument used by doctors for endoscopy

(c) Optical fibre communication (d) All of these

(ii) A ray of light will undergo rotal internal reflection inside the optical fibre, if it

(a) goes from rarer medium to denser medium

(b) is incident at an angle less than the critical angle

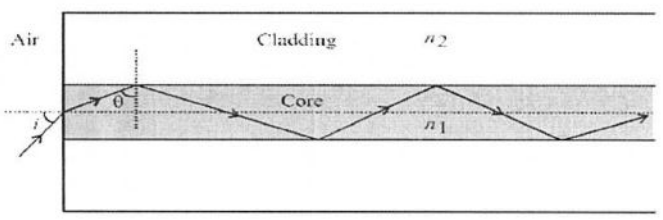
(c) strikes the interface normally

(d) is incident at an angle greater than the critical angle

(iii) If in core, angle of incidence is equal to critical angle, then angle of refraction will be

(a) 0° (b) 45° (c) 90 (d) 180°

(iv) In an optical fibre (shown), correct relation for refractive indices of core and cladding is,



(a) $n_1 = n_2$ (b) $n_1 > n_2$ (c) $n_1 < n_2$ (d) $n_1 + n_2 = 0$

(v) If the value of critical angle is 30° for total internal reflection from given optical fibre, then speed of light in that fibre is

(a) 3×10^8 m s^{-1} (b) 1.5×10^8 m s^{-1} (c) 6×10^8 m s^{-1} (d) 4.5×10^8 m s^{-1}

30.Read the following paragraph and answer the questions that follow.

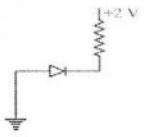
Biasing of Diode

When the diode is forward biased, it is found that beyond forward voltage $V = V_k$, called knee voltage, the conductivity is very high. At this value of battery biasing for $p - n$ junction, the potential barrier is overcome and the current increases rapidly with increase in forward voltage.

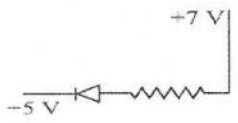
When the diode is reverse biased, the reverse bias voltage produces a very small current about a few microamperes which almost remains constant with bias. This small current is reverse saturation current.

(i) In which of the following figures, the $p - n$ diode is forward biased.

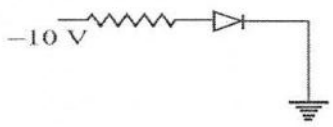
(a)



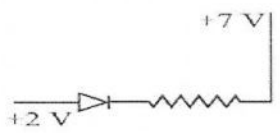
(b)



(c)



(d)



(ii) Based on the $V - I$ characteristics of the diode, we can classify diode as

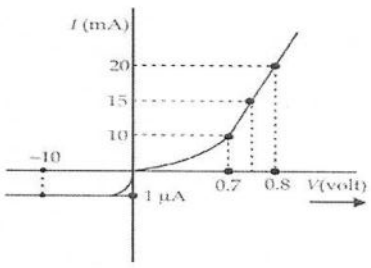
(a) bi-directional device

(b) ohmic device

(c) non-ohmic device

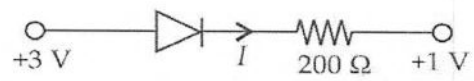
(d) passive element

(iii) The $V - I$ characteristic of a diode is shown in the figure. The ratio of forward to reverse bias resistance is



(a) 100
(b) 10^6
(c) 10
(d) 10^{-6}

OR



If an ideal junction diode is connected as shown, then the value of the current I is

(a) 0.013 A
(b) 0.02 A
(c) 0.01 A
(d) 0.1 A

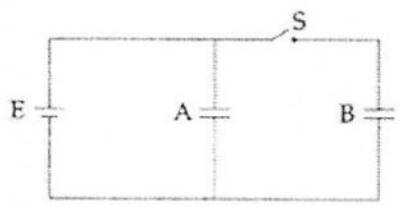
iv.How does dynamic resistance of a diode vary with temperature?
(a) directly proportional (b) inversely proportional
(c) independent of temperature (d) directly proportional to the square of temperature

SECTION E

31.a)State Gauss theorem in electrostatics and hence derive an expression for electric field due to a uniformly charged spherical shell at a point a)outside b)on the surface and d)inside the shell .
b) A charge of 4×10^{-8} C is distributed uniformly on the surface of a sphere of radius 1 cm.What is the electric field at a distance a) 2.0 cm and b) 0.5 cm from the centre of the sphere.

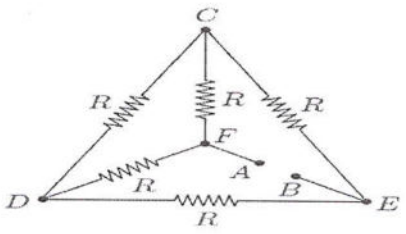
OR

a)Derive an expression for the capacity of a parallel plate capacitor .On what factors does it depend ?
b) Two identical parallel plate capacitors A and B are connected to a battery of V volts with the switch S closed. The switch is now opened and the free space between the plates of the capacitors is filled with a dielectric of dielectric constant K. Find the ratio of the total electrostatic energy stored in both capacitors before and after the introduction of the dielectric.



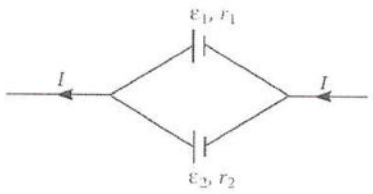
32. a)State wheat stone bridge principle brifly. Using kirchhoff's rules derive condition for balanced wheatstone bridge.

b)Five equal resisters each R are connected as shown in the figure .A battery of V volt is connected between the terminals A&B .Find the current drawn from the battery.



