KVS(RO) JAIPUR
CLASS-XII
SESSION-2023-2024
SAMPLE PAPER GROUP-A
SUBJECT: - PHYSICS (BLUE PRINT)

SNO.	UNIT	NAME OF CHAPTER	MCQ 1-MARK	A & R 1-MARK	2-MARKS	3-MARKS	4-MARKS CBQ	5-MARKS	TOTAL
1	1 & 2	Electric charges and field	1(1)			3 (1)			16 (7)
2		Electrostatics potential and capacitor	1(1)	1(1)				5(1)	
3		Current Electricity			2 (1)	3 (1)			
4	3 & 4	Moving Charges and Magnetism	3(3)			3 (1)			17 (9)
5		Magnetism and Matter	1(1)						
6		Electromagnetic Induction	1(1)			3 (1)			
7		Alternating Current	1(1)					5(1)	
8	5 & 6	Electromagnetic Wave				3 (1)			18 (7)
9		Ray Optics and Optical Instruments			4 (2)			5(1)	
10		Wave Optics	1(1)	1(1)			4(1)		
11	7 & 8	Dual nature of Radiation and Matter	1(1)	1(1)	2 (1)				12 (7)
12		Atoms	1(1)						
13		Nuclei	1(1)			6 (2)			
14	9	Semiconductor		1(1)	2 (1)		4(1)		7 (3)
			12(12)	**4(4)**	**10(5)**	**21 (7)**	**8(2)**	**15(3)**	**70 (33)**

SAMPLE QUESTION PAPER (GROUP-A)
CLASS: XII
SESSION: 2023-24
SUBJECT: PHYSICS (THEORY)

Maximum Marks: 70 **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 insuch questions.
(6) Use of calculators is not allowed.
(7) You may use the following values of physical constants where ever 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. $\mu_0 = 4\pi \times 10^{-7}$ Tm$\boldsymbol{A^{-1}}$
v. $h = 6.63 \times 10^{-34}$ Js vi. $\varepsilon_0 = 8.854 \times 10^{-12}$ $\boldsymbol{C^2N^{-1}m^{-2}}$
vii. Avogadro's number = 6.023 X $\mathbf{10^{23}}$ per gram mole

SECTION-A

1. An electric dipole is placed antiparallel in uniform electric field can experience –
   (a) A force but not a torque
   (b) A torque but not a force
   (c) Always a force and a torque
   (d) Neither a force nor a torque.
2. Two capacitors of 3 μF and 6 μF are connected in series with a battery of P.d. 12 V. The P.d. across 3μF and 6μF capacitors respectively will be:
   (a) 8 V, 4 V (b) 6 V, 6 V (c) 4 V, 8 V (d) 9 V, 3 V
3. A metallic plate exposed to white light emits electrons. For which of the following color 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. 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. The SI unit of inductance is the henry. It can be written as-

(a) weber/ampere (b) volt-second/ampere (c) joule/(ampere)^2 (d) ohm-second

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) decrement of current (b) decrement of current and voltage both

(c) Increment of current (d) Increment of current and voltage both

10. Two monochromatic light beams intensities of I and 4I are superposed. The maximum and minimum possible intensities In the resulting beam are-

(a) 5I and I (b) 5I and 3I (c) 9I and I (d) 9I and 3I.

11. An electron enters a uniform magnetic field with speed v. It describes a semicircular path and comes out of the field. The final speed of the electron is-

(a) zero (b) v (c) v/2 (d) 2v

12. Which state of triply ionized beryllium (Be^{+++}) has the same orbital radius as that of the ground state of hydrogen?

(a) n=1 (b) n=2 (c) n=3 (d) n=4

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**: If the temperature of a semiconductor is increased then it's resistance decreases.

Reason: In a semiconductor the energy gap between conduction band and valence band is very small.

14. **Assertion**: A white light source is used in interference experiment forms only bright and dark fringes.

Reason: Width of fringe is inversely proportional to the wavelength of the light used.

15. **Assertion**: In Photoelectric effect saturation current increases with the increase in frequency of incident light.

Reason: Energy of incident photons increases with increase in frequency and as a result current also increases.

16. **Assertion**: The work done to move a charge on an equipotential surface may not be zero.

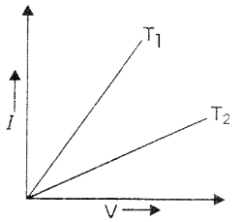
Reason: The work done does not depend on quantity of charge to be moved.

SECTION-B

17. An alpha-particle and a proton are accelerated from the state of rest through the same potential difference V. Find the ratio of de Broglie wavelengths associated with them.

18. A converging and a diverging lens of equal focal lengths are placed co-axially in contact. Find the power and the focal length of the combination.

19. V-I graph for a metallic wire at two different temperature T_1 and T_2 is shown in the figure. Which of these two temperatures is higher? Justify your answer.



20. With the help of a circuit diagram explain the use of PN junction diode as a half wave rectifier.

21. State the condition for total internal reflection. Calculate the speed of light in the medium whose critical angle is 45^0 .

OR

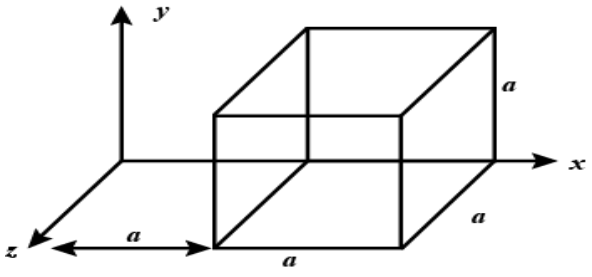
The image of a candle is formed by a convex lens on a screen. The lower half of the lens is painted black to make it completely opaque. Draw the ray diagram to show the image formation. How will image be different from the one obtained when the lens is not painted black?

SECTION-C

22. Draw the graph showing variation in Binding Energy per nucleon versus mass number and explain the phenomenon of nuclear fusion and fission by using it.

23. The electric field components in the fig. shown are $E_x = \alpha$ x ½, Ey = Ez = 0, where α = 800 N/Cm ½. Calculate-

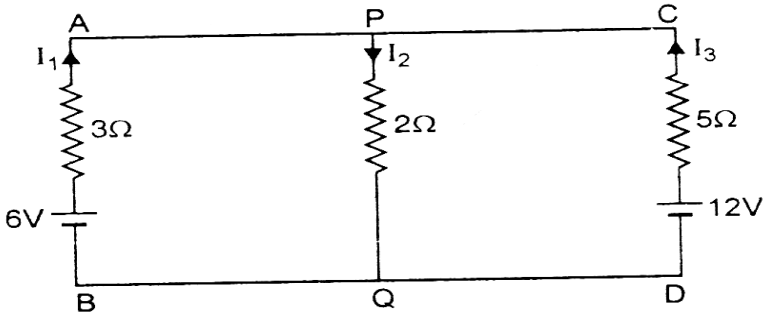
(a) the electric flux through the cube (b) the charge within the cube. The side of cube a= 1 m.



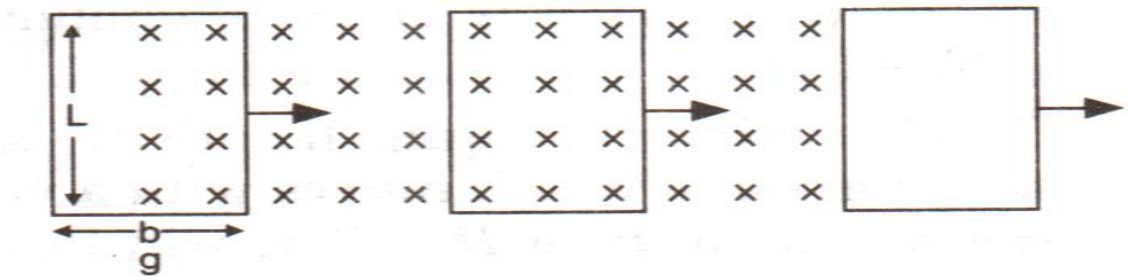
24. How long an electric lamp of 100 W can be kept glowing by fusion of 2.0 kg of deuterium? The fusion reaction can be taken as:

$$_1H^2 + {}_1H^2 \longrightarrow {}_2He^3 + n + 3.2\ MeV$$

25. Using Kirchhoff's law, calculate the value of electric current I_1, I_2 and I_3 in the given network.



26. A uniform magnetic field exists normal to the plane of the paper over a small region of space. A rectangular loop of conducting wire is slowly moved with a uniform velocity across the field as shown. Draw the graph showing the variation of (i) magnetic flux linked with the loop and (ii) the induced e.m.f. in the loop with time and justify.



27. Identify the part of the electromagnetic spectrum which is :

(i) suitable for radar systems used in aircraft navigation.

(ii) adjacent to low frequency end of the electromagnetic spectrum

(iii) produced in nuclear reactions.

Write the name of sources from which these can be obtained.

28. Two long straight parallel current carrying conducting wires are kept 'a' distant apart in air.The direction of currents in both the wires are same. Find the magnitude of force per unit length. Hence define 1 Ampere.

OR

By using Biot-Savart law derive the expression of magnetic field intensity at the axis of a current carrying circular coil. If magnetic field at the center a current carrying coil is 16 T, calculate its value along the axis of same coil at a distance $\sqrt{3}$ times of the radius of coil.

SECTION-D

Case Study Based Questions

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

Light Emitting Diode: It is a heavily doped p-n junction which under forward bias emits spontaneous radiation. The diode is encapsulated with a transparent cover so that emitted light can come out. When the diode is forward biased, electrons are sent from n → p (where they are minority carriers) and holes are sent from p → n (where they are minority carriers). At the junction boundary, the concentration of minority carriers increases as compared to the equilibrium concentration (i.e., when there is no bias).

Thus, at the junction boundary on either side of the junction, excess minority carriers are there which recombine with majority carriers near the junction. On recombination, the energy is released in the form of photons. Photons with energy equal to or slightly less than the band gap are emitted. When the forward current of the diode is small, the intensity of light emitted is small. As the forward current increases, intensity of light increases and reaches a maximum. Further increase in the forward current results in decrease of light intensity. LED's are biased such that the light emitting efficiency is maximum The V-I characteristics of a LED is similar to that of a Si junction diode. But the threshold voltages are much higher and slightly different for each color. The reverse breakdown voltages of LED's are very low, typically around 5 V. So, care should be taken that high reverse voltages do not appear across them. LED's that can emit red, yellow, orange, green and blue light are commercially available.

1. LED is a:

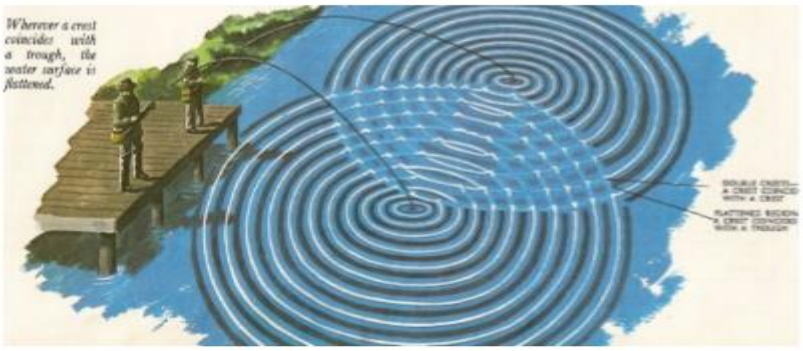
(A) Lightly doped p-n junction diode. (B) Heavily doped p-n junction diode.
(C) Moderately doped p-n junction diode. (D) Two back-to-back p-n junction diodes.

2. LED emits light:
   (A) when reversed biased (B) When forward biased.
   (C) When forward or reverse biased (D) When heated.
3. During recombination at the junction, emitted photons have:
   (A) Energy greater than the band gap. (B) Energy equal to or slightly less than the band gap.
   (C) Energy which has no relation with the band gap. (D) Very low energy compared to band gap.
4. Threshold voltage of LED is:
   (A) lower compared to other p-n junction diodes and slightly different for each color.
   (B) Higher compared to other p-n junction diodes and slightly different for each color.
   (C) Higher compared to other p-n junction diodes and same for all colors.
   (D) lower compared to other p-n junction diodes and same for all colors.

OR

The reverse breakdown voltages of LED's are:
(A) very low and typically around 0.5 V. (B) very low and typically around 5 V.
(C) very high and typically around 50 V. (D)very low and typically around 0.05 V.

30. Jimmy and Johnny were both creating a series of circular waves by jiggling their legs in water. The waves form a pattern similar to the diagram as shown. Their friend, Anita, advised Jimmy and Johnny not to play with water for a long time. She then observed beautiful patterns of ripples which became very colorful. When her friend Latha poured an oil drop on it. Latha, a 12th standard girl, had explained the cause for colorful ripple patterns to Anita earlier.



(i) Name the phenomenon involved in the activity

(a) Reflection (b) Refraction (c) Interference (d) Polarization

(ii) A surface over which an optical wave has a constant phase is called.

(a) Wave (b) Wavefront (c) Elasticity (d) None of these

(iii) Which of the following is correct for light diverging from a point source?