OR

a)Two cells of emf ε_1, ε_2 and internal resistance r_1 and r_2 respectively are connected in parallel in the figure.



Deduct the expression for

(i) The equivalent emf of the combination.

(ii) The equivalent internal resistance of the combination.

(iii) The potential difference between the points A and B.

b)Two identical cells whether connected in series or in parallel with each other send the same current through an external resistance R. What is the internal resistance of the each cell ?

33.(a) Draw the intensity pattern for single slit diffraction and double slit interference. Hence, state differences between interference and diffraction patterns.

(b) What is the effect on the interference fringes in Young's double slit experiment when (i) the width of the source slit is increased; (ii) the monochromatic source is replaced by a source of white light?

OR

(a) Draw a ray diagram showing the image formation by an astronomical telescope when the final image is formed at infinite.

(b) (i) A small telescope has an objective lens of focal length 140 cm and an eyepiece of focal length 5.0 cm. Find the magnifying power of the telescope for viewing distant objects when the telescope is in normal adjustment and the final image is formed at the least distance of distinct vision.

(ii) Also find the separation between the objective lens and the eyepiece in normal adjustment.

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DELHI PUBLIC SCHOOL, BHILAI

CLASS - XII PRACTICE PAPER – 2024-25 MM - 70

General Instructions:

1. There are 33 questions in all. All questions are compulsory.
2. This question paper has five sections : Section A, Section B, Section C, Section D and Section E.
3. All the sections are compulsory.
4. **Section A** contains sixteen questions, twelve MCQ and four Assertion Reasoning based of **1 mark each, Section B** contains five questions of **two marks each, Section C** contains seven questions of three marks each, **Section D** contains two case study based questions of four marks each and **Section E** contains three long answer question of five marks each
5. There is no overall choice. However, an internal choice has been provided in one question in Section B, one question in section C one question in each CBQ in Section D and all three question of Section E. You have attempt only one choices in such question.
6. Use of calculator is not allowed.

SECTION - A

1. Electric flux of an electric field $\vec{E}$ through an area $d\vec{A}$ is given by:

   (A) $\vec{E} \times d\vec{A}$ (B) $\frac{\vec{E} \times d\vec{A}}{\varepsilon_0}$ (C) $\vec{E}.d\vec{A}$ (D) $\frac{\vec{E}.d\vec{A}}{\varepsilon_0}$ (1)

2. A uniform electric field pointing in positive X-direction exists in a region. Let A be the origin, B be the point on the X-axis at x = -1 cm and C be the point on the Y-axis at y = +1 cm. Then the potential at points A, B and C satisfy:

   (A) $V_A < V_B$ (B) $V_A > V_B$ (C) $V_A < V_C$ (D) $V_A > V_C$ (1)

3. A long straight wire of circular cross section of radius 'a' carries a steady current I. The current is uniformly distributed across its cross section. The ratio of magnitude of the magnetic field at a point a/2 above the surface of wire to that of a point a/2 below its surface is:

   (A) 4 : 1 (B) 1 : 1 (C) 4 : 3 (D) 3 : 4 (1)

4. A long wire carries a steady current. It is bent into a circle of one turn and the magnetic field at the centre of the coil is B. It is then bent into a circular loop of n turns. The magnetic field at the centre of the coil will be :

   (A) nB (B) n^2B (C) 2 nB (D) $2n^2B$ (1)

5. A current carrying circular loop of magnetic moment is suspended in a vertical plane in an external magnetic field such that its plane is normal to . The work done in rotating this loop by 45^0 about an axis perpendicular to is closest to :

   (A) - 0.3 MB (B) 03 MB (C) - 1.7 MB (D) 1.7 MB (1)

6. A bar magnet is dropped in a hollow metallic cylinder along its vertical axis. The acceleration of falling magnet will be :
(a) zero (b) equal to g (c) less than g (d) greater than g (1)

7. The emf induced in a 10 H inductor in which current changes from 11 A to 2 A in 9×10^{-1} s is :
(A) 10^4 V (B) 10^3 V (C) 10^2 V (D) 10 V (1)

8. The magnetic field of an electromagnetic wave is represented as $B_X = V_0 \sin(ky - \omega t)$. It means that the wave propagation direction and wave vector k are respectively :
(A) + z axis, $\frac{2\pi}{v}$ (B) - z axis, $\frac{2\pi}{T}$ (C) + y axis, $\frac{2\pi}{\lambda}$ (D) - y axis, $\frac{\lambda}{2\pi}$ (1)

9. The distance of closest approach of an alpha particle is d when it moves with a speed V towards nucleus. Another alpha particle is projected with higher energy such that the new distance of the closest approach is d/2. What is the speed of projection of the alpha particle in this case?
(A) V/2 (B) $\sqrt{2}$V (C) 2 V (D) 4V (1)

10. The ratio of the energy of a photon with $\lambda = 150$ nm to that with $\lambda = 300$ nm is
(a) 2 (b) 1 / 4 (c) 4 (d) 1 / 2 (1)

11. Ratio of longest wavelengths corresponding to Lyman and Balmer series is hydrogen spectrum is :
(a) 5 / 27 (b) 3 / 23 (c) 7 / 29 (d) 9 / 31 (1)

12. The breakdown in a reverse biased p-n junction diode is more likely to occur due to :
(a) large velocity of the minority charge carriers if the doping concentration is small. (1)
(b) large velocity of the minority charge carriers if the doping concentration is large.
(c) strong electric field in a depletion region if the doping concentration is small.
(d) strong electric field in the depletion region if the doping concentration is large.

For Question 13 to 16, two statements are given - one labelled Assertion (A) another labelled Reason (R). Select the correct answer to these questions from the options as given below.

(a) If both Assertion and Reason are true and Reason is correct explanation of Assertion.
(b) If both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
(c) If Assertion is true but Reason is false.
(d) If both Assertion and Reason are false.

13. Assertion(A) : Silicon is preferred over germanium for making semiconductor devices.
Reason (R) : The energy gap for germanium is more than the energy gap for silicon . (1)

14. Assertion(A) : de Broglie's wavelength of a freely falling body keeps decreasing with time.

Reason(R) : The momentum of the freely falling body increases with time. (1)

15. Assertion (A) : Nuclei having mass number about 60 are least stable.

Reason(R) : When two or more light nuclei are combined into a heavier nucleus then the binding energy per nucleon will decrease. (1)

16. Assertion(A) : In phase difference between any two points on a wavefront is zero.

Reason (R) : All points on a wavefront are at the same distance from the source and thus oscillate in the same phase. (1)

SECTION - B

17. Define the term 'mobility' of charge carriers in a current carrying conductor. Obtain the relation for mobility in terms of relaxation time. (2)

OR

Define the term 'drift velocity' of electrons in a current carrying conductor. Obtain the relationship between the current density and the drift velocity of electrons.

18. A converging lens has a focal length of 20 cm in air. It is made of a material of refractive index 1.6. If it is immersed in a liquid of refractive index 1.3. What will be its new focal length ?. (2)

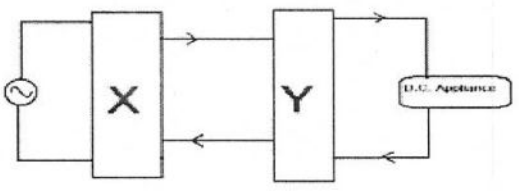
19. Use mirror equation to show that

(i) on object placed between f and 2f of a concave mirror produces a real image beyond 2f.

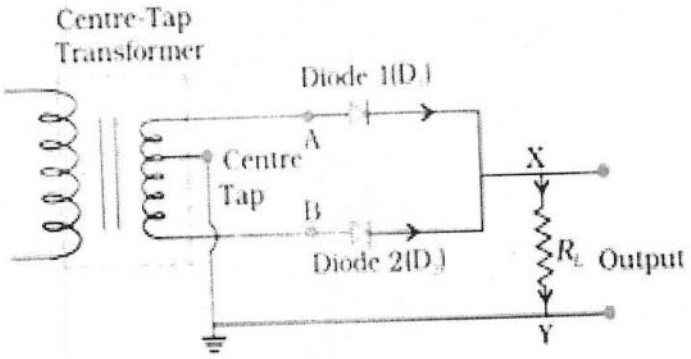
(ii) a convex mirror always produces a virtual image independent of the location of the object. (2)

20. A platinum surface having work function 5.63 eV is illuminated by a monochromatic source of 1.6×10^{15} Hz. What will be the minimum wavelength associated with the ejected electron.

21.(a) Identify the circuit elements X and Y as shown in the given block diagram and draw the output waveforms of X and Y. (2)

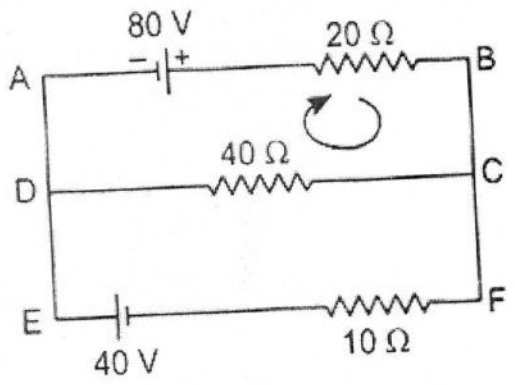


(b) If the centre tapping is shifted towards Diode D_1 as shown in the diagram, draw the output waveform of the given circuit.



SECTION – C

22. Using Kirchhoff's rules, calculate the current through the 40 Ω and 20 Ω resistors in the following circuit:



(3)

23. A boy is holding a smooth, hollow and non-conducting pipe vertically with charged spherical ball of mass 10 g carrying a charge of +10 mC inside it which is free to move along the axis of the pipe. The boy is moving the pipe from East to West direction in the presence of magnetic field of 2T. With what minimum velocity, should the boy move the pipe such that the ball does not move along the axis. Also determine the direction of the magnetic field.

24. Alternating voltage and current in circuit is given as V = (100 sin ω t) volt

$I = 100\sin\ mA\left(\omega t + \frac{\pi}{3}\right)$. Find average power dissipated in circuit.

(a) 2.5 W (b) 5 W (c) 10 W (d) 20 W (3)

25. (a)The small ozone layer on top of the stratosphere is crucial for human survival. Why ?