(a) The intensity decreases in proportion for the distance squared.

(b) The wavefront is parabolic.

(c) The intensity at the wavelength does depend of the distance.

(d) None of these.

(iv) The phenomena which is not explained by Huygens's construction of wavefront

(a) reflection (b) diffraction (c) refraction (d) origin of spectra

OR

Huygens's concept of secondary wave

(a) allows us to find the focal length of a thick lens (b) is a geometrical method to find a wavefront

(c) is used to determine the velocity of light (d) is used to explain polarization

SECTION-E

31. (a) With the help of a diagram explain the working principle and construction of AC generator. Hence, obtain an expression for the instantaneous value of the emf generated. Plot the graph between generated alternating emf and time.

(b) The primary coil of an ideal step-up transformer has 100 turns and transformation ratio is also 100. The input voltage and power are 220 V and 1100 W respectively. Calculate

(i) the number of turns in the secondary coil (ii) the current in the primary coil

(iii) the voltage across the secondary coil (iv) the current in the secondary coil

OR

(a) A series LCR circuit is connected to an ac source. Draw its phasor diagram and by using it derive an expression for the impedance of the circuit.

(b) A sinusoidal voltage V = 200 sin 314 t is applied to a resistor of 10Ω resistance. Calculate-

(i) rms value of voltage (ii) rms value of current (iii) power dissipated as heat in watt

32. (a) Derive an expression for electrostatics potential energy of an electric dipole placed in uniform electric field obliquely. Draw diagram showing electric dipole in- (i) stable & (ii) unstable equilibrium.

(b) An electron is taken from a point at – 20 V potential to another point at -10 V. calculate the amount of work done in eV.

OR

(a) A 4 μF capacitor is charged by a 200 V supply. The supply is then disconnected and the charged capacitor is connected to another uncharged 2 μF capacitor. How much electrostatic energy of the first capacitor is lost in the process of attaining the steady situation?

(b) A parallel plate capacitor is charged by a battery. When the battery remains connected, a dielectric slab is inserted in the space between the plates. Explain with reason what changes if any, occur in the values of-

(i) electric field strength between the plates(ii) charge on the plates (iii) energy stored in the capacitor?

33. (a) A thin convex lens having two surfaces of radii of curvature R_1 and R_2 is made of a material of refractive index n_2. It is kept in a medium of refractive index n_1 . Derive, with the help of ray diagram the lens maker formula when a point object placed on the principal axis in front of a radius of curvature R_1 produces an image I on the other side of the lens. ($n_2 > n_1$)

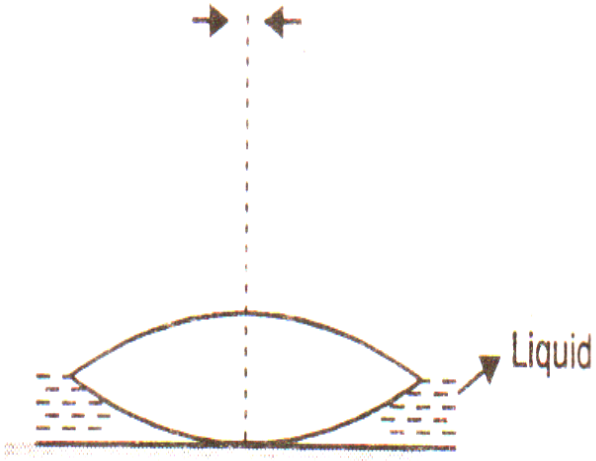
(b) A prism is made of glass of unknown refractive index. A parallel beam of light is incident on a face of the prism. By rotating the prism, the minimum angle of deviation is measured to be 40º. What is the refractive index of the prism. Now this prism is placed in water (refractive index 1.33), predict the new minimum angle of deviation of prism in water. The refracting angle of prism is 60º.

[sin 50º = .7660, sin35º = .576].

OR

(a) A converging lens of focal length 6.25 cm is used as a magnifying glass. If the near point of the observer is 25 cm from the eye and lens is held close to eye, calculate (i) the distance of the object from the lens (ii) angular magnification (iii) angular magnification when final image is formed at infinity.

(b) An equi-convex lens with radii of curvature of magnitude r each, is put over a liquid layer poured on top of a plane mirror. A small needle, with its tip on the principal axis of the lens, is moved along the axis until its inverted real image coincides with the needle itself. The distance of the needle from the lens is measured to be 'a'. On removing the liquid layer and repeating the experiment the distance is found to be 'b.' Obtain a formula for the refractive index of the liquid in term of given variables.



THE END

(Group-A)
MARKING SCHEME (SESSION: 2023-24)

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
D	A	D	C	B	D	B	A
Q9	**Q10**	**Q11**	**Q12**	**Q13**	**Q14**	**Q15**	**Q16**
A	C	B	B	B	D	D	D

17. Formula used $\lambda = h/\sqrt{2meV}$ ……1M

$\lambda\alpha/\lambda p = 1/\sqrt{8} = 1/2\sqrt{2}$……1M

18. Formula of Power $P = P_1 + P_2$ ……(0.5 M)

P = 0 D ……(0.5 M)

Formula of focal length $f = 1/f_1 + 1/f_2$ …… ……(0.5 M)

f = Infinite …… ….(0.5 M)

19. Slope of I-V graph = 1/R ……1M

$T_2 > T_1$……1M

20. Circuit diagram of HWR ……1M

Correct Explanation of HWR ……1M

21. Condition for total internal reflection……1M

Calculate the speed of light = 2.12×10^8 m/s ……1M

OR

Ray diagram……1M

Intensity will decrease……1M

22. Graph between Binding Energy per nucleon versus mass number……1M

Correct explanation of nuclear fusion and fission……(1M + 1M)

23. Formula of electric flux ……0.5 M

Calculation of total flux $=\alpha a^{5/2}(\sqrt{2}-1)$……1M

Formula of electric charge ……0.5 M

Calculation of electric charge = $q=3\times10^{-9}$C (approx.) …… ……1M

24. Given, the power of an electric lamp is 100 W and the mass of deuterium is 2.0 kg.

The fusion reaction is represented as,

$H^2 + H^2 \rightarrow He^2 + n + 3.27$ MeV.

1mole of deuterium has a mass of 2 g and contains 6.023×10^{23} atoms. Thus, the number of atoms in 2 kg of deuterium is given by,

$n = 6.023\times 10^{23} \times 2000 = 6.023\times 10^{26}$ atoms …… 1M

When two atoms of deuterium fuse together, then 3.27 MeV energy is released as shown in the above reaction.