Illustrate by giving suitable examples, how you can show that electromagnetic waves carry both energy and momentum. (1+2)

26. The energy of a hydrogen atom in the first excited state is - 3.4 eV. Find :

(a) the radius of this orbit. (Take Bohr radius = $0.53A^0$)
(b) the angular momentum of the electron in the orbit.
(c) the kinetic and potential energy of the electron in the orbit. (3)

OR

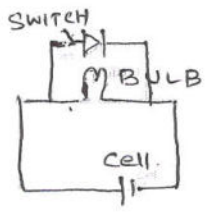
(a) Depict the variation of the potential energy of a pair of nucleons with the separation between them.

(b) Imagine the fission of a into two equal fragments of nucleus . Is the fission energetically possible? Justify your answer Given : m($^{56}_{26}$Fe) = 55.93494 u , m($^{28}_{13}$Al)=27.98191u. (1 +2)

27. State Bohr's first and second postulates. Use them to derive an expression for the radius of the n^{th} orbit in a hydrogen atom. (3)

28. (a) Draw the energy band diagram for P-type semiconductor at (i) T=0K and (ii) room temperature. (3)

(b)In the given diagram considering an ideal diode, in which condition will the bulb glow (a) when the switch is open (b) when the switch is closed Justify your answer. (1 +2)



SECTION - D

Section D contains 2 case study-based questions of 4 marks each.
Read the following paragraph and answer the following questions:

29. Case Study – **LENS**

The lens maker's formula is useful to design lenses of desired focal lengths using surfaces of suitable radii of curvature. The focal length also depends on the refractive index of the material of the lens and the surrounding medium. The refractive index depends on the wavelength of the light used. The power of a lens is related to its focal length. (1x 4=4)

Answer the following questions based on the above:

(i) How does the power of lens change with an increase of wavelength of light?

(a) Increases (b) Decreases

(c) Remains same (d) None of these

(ii) The radius of curvature of two surfaces of a convex lens is R each. For what value of μ of its material will its focal length become equal. to 'R'?

(a) 1.4 (b) 1.7 (c) 1.5 (d) 1.33

(ii) The focal length of a concave lens of μ = 1.5 is 20 cm in air. It is completely immersed in 4 water of μ = $\frac{4}{3}$. The focal length of lens in water is

(a) 80 cm (b) - 80 cm (c) 60 cm (d) 60 cm

(iv) An unsymmetrical double convex thin lens forms the image of a point object on its axis. If the lens is reversed

(a) The position of image change (b) The position of image change remain same

(c) The focal length of the lens will change (d) insufficient data

OR

We combine two lenses, one is convex and the other is concave having focal lengths f_1 and f_2 and their combined focal length F. Combination of the lenses will behave like concave lens, if

(a) $f_1 > f_2$ (b) $f_1 = f_2$ (c) $f_1 < f_2$ (d) $f_1 \leq f_2$

30. Case Study - **ELECTRICAL DIPOLE**

An electric dipole is a system consisting of the two equal and opposite point charges separated by a small and finite distance. If dipole moment of this system is $\vec{p}$ and it is placed in a uniform electric field $\vec{E}$. (1x 4=4)

(i) What is the expression of torque experienced by a dipole?

(a) $\vec{E} \times \vec{p}$ (b) $\vec{p} \times \vec{E}$ (c) $\vec{p} \times \vec{F}$ (d) pE

(ii) Identify two pairs of perpendicular vectors in the above expression

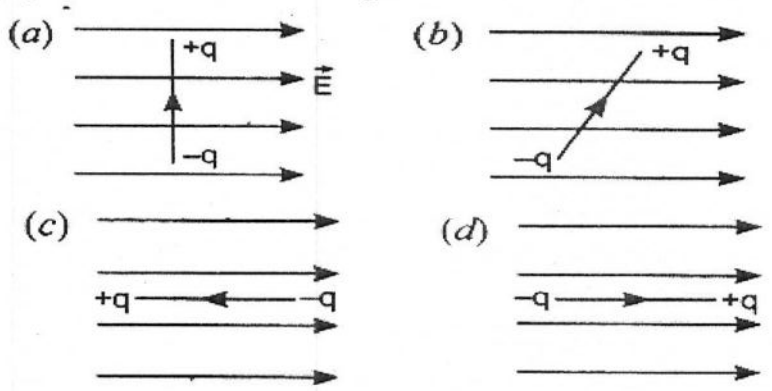
(a) Force is perpendicular to both $\vec{p}$ and $\vec{E}$.

(b) $\vec{E}$ is perpendicular to both $\vec{F}$ and $\vec{p}$.

(c) Torque is perpendicular to both $\vec{E}$ and $\vec{p}$.

(d) $\vec{p}$ is perpendicular to both torque and force

(iii) Which of the following orientation is for maximum torque?



(iv) Which of the following is a condition for stable equilibrium?

(a) $\vec{p} \parallel \vec{E}$ (b) $\vec{p} \perp \vec{E}$

(c) Angle between $\vec{p}$ and $\vec{E}$ is 180° (d) Angle between $\vec{p}$ and $\vec{E}$ is 30°

OR

(iv) If the dipole is placed in non-uniform electric field then

(a) F = 0 but $\tau \neq 0$ (b) F = 0 and $\tau = 0$

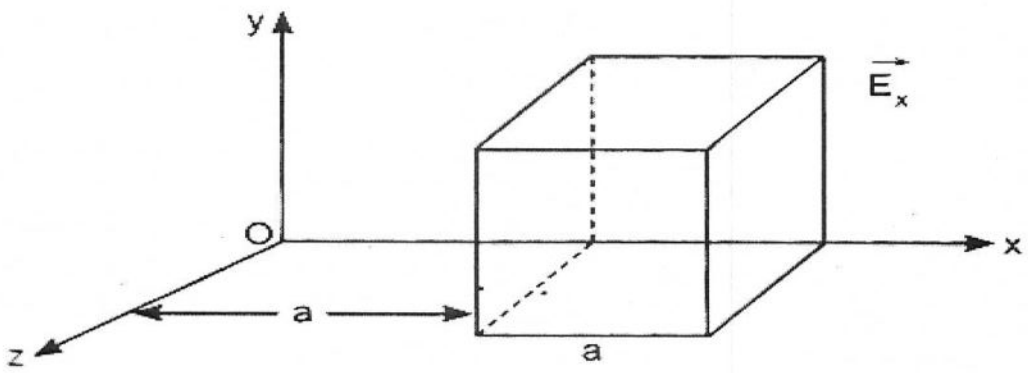
(c) $F \neq 0$ but $\tau \neq 0$ (d) $F \neq 0$ but $\tau = 0$

SECTION – E

Section E contains 3 long answer questions of 5 marks each.

31. (a) Use Gauss' law to obtain an expression for the electric field due to an infinitely long thin straight wire with uniform linear charge density λ.

(b) The electric field component in the figure shown are: $E = \alpha x$, $X E = 0$, $E=0$ where $a = 100$ N Cm Calculate the charge within the cube, assuming $a = 0.1$ m.



OR (3+2)

(a) Obtain the expression for the capacitance of a parallel plate capacitor in vacuum in terms of plate area A and separation d between the plates.

(b) A capacitor of capacitance C is charged to V volts by a battery. After some time the battery is disconnected and the distance between the plates is doubled. Now a slab of dielectric constant, $1 < k < 2$, is introduced to fill the space between the plates. How will the following be affected.

(a) The electric field between the plates of the capacitor.

(b) The energy stored in the capacitor. Justify your answer by writing the necessary expressions.

32.(a) Derive an expression for the force acting on a current carrying straight conductor kept in a magnetic field. State the rule which is used to find the direction of this force. Give the condition under which this force is (1) maximum, and (2) minimum.

(b) Two long parallel straight wires A and B are 2.5 cm apart in air. They carry 5.0 A and 2.5 A currents respectively in opposite directions. Calculate the magnitude of the force exerted by wire A on a 10 cm length of wire B.

OR (3+2)

(a) Using Biot-Savart's law, write the expression for the magnetic field B due to an element dl carrying current I at a distance r from it in a vector form.
Hence, derive the expression for the magnetic field due to a current carrying loop of radius R at a point P and distance x from its centre along the axis of the loop.

(b) Two long and parallel straight wires A and B carrying currents of 8.0 A and 5.0 A in the same direction are separated by distance of 4.0cm. Estimate the force on a 10 cm section of wire A

33. (a) Draw a labelled ray diagram showing the formation of an image by an astronomical refracting telescope in normal adjustment.

(b) A giant refracting telescope at an observatory has an objective lens of focal length 15 m. If an eyepiece of focal length 1.0 cm is used, what is angular magnification of the telescope in normal adjustment?
If this telescope is used to view the moon, what is the diameter of the image of the moon formed by the objective lens? The diameter of the moon is 3.48×10^6 m, and the radius of lunar orbit is 3.8×10^8 m. (2+3)

OR

(a) Draw a labelled ray diagram showing the formation of an image by an compound microscope when the final image is at near point.

(b) A compound microscope consists of an objective lens of focal length 2.0 cm and an eyepiece of focal length 6.25 cm separated by a distance of 15 cm. How far from the objective should an object be placed in order to obtain the final image at (a) the least distance of distinct vision (25 cm) and
(b) infinity? What is the magnifying power of the microscope in each case?

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Delhi Public School - Risali - Bhilai

Sample Paper- 2024'25

Sub: Physics | Marks : 70
Class : XII | Time : 3hrs

General Instructions:

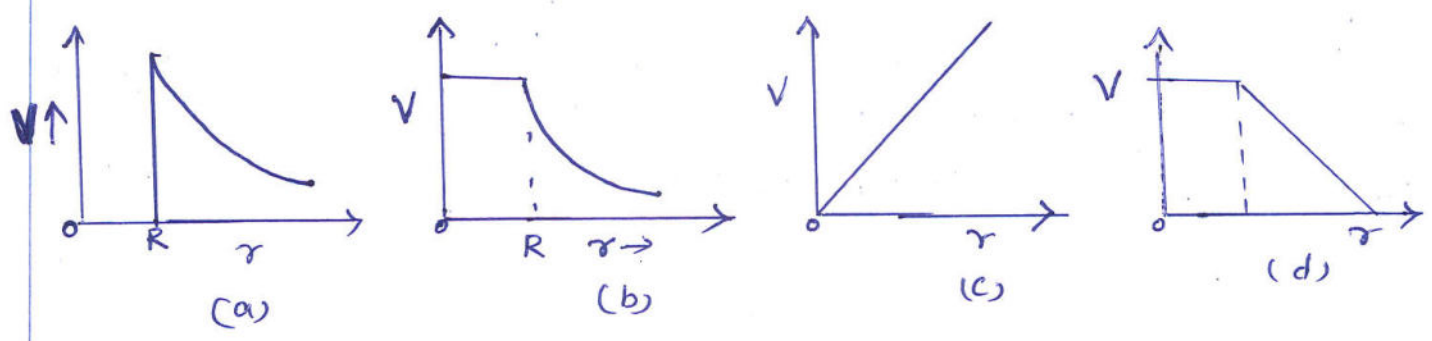
1. There are 33 questions in all. All questions are compulsory.
(i) Section A consist of twelve MCQ's and four Assertion and reasoning questions of 1 mark each. Section B contains five questions of 2 marks each. Section C Contains Seven question of 3 marks each. Section D contains two Case study question of 4 marks each. Section E Contains three 5 marks question.
(ii) An internal choice is provided in sections B, C and D.
(iv) All the three question in section E has internal choice.
(v) Use of calculator is not allowed.