Therefore, total energy per nucleus released in the fusion reaction is

$E = 3.272 \times 6.023 \times 10^{26}$ MeV ……1M

Substituting the value of the charge of an electron in the equation (1), we

get: $E = 3.272 \times 6.023 \times 10^{26} \times 1.6 \times 10^{-19} \times 10^{6} = 1.576 \times 10^{14}$ J

The total time for which the electric lamp will glow is given by the equation,

$t = E/P = 1.576 \times 10\ 14\ /100$ sec $= 1.576 \times 10^{12}$ sec

The total time in years is,

$t = 1.576 \times 10^{12}\ 60 \times 60 \times 24 \times 365 = 4.9 \times 10^{4}$ ……1M

Thus, the total time for which an electric lamp will be kept glowing by the fusion is 4.9×10^{4} years.

25. Each value of current carry equal marks …….. 1X3 = 3M

$I_1 = 18/31$ A, $I_2 = 66/31$ A $I_3 = 48/31$ A

26. Relation Between Flux and time……0.5 M

Graph between Flux and time……1 M

Relation Between emf and time……0.5 M

Graph between emf and time……1 M

27. (i) Microwave, Source- Special vacuum tube and etc.……(0.5M + 0.5M)

(ii) Microwave, Source- Special vacuum tube and etc.……(0.5M + 0.5M)

(iii) gamma ray, Source- Radioactive decay, nuclear reaction etc. ……(0.5M + 0.5M)

28. Diagram -……0.5M

Formula of field ……0.5M Derivation for force……0.5M

Formula for force per unit length……0.5M

Definition of 1A……1M

OR

Diagram ……1M

Derivation for MF at the axis of current carrying coil……1M correct calculation of value at the axis, B = 2 Tesla ……1M

29. (1) B……1M

(2) B……1M

(3) B……1M

(4) B……1M

(OR) B……1M

30. (1) C……1M

(2) B……1M

(3) A……1M

(4) D……1M

(OR) B……1M

31. (a) Diagram of AC generator……0.5M

Working Principal ……0.5M

Construction……0.5M

Correct expression for generated induced emf……1M

Correct graph plotted between emf and time……0.5M

(b) N_S= 10000 ……0.5M

I_P= 5A ……0.5M

V_S= 22000V ……0.5M

I_S= 0.05A……0.5M

OR

(a) Phasor diagram ……1M

Correct expression for impedance ……1M

(b) $V_{rms} = 100\sqrt{2}$ volt……1M

$I_{rms} = 10\sqrt{2}$ A……1M

P = 2000 Watt……1M

32. (a) correct derivation for electrostatic P.E. with diagram ……2.5M

Diagram for stable and unstable equilibrium ……(0.5M + 0.5M)

(b) correct formula for work done $W = q(V_f - V_i)$ ……0.5M

Work done W = -10eV ……1M

OR

(a) Correct formula ……0.5M

substitute correct values in proper SI unit……0.5M

Correct calculation with answer, energy loss = 2.67×10^{-2} J……1M

(b) (i) correct explain with reason (E will remains same) ……1M

(ii) correct explain with reason (Q will increase) …… ……1M

(iii) correct explain with reason (U will increase) ……1M

33. (a) ray diagram for lens maker formula……..1M

Correct derivation of lens maker formula ……..2M

(b) correct formula of refractive index……..0.5M
correct calculation of R.I. = 1.532……0.5M
correct formula of angle of minimum deviation……..0.5M
correct calculation of angle of minimum deviation = 10 degree……0.5M

OR

(a) (i) calculation of object distance u = -5 cm……..1M
(ii) formula and correct calculation of M = 5 ……..(0.5M + 0.5M)
(iii) formula and correct calculation of M = 4 ……..(0.5M + 0.5M)

(b) Formula for net focal length of combination of 2 lenses……0.5M
Lens maker formula ……..0.5M
Correct relation between R.I. and various focal length……1M

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SAMPLE PAPER GROUP-B
SUBJECT: - PHYSICS (BLUE PRINT)

S. No.	Unit	MCQ (1-M)	Assertion Based Question (1-M)	SA I (2-M)	SA II (3-M)	Case Study Question (4 M)	LA (5-M)	TOTAL
1	Chapter 1- Electric Charges and Fields, Chapter 2- Electrostatic Potential and Capacitance Chapter 3- Current Electricity	3	-	1	2	-	1	16(7)
2	Chapter 4- Moving Charges and Magnetism Chapter 5- Magnetism and Matter Chapter 6 - Electromagnetic Induction	2	1	2	2	1	-	17(8)
3	Chapter 8- Electromagnetic Waves Chapter 9- Ray Optics and Optical Instruments Chapter 10- Wave Optics	3	2	1	2	-	1	18(9)
4	Chapter 11 - Dual Nature of Radiation and Matter Chapter 12- Atoms Chapter 13- Nuclei	2	-	1	1	-	1	12(5)
5	Chapter 14- Semiconductor Electronics: Materials, Devices and Simple Circuits	2	1	-	-	1	-	7(4)
	Total	12(12)	4(4)	10(5)	21(7)	8(2)	15 (3)	70 (33)

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

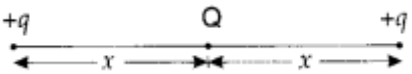
iii. $e = 1.6 \times 10^{-19}$ C

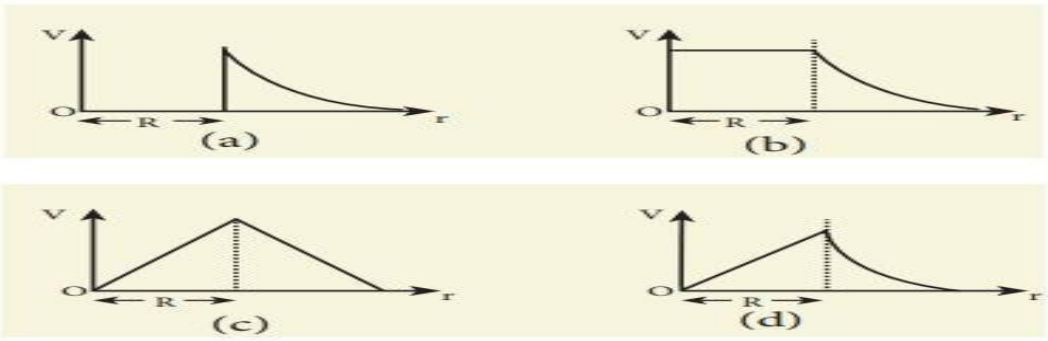
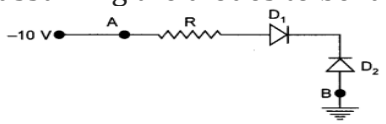
iv. $\mu_0 = 4\pi \times 10^{-7}$ Tm$\boldsymbol{A^{-1}}$