Section A

1. Two point charges Placed in a medium of dielectric constant 5 are at a distance 'r' between them, Experience an electrostatic force 'F'. The electric force between them in vacuum at the same distance r will be

(a) 5F (b) F (c) F/2 (d) F/5

2. In the case of a charged metallic sphere of radius R Potential (V) changes with respect to distance (r) from the centre as.



3. Two equal resistances when Connected in series to a battery Consumes electric power of 60W. If these resistances are now connected in parallel Combination to the same battery, the electric power Consumed will be.

(a) 60W (b) 30W (c) 120W (d) 240W

4. B_x and B_y are the magnetic fields at the centre of the coils X and Y respectively each carrying equal current. If the coil X has 200 turns and 20 cm radius and the coil y has 400 turns and 20cm radius, the ratio of B_x and B_y is

(a) 1 : 1 (b) 1 : 2 (c) 2 : 1 (d) 4 : 1

5. The magnetic flux linked with the coil is given by $\phi = 5t^2 + 3t + 16$ weber. The induced emf in the coil at time $t = 4s$ will be

(a) -27 V (b) -108 V (c) -43 V (d) 210 V

6. In an electromagnetic wave the electric field vector and magnetic field vector are given as $\vec{E} = E_0 \hat{i}$ and $\vec{B} = B_0 \hat{k}$ respectively. the direction of propagation of electromagnetic wave is along.

(a) $-\hat{j}$ (b) $-\hat{k}$ (c) $\hat{j}$ (d) $\hat{k}$

7. The ratio of contributions made by the electric field and magnetic field components to the intensity of an electromagnetic wave is

(a) 1 : 1 (b) 1 : c (c) $1 : c^2$ (d) c : 1

8. An astronomical telescope of ten times angular magnification has a length 44 cm. The focal length of the objective lens is,

(a) 4cm (b) 44cm (c) 40cm d) 440cm.

9. To a fish underwater, viewing obliquely a fisherman standing on the bank of a lake, the man looks.

(a) taller than what he actually is (b) shorter than what he actually is.
(c) the same height as he actualy is (d) depends on the obliquity

10. If the screen is moved away from the plane of the slits in a young's double slit Experiment, then.

(a) angular separation of the fringe increases.
(b) angular separation of the fringe decreases.
(c) linear separation of the fringe increases.
(d) linear separation of the fringe decreases.

11. The size of the nucleus of an atom of mass number A is Proportional to

(a) $A^{3/4}$ (b) $A^{1/3}$ (c) $A^{2/3}$ (d) $A^{5/4}$

12. Carbon, silicon and germanium have four valance electrons each. These are characterised by valance and conduction band separated by energy gap given by $(E_g)_C$, $(E_g)_{Si}$ and $(E_g)_{Ge}$. Which of the following statement is true?

(a) $(E_g)_{Si} < (E_g)_{Ge} < (E_g)_C$ (b) $(E_g)_C < (E_g)_{Ge} > (E_g)_{Si}$

(c) $(E_g)_C > (E_g)_{Si} > (E_g)_{Ge}$ (c) $(E_g)_C = (E_g)_{Si} = (E_g)_{Ge}$.

For the questions 13 to 16 two statements are given one labelled as Assertion (A) and other labelled as Reason (R). Select the correct answer to these option questions from the options.

(a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

(b) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

(c) Assertion is true but Reason is false.

(d) Both Assertion and Reason are false.

13. Assertion : A pure semiconductor has negative temperature coefficient of resistance.
Reason : As temperature increases, more charge carriers are released, conductance increases.

14. Assertion : Balmer series lies in the visible region of E.M. spectrum.
Reason : $\frac{1}{\lambda} = R\left(\frac{1}{3^2} - \frac{1}{m^2}\right)$.

15. Assertion : Photoelectric effect demonstrate the wave nature of light
Reason : The number of photoelectrons is proportional to the frequency of light.

16. Assertion : Magnetic field interacts with moving charges and not with a stationary charge.
Reason : Moving charge produce magnetic field.

Section B

17. State Biot-Savart law. A long wire with a small current element of length 1cm is placed at the origin and carries a current of 10 A along the X axis. Find the magnitude and the

direction of the magnetic field due to the element on the y axis at a distance of 0.5m from it. (2)

18. Draw a labelled diagram of Cassegrain reflecting telescope. Write any two advantages of it over refracting type telescope. (2)

19. Define temperature coefficient of resistance. At room temperature (27°C), the resistance of the heating element is 100 Ω. What is the temperature of the element if the resistance is found to be 117 Ω? Given that temperature coefficient of resistance of the material is 1.70×10^{-4} per degree celsius. (3)

20. Draw a graph to show the variation of binding energy per nucleon with mass number of different nuclei. How does this curve explain the release of energy in the Process of nuclear fission

(OR)

Draw a graph to show the variation of potential energy of a pair of nucleons with their separation. Write any two properties of nuclear force.