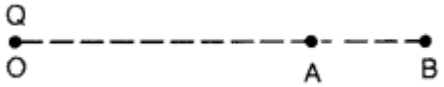
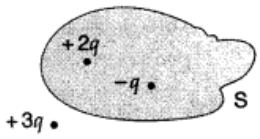
v. $h = 6.63 \times 10^{-34}$ Js

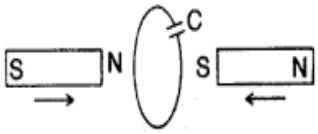
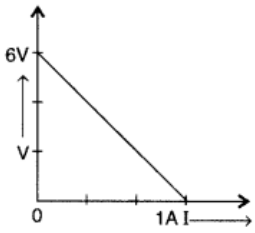
vi. $\varepsilon_0 = 8.854 \times 10^{-12}$ $\boldsymbol{C^2N^{-1}m^{-2}}$

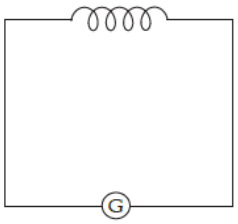
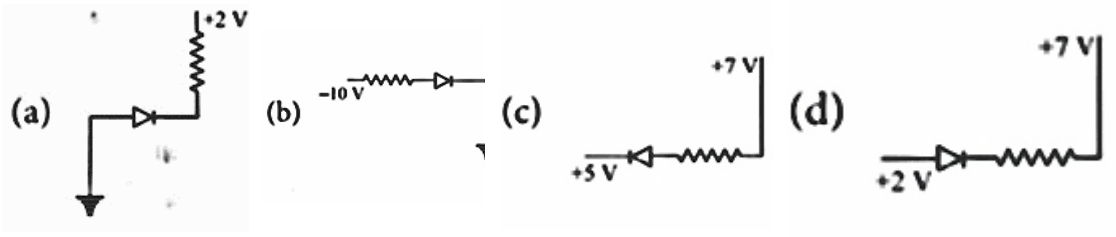
vii. Avogadro's number = 6.023 X $\mathbf{10^{23}}$ per gram mole

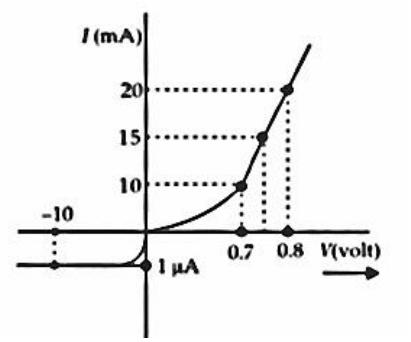
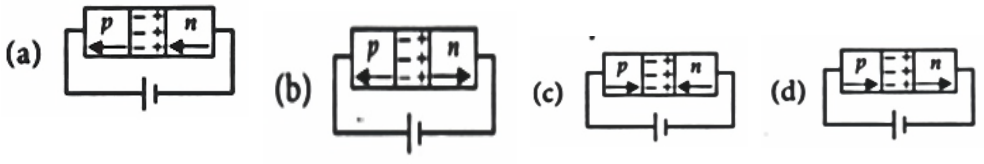
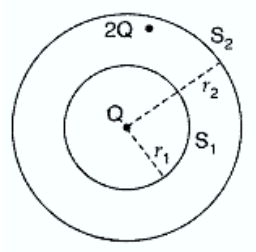
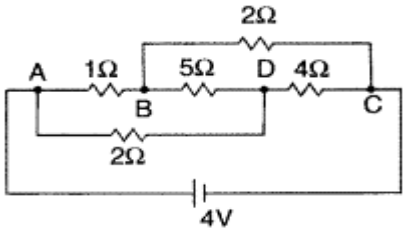
	Section A	
1	A moving coil galvanometer can be converted into an ammeter by (a) introducing a shunt resistance of large value in series. (b) introducing a shunt resistance of small value in parallel. (c) introducing a resistance of small value in series. (d) introducing a resistance of large value in parallel.	1
2	In electromagnetic waves the phase difference between electric field vector and magnetic field vector is (a) zero (b) π/2 (c) π (d) π/3	1
3	A charge Q is placed at the centre of the line joining two point charges in equilibrium +q and +q as shown in the figure. The ratio of charges Q and q is  (a) 4 (b) ¼ (c) -4 (d) -1/4	1
4	In the case of an inductor (a) voltage lags the current by π/2 (b) voltage leads the current by π/2 (c) voltage leads the current by π/3 (d) voltage leads the current by π/4	1

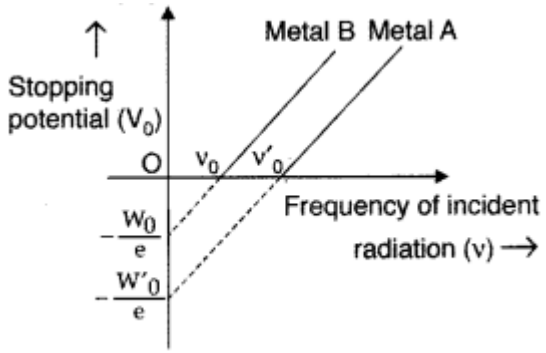
5	A convex lens is dipped in a liquid whose refractive index is equal to the refractive index of the lens. Then its focal length will (a) become zero (b) become infinite (c) become small, but non-zero (d) remain unchanged	1
6	The wavefront due to a source situated at infinity is (a) spherical (b) cylindrical (c) planar (d) circular	1
7	The photoelectric current does not depend upon the (i) frequency of incident light (ii) work function of the metal (iii) stopping potential (iv) intensity of incident light (a) (i) and (iv) only (b) (ii) and (iii) only (c) (iii) only (d) (ii) only	1
8	A thin conducting spherical shell of radius R has a charge Q which is uniformly distributed on its surface. The correct plot for electrostatic potential due to this spherical shell is 	1
9	When the number of nucleons in nuclei increases, the binding energy per nucleon (a) increases continuously with mass number (b) decreases continuously with mass number (c) remains constant with mass number (d) first increases and then decreases with increase of mass number	1
10	In semiconductors, at room temperature (a) the conduction band is completely empty (b) the valence band is partially empty and the conduction band is partially filled (c) the valence band is completely filled and the conduction band is partially filled (d) the valence band is completely filled	1
11	In figure given, assuming the diodes to be ideal  (a) D_1 is forward biased and D_2 is reverse biased and hence current flows from A to B. (b) D_2 is forward biased and D_1 is reverse biased and hence no current flows from B to A and vice versa. (c) D_1 and D_2 are both forward biased and hence current flows from A to B. (d) D_1 and D_2 are both reverse biased and hence no current flows from A to B and vice versa.	1

12	In a Wheatstone bridge if the battery and galvanometer are interchanged then the deflection in galvanometer will (a) change in previous direction (b) not change (c) change in opposite direction (d) none of these.	1
	Each question has 4 choices (A), (B), (C) and (D) out of which ONLY ONE is correct. So select the correct choice : a) assertion is true, reason is true; & reason is a correct explanation for assertion b) assertion is true, reason is true; & reason is not a correct explanation for assertion c) assertion is true, but reason is false. d) assertion is false, and reason is also false	
13	Assertion : The direction of induced e.mf. is always such as to oppose the change that causes it. Reason : The direction of induced e.m.f. is given by Lenz's Law.	1
14	Assertion : In YDSE, if a thin film is introduced in front of the upper slit, then the fringe pattern shifts in the downward direction. Reason : In YDSE if the slit widths are unequal, the minima will be completely dark.	1
15	Assertion : The diffusion current in a p-n junction is from the p-side to the n-side. Reason : The diffusion current in a p-n junction is greater than the drift current when the junction is in forward biased.	1
16	Assertion : According to Huygen's principle, no backward wave-front is possible. Reason : Amplitude of secondary wavelet is proportional to $(1 + \cos\theta)$ where θ is the angle between the ray at the point of consideration and the direction of secondary wavelet.	1
	Section B	
17	A point charge Q is placed at point O as shown in the figure. Is the potential difference $V_A - V_B$ positive, negative or zero, if Q is (i) positive (ii) negative?  **OR** Figure shows three-point charges, +2q, -q and + 3q. Two charges +2q and -q are enclosed within a surface 'S'. What is the electric flux due to this configuration through the surface 'S'  	2
18	An ammeter of resistance 0.6 Ω can measure current upto 1.0 A. Calculate (i) The shunt resistance required to enable the ammeter to measure current upto 5.0 A (ii) The combined resistance of the ammeter and the shunt.	2

19	Two bar magnets are quickly moved towards a metallic loop connected across a capacitor 'C' as shown in the figure. Predict the polarity of the capacitor with suitable justification. 	2
20	Name the part of electromagnetic spectrum which is suitable for radar systems used in aircraft navigation and treatment of cancer tumours.	2
21	Find the ratio of radii of the orbits corresponding to first excited state and ground state in a hydrogen atom?	2
	Section C	
22	The plot of the variation of potential difference A across a combination of three identical cells in series, versus current is shown along the question. What is the emf and internal resistance of each cell?  **OR** Mention the factors on which the internal resistance of a cell depends.	3
23	Two metallic wires of the same material have the same length but cross-sectional area is in the ratio 1 : 2. They are connected (i) in series and (ii) in parallel. Compare the drift velocities of electrons in the two wires in both the cases (i) and (ii).	3
24	Prove that an ideal capacitor in an a.c. circuit does not dissipate average power.	3
25	Define magnetic susceptibility of a material. Name two elements, one having positive susceptibility and the other having negative susceptibility. What does negative susceptibility signify?	3
26	A biconvex lens made of a transparent material of refractive index 1.25 is immersed in water of refractive index 1.33. Will the lens behave as a converging or a diverging lens? Justify your answer.	3
27	How does the fringe width of interference fringes change, when the whole apparatus of Young's experiment is kept in a liquid of refractive index 1.3?	3
28	An electron and alpha particle have the same de-Broglie wavelength associated with them. How are their kinetic energies related to each other?	3
	Section D	

29	**Read the para given below and answer the questions that follow:** Self-Induction. When a current I flow through a coil, flux linked with it is $\varphi = LI$, where L is a constant known as self-inductance of the coil.  Any charge in current sets up an induced emf in the coil. Thus, self-inductance of a coil is the induced emf set up in it when the current passing through it changes at the unit rate. It is a measure of the opposition to the growth or the decay of current flowing through the coil. Also, value of self-inductance depends on the number of turns in the solenoid, its area of cross-section and the permeability of its core material. (i) The inductance in a coil plays the same role as (a) inertia in mechanics (b) energy in mechanics (c) momentum in mechanics (d) force in mechanics (ii) A current of 2.5 A flows through a coil of inductance 5 H. The magnetic flux linked with the coil is (a) 0.5 Wb (b) 12.5 Wb (c) zero (d) 2 Wb (iii)The inductance L of a solenoid depends upon its radius R as (a) $L \propto R$ (b) $L \propto 1/R$ (c) $L \propto R^2$ (d) $L \propto R^3$ (iv) The unit of self-inductance is (a) Weber ampere (b) Weber^{-1} ampere (c) Ohm second (d) Farad **OR** (iv)The induced emf in a coil of 10 henry inductance in which current varies from 9 A to 4 A in 0.2 second is (a) 200 V (b) 250 V (c) 300 V (d) 350 V	4
30	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.  (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	4

	(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} (iv) In the case of forward biasing of a p-n junction diode, which one of the following figures correctly depicts the direction of conventional current (indicated by an arrow mark)?  	
	Section E	
31	i)State Gauss's Law. Derive expression for Electric field intensity at a point on axial line of dipole. ii) A sphere S_1 of radius r_1 encloses a net charge Q. If there is another concentric sphere S_2 of radius r_2 ($r_2 > r$,) enclosing charge 2Q, find the ratio of the electric flux through S_1 and S_2. How will the electric flux through sphere S_1 change if a medium of dielectric constant K is introduced in the space inside S_2 in place of air?  **OR** i)Derive the relation for ξ_{eq} when two cells of EMF ξ_1 and ξ_2 are connected in parallel combination. ii) Calculate the current drawn from the battery by the network of resistors shown in the figure.  	5
32	i)Define total internal reflection.	5

	ii) Derive the relation between refractive index and critical angle for total internal reflection by using suitable diagram and write the condition necessary for Total internal reflection. iii) A ray of light passing through an equilateral triangular glass prism from air undergoes minimum deviation when angle of incidence is $3/4^{th}$ of the angle of prism. Calculate the speed of light in the prism. **OR** i)State Huygens's principle and prove the laws of reflection by using it. ii) Laser light of wavelength 640 nm incident on a pair of slits produces an interference pattern in which the bright fringes are separated by 7.2 mm. Calculate the wavelength of another source of light which produces interference fringes separated by 8.1 mm using same arrangement. Also find the minimum value of the order 'n' of bright fringe of shorter wavelength which coincides with that of the longer wavelength.	
33	On the basis of Lenard's and Hallwach's observation on experiment of Photo electric emission answer following: i) The graph shows the variation of stopping potential with frequency of incident radiation for two photosensitive metals A and B. Which one of the two has higher value of work- function? Justify your answer.  ii) Plot the graph between intensity of incident light and photo electric current iii) Plot the graph between stopping potential and photoelectric current for different frequencies (f_1, f_2 and f_3) of incident photon at constant intensity of light. iv) Write Einstein's photoelectric equation. State clearly the three salient features observed in photoelectric effect, which can be explained on the basis of the above equation. **Or** i) Draw Binding Energy per nucleon curve by showing regions prone to nuclear fission and nuclear fusion. ii) (i) In hydrogen atom, an electron undergoes transition from 2nd excited state to the first excited state and then to the ground state. Identify the spectral series to which these transitions belong. (ii) Find out the ratio of the wavelengths of the emitted radiations in the two cases.	5