21. Briefly Explain how a potential barrier is setup across a P-N Junction as a result of diffusion and drift of charge Carriers.

Section-C

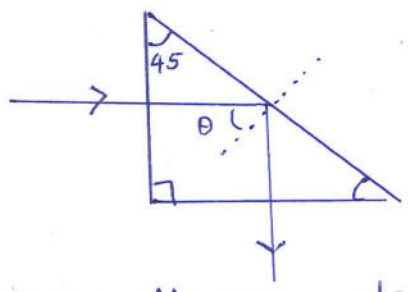
22. State Gauss's theorem. Using it derive an expression for the electric field due to a thin, infinite line of charge of uniform charge density λ Cm^{-1} (3)

23. What do you mean by a dielectric? A dielectric slab of thickness 't' less than the Plate separation 'd' of a capacitor is inserted between the Plates of a Parallel capacitor. Deduce the expression of its capacitance. (3)

24. (a) Write the necessary Conditions for total internal reflection.

(b) A ray of light incident normally on one face of a

right isoscales prism is totally reflected as shown in the figure. What must be the minimum value of refractive index of the glass? Give relevent Calculations.



(3)

25. On the basis of Huygen's wave theory derive the law of refraction of light.

(OR)

(a) Write the conditions for sustained interference.
(b) A plane wavefront incident on (i) a Prism (ii) a convex lens. draw the refracted wave front. (3)

26. Hydrogen atoms are excited with an electron beam of energy 12.5eV. Find (i) The heighest energy level upto which the hydrogen atoms will be excited. (ii) Calculate the H_α line in the Balmer Series. [$R = 1.097 \times 10^7\ m^{-1}$]. (3)

27. The susceptibility of a magnetic material is -0.085. Identify the magnetic type of the substance. A Specimen of this material is kept in a uniform magnetic field. Draw the modified field pattern. How does the susceptibility of the material get affected by changing the temperature? Show it graphically. (3)

28. What is a rectifier? With the help of a neat Circuit diagram Explain the working of a fullwave rectifier draw its input and output wave forms (3)

Section -D

29. **Case study : Conversion of Galvanometer in to an ammeter and Voltmeter :**

A galvanometer is a device used to detect current in an electric circuit. It Can't be used as an ammeter because it is a sensitive device and it gives fullscale deflection for a current of few μA. We can connect a small resistance called shunt resistance in paralled with the galvanometer to Convert it to an ammeter. This can be Converted in to a

voltmeter by Connecting a suitable high resistance in series with galvanometer.

1. A sensitive galvanometer can be converted in to an ammeter or a voltmeter by Connecting a proper resistance to it. which of the following statement is true?
(a) A voltmeter is connected in parallel and current through it is negligible.
(b) an ammeter is connected in parallel and Potential difference across it is small.
(c) A voltmeter is connected in series and potential difference across it small
(d) an ammeter is connected in series in a circuit and the current through it is negligible

2. By mistake a voltmeter is connected in series and an ammeter is connected in parallel with a resistance in an electrical circuit. What will happen to the instrument?
(a) voltmeter is damaged (b) Ammeter is damaged.
(c) Both are damaged (d) None is damaged.

3. Two identical galvanometer are converted to ammeter and milli ammeter. Resistance of the shunt of milli ammeter through which the current pass through will be
(a) more (b) equal (c) less (d) zero

4. A voltmeter has resistance of 'G' ohm and range V volt. The value of resistance used in series to convert it in to a voltmeter of range nV volt is
(a) nG (b) $(n-1)G$ (c) $\frac{G}{n}$ (d) $\frac{G}{n-1}$

(OR)

A galvanometer has a resistance of 10Ω and shows the full scale deflection for a current of 1mA. The shunt require to convert it in to ammeter of range 0 – 100 mA is about
(a) 10Ω (b) 0.1Ω (c) 1Ω (d) 0.01Ω

(4)

30 Case study II : Photo electric effect:

The phenomenon of emission of electron from a photosensitive material when a light of suitable frequency fall over it is

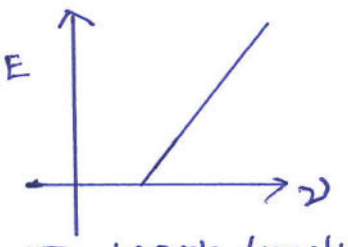
called Photo electric effect. The ejected electrons contribute Photoelectric current. The variation of Photo electric current with various factors such as intensity of incident radiation, frequency of incident radiations were studied. But wave theory failed to explain this effect. Einstein explain this effect based on photon picture of radiation and the Photoelectric effect is due to the interaction of matter with Photon of energy $h\nu$.

1. Green light causes emission of photo electron from a surface, but not the yellow light. Emission of photo electrons will occur. If the surface is illuminated by

(a) micro waves (b) red rays (c) UV rays (d) IR rays.

2. The graph of KE of emitted electrons with frequency of incident radiation is plotted as shown. The slope of the curve is

(a) $\frac{h}{\nu}$ (b) h (c) hc (d) h/e

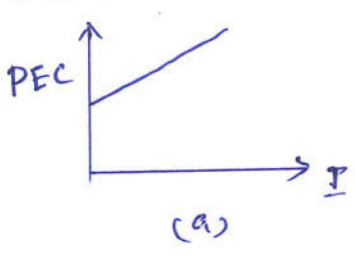


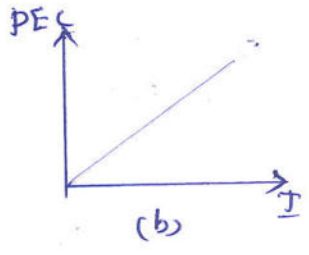
3. The stopping potential when a metal with work function 0.6 ev is illuminated with light of energy 2ev will be

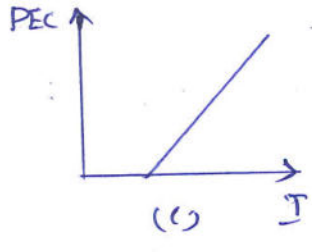
(a) 1.4 V (b) 2.8 eV (c) 4.2 eV (d) 0.7 V

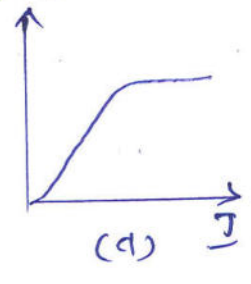
4. The graph between intensity of light (I) falling on a metallic Plate with the Photo electric current (I) is

(i)



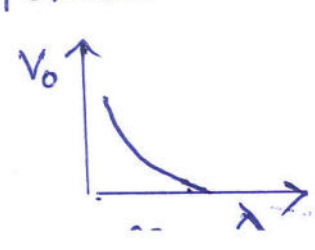


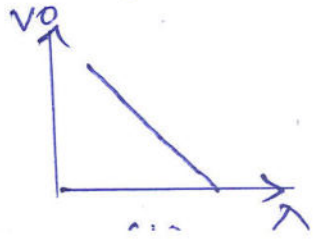


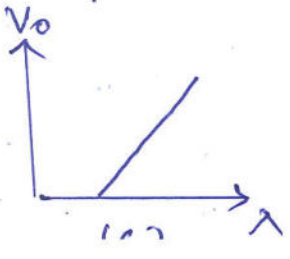


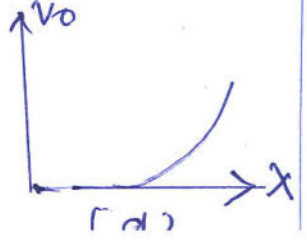
(OR)

(ii) For a Photon of wave length λ incident on a surface the stopping potential is V_0. Identify the Correct graph for V_0 (V_s) λ.







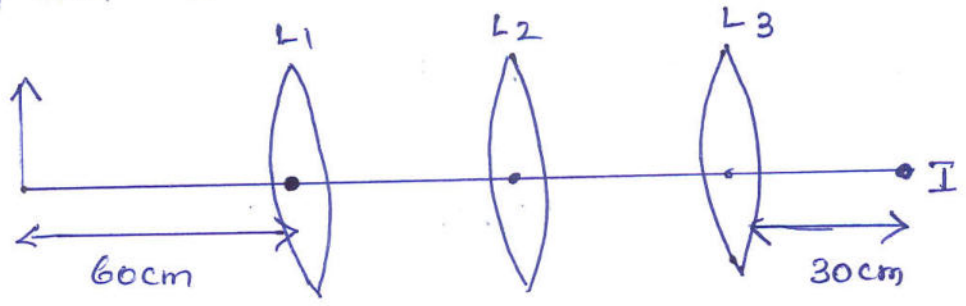


(4)

Section - E

31. (a) Derive the expression for the lens maker's formula for a Convex lens -

(b) Three lenses L_1, L_2 and L_3 each of focal length 30 cm are Placed co-axially as shown in the figure. An object is held at 60 cm from the first lens L_1. The final image is formed at the focus (I) of L_3. Calculate the separation between (i) L_1 and L_2 and (ii) L_2 and L_3



(OR)

(a) Trace the path of a monochromatic light through a prism of refracting angle A. Draw a graph to show the variation of angle of deviation (d) with angle of incidence I. Derive the relation $\mu_2 = \frac{\sin\left(\frac{A+d_m}{2}\right)}{\sin\frac{A}{2}}$.

(b) In case of an equilateral prism, in minimum deviation position what should be the angle made by the refracted ray (inside the Prism) with the normal drawn to the refracting surface? (5)

32. An alternating voltage is applied to a series LCR circuit. Using Phasor diagram, derive the expression for Impedance of the circuit. Find the Condition when the current will be in phase with the voltage. Plot a graph to show the Variation of current with frequency of the source.

(OR)

(a) Write the Principle of a transformer.
(b) Explain how the laminating core of transformer help in reducing the eddy current.
(c) Why is it Preferrable to wind Primary & Secondary coils on same core material?
(d) Write any two Energy losses in the transformer? (5)

33. (a) Define the term resistivity of a conductor. Give its SI unit. Show that the resistance of the conductor is $R = \frac{ml}{\eta A^2 r}$.

(b) Draw a plot showing the variation of resistivity of a (i) metal (ii) Semi conductor with raise of temperature.

(OR)

(a) Two cells of emf E_1 and E_2 and internal resistances r_1 and r_2 are connected in parallel. Derive the expression for equivalent emf and equivalent internal resistance of the combination

(b) A storage battery of emf 8.0 V and internal resistance 0.5 Ω is being charged by a 120 V dc supply using a series resistor of 15.5 Ω. What is the terminal voltage of the battery during charging? (5)