Marking Scheme- Sample Paper (Group B)

1	2	3	4	5	6	7	8
b	a	d	b	b	c	c	a
9	10	11	12	13	14	15	16
d	b	b	b	a	b	b	b

17 Clearly, 2

$$V_A - V_B = \left(\frac{1}{4\pi\varepsilon_0}\cdot\frac{q}{OA}\right) - \left(\frac{1}{4\pi\varepsilon_0}\cdot\frac{q}{OB}\right)$$

$$= \frac{q}{4\pi\varepsilon_0}\cdot\left[\frac{1}{OA} - \frac{1}{OB}\right]$$

As OA < OB, so the quantity within bracket is negative.
(i) If q is positive charge, $V_A - V_B$ = negative
(ii) If q is negative charge, $V_A - V_B$ = positive

OR

Answer:
Electric flux $= \oint SE \rightarrow \cdot dS \rightarrow$

According to *Gauss's law*, $\phi = \oint_S \vec{E}.\vec{dS} = \frac{q_1}{\varepsilon_0}$

...where [q_1 is the total charge enclosed by the surface S

$$\phi = \frac{2q - q}{\varepsilon_0} = \frac{q}{\varepsilon_0} \quad \therefore \quad \textbf{Electric flux, } \phi = \frac{q}{\varepsilon_0}$$

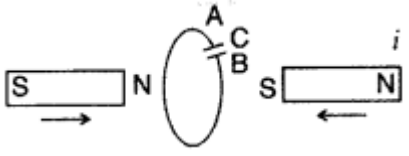
18 Answer: 1

(*i*) Shunt Resistance, $S = \frac{R_A i_g}{i - i_g} = \frac{0.6 \times 1}{4} = 0.15\ \Omega$

(*ii*) Total Resistance, $\frac{1}{R_{total}} = \frac{1}{0.6} + \frac{1}{0.15} = \frac{25}{3}$ 1

$$R_{total} = \frac{3}{25}\ \Omega = 0.12\ \Omega$$

19 Answer: 2
When both magnets move towards loop, the A side plate of capacitor will be positive while the lower plate B is negative, making the induced current in a clockwise direction.



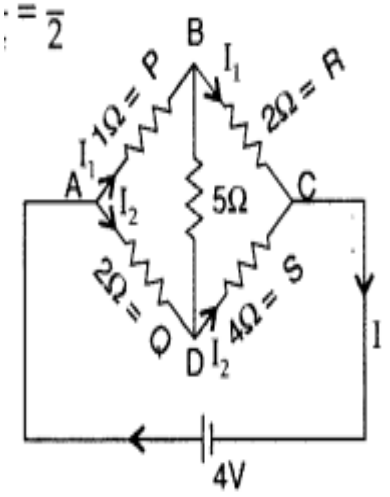
20 Answer: 1

1. Micro-waves
2. Gamma-rays. 1

21	Answer: Radius of Bohr's stationary orbits, $r = \frac{n^2h}{4\pi^2 mKe^2}$ Clearly, $r \propto n^2$ and in ground state, $n = 1$ For 1st excited state, $n = 2$ $\therefore$ Ratio of radii of the orbits $= \frac{2^2}{1^2} = \frac{4}{1} = \mathbf{4 : 1}$	1 1
22	Answer: (*i*) Since 3 identical cells are connected in series $E' = E_1 + E_2 + E_3 = 3E = 6V$ when I is zero Hence **E = 2V** (*ii*) $E = Ir + V$ or $Ir = E - V$ or $r = \frac{E - V}{I} = \frac{2 - 0}{1} = \mathbf{2\Omega}$ (From the graph, current is 1A corresponding to V = 0) **Or** Write three factors	1 2 3
23	**Given :** $l_1 = l_2 = l$ $A_1 : A_2 = 1 : 2$ or $\frac{A_1}{A_2} = \frac{1}{2}$ As $R = \rho \frac{l}{A}$, as $\rho_1 = \rho_2$ We have $\frac{R_1}{R_2} = \frac{2}{1}$ (*i*) In series current is same so from $v_d = \frac{I}{neA}$ So, $I_1 = I_2$, $\frac{A_1}{A_2} = \frac{1}{2}$ We get $\frac{v_{d_1}}{v_{d_2}} = \frac{2}{1}$ $\therefore$ $v_{d_1} : v_{d_2} = \mathbf{2 : 1}$ (*ii*) In parallel current gets divided in inverse ratio of resistances $\therefore$ $\frac{I_1}{I_2} = \frac{R_2}{R_1} = \frac{1}{2}$ As $v_{d_1} = \frac{I_1}{enA_1}$, $v_{d_2} = \frac{I_2}{enA_2}$ We have $\frac{v_{d_1}}{v_{d_2}} = \frac{I_1}{I_2} \times \frac{A_2}{A_1} = \frac{1}{2} \times \frac{2}{1} = \frac{1}{1}$ $\therefore$ $\mathbf{v_{d_1} : v_{d_2} = 1 : 1}$	1 2
24	Average power associated with a capacitor: When an a.c. is applied to a capacitor, the current leads the voltage in phase by π2radian. So we write the expressions for instantaneous voltage and current as follows: $V = V_0 \sin \omega t$, $I = I_0 \sin\left(\omega t + \frac{\pi}{2}\right) = I_0 \cos \omega t$ Work done in the circuit in small time dt will be	3

	$d\omega = pdt = VI\,dt = V_0 I_0 \sin \omega t \cos \omega t\, dt$ $= \frac{V_0 I_0}{2} \sin 2\omega t\, dt$ The average power dissipated per cycle in the capacitor is, $P_{av} = \frac{W}{T} = \frac{1}{T}\int_0^T dW$ $= \frac{V_0 I_0}{2T}\int_0^T \sin 2\omega t\, dt = \frac{V_0 I_0}{2T}\left[\frac{-\cos 2\omega t}{2\omega}\right]_0^T$ $\left[\because \omega = \frac{2\pi}{T}\right]$ $= \frac{-V_0 I_0}{4T\omega}\left[\cos\left(\frac{4\pi T}{T}\right)\right]_0^T$ $= \frac{-V_0 I_0}{4T\omega}[\cos 4\pi - \cos 0]$ $= \frac{-V_0 I_0}{4T\omega}[1-1] = 0$ Thus the average power dissipated per cycle in a capacitor is zero.	
25	Answer: (i) Magnetic susceptibility (χm) : It is the property of a material which determines how easily it can be magnetised when kept in a magnetising field. Also, it is the ratio of intensity of magnetisation (I) produced in the material to the intensity of magnetising field (H) $\chi_m = \frac{I}{H}$ (ii) Positive susceptibility: para-magnetic material Example: Al, Ca. Negative susceptibility: diamagnetic material Example: Bi, Cu. (iii)Negative susceptibility signifies that the material is diamagnetic in nature.	1 1 1
26	Answer: The lens will behave as a diverging lens, because -1 $\frac{1}{f} = (\mu - 1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$ $\frac{1}{f} = \left(\frac{\mu_1}{\mu_2} - 1\right)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$ $\frac{\mu_1}{\mu_2} = \frac{1.25}{1.33} = 0.98$ The value of ($\mu - 1$) is negative and 'f' will be negative.	3

27	Answer: $\beta_{air} = \frac{\lambda D}{d}$ In water, $\lambda_\omega = \frac{\lambda_a}{1.3}$ ...**where** [λ_ω = wavelength in water and λ_a = wavelength in air $\beta_{water} = \frac{\lambda_\omega D}{d} = \frac{\lambda_a D}{\mu d} = \frac{\beta_{air}}{1.3}$ ...**where** [μ = refractive index] Fringe width becomes yL times of its initial value.	3
28	Answer: $E_K = \frac{p^2}{2m}$ **where** [E_K = **Kinetic energy**, p = **momentum**, m = **mass of the particle**] de-Broglie wavelength, $\lambda = \frac{h}{p}$ ...**where** [h = Planck's constant $\therefore \quad \lambda = \frac{h}{\sqrt{2mE_K}}$ $\because$ Both the particles have the same de-Broglie wavelength ...[Given $\therefore \quad \frac{h}{\sqrt{2m_e E_{Ke}}} = \frac{h}{\sqrt{2m_\alpha E_{K\alpha}}}$ or $\frac{m_e}{m_\alpha} = \frac{E_{K\alpha}}{E_{Ke}}$ **where** [m_e = **mass of electron**, m_α = **mass of α - particle**, E_{Ke} = **K.E. of electron**, $E_{K\alpha}$ = **K.E. of α - particle**] As $m_\alpha > m_e \quad \therefore K.E_{Ke} > E_{K\alpha}$	3
29	(i) a (ii) b (iii) c (iv) c **Or** b	4
30	(i) (c) :The p-n diode is forward biased when p-side is at a higher potential than n-side. (ii) (c) (iii) (d) : Forward bias resistance, (iv) (d) : In p-region the direction of conventional current is same as flow of holes. In n-region the direction of conventional current is opposite to the flow of electrons.	4
31	. i) statement gauss's law- Correct derivation-	1 2

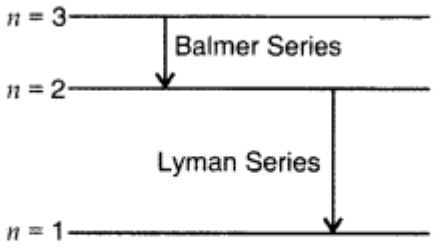
	ii) Answer: Flux through $S_1(\phi_1) = \frac{Q}{\epsilon_0}$ …(i) Flux through $S_2(\phi_2) = \frac{Q+2Q}{\epsilon_0} = \frac{3Q}{\epsilon_0}$ …(ii) $\therefore$ Ratio of flux $= \frac{\phi_1}{\phi_2} = \frac{Q/\epsilon_0}{3Q/\epsilon_0} = \frac{1}{3}$ Therefore, there will be no change in the flux through S_1 on introducing dielectric medium inside the sphere S_2.	2
	OR	
	Answer: (i) Correct derivation- ii) Given: Circuit diagram can be rearranged as shown below: It forms a Wheatstone's bridge $\frac{P}{Q} = \frac{R}{S} \Rightarrow \frac{1}{2} = \frac{2}{4} = \frac{1}{2}$ It is the condition of null point when no current flows through BD arm, i.e. 5 Ω. Resistances P = (1 Ω) and R = (2 Ω) are in series; Similarly, Resistances Q = (2 Ω) and S in series, $= \frac{1}{2}$  $R_2 = 2 + 4 = 6\ \Omega$ Now, R_1 and R_2 are in parallel, $\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} = \frac{1}{3} + \frac{1}{6} = \frac{1}{2} \Rightarrow R = 2\ \Omega$ $I = \frac{V}{R} = \frac{4}{2} = \mathbf{2A}$ $\therefore$ Current in the circuit is **2A**.	2 3
32	i) correct definition ii) correct derivation correct conditions iii) since i=3/4 A, using formula of refractive index for prism $C_1/C_2 = \sqrt{2}$ $C_2 = 2.2 \times 10^8$ m/s	1 1 1 2

	Or i) Correct statement Proof of Laws of reflection using Huygens laws - ii) Answer: Distance between two bright fringes = Fringe width $\beta = \frac{\lambda D}{d}$ For same values of D and d, we have $\frac{\beta_1}{\beta_2} = \frac{\lambda_1}{\lambda_2}$ or $\frac{7.2}{8.1} = \frac{640}{\lambda_2}$ or $\frac{0.8}{0.9} = \frac{640}{\lambda_2}$ or $0.8\lambda_2 = 576 \therefore \lambda_2 = 720$ nm Calculation of minimum value of order: for n to be minimum $(n + 1)^{th}$ maxima of shorter wavelength should coincide with n^{th} maxima of longer wavelength coincide with n^{th} maxima of longer wavelength $(n + 1)\,640 = n \times 720$ or $640\,n + 640 = 720\,n$ or $640 = 720\,n - 640\,n$ *i.e.* $80\,n$ or $80\,n = 640$ or $n = 8$ $\therefore$ *Minimum order of shorter wavelength* $= (n + 1) = (8 + 1) = 9$	2 1 2
33	i) correct justification ii) correct graph Correct graph iv) Einstein's photoelectric equation is $K_{max} = h\nu - \phi_0$ (i) We find K_{max} depends linearly on V only. It is independent of intensity of radiation. (*ii*) Since K_{max} must be positive. $h\nu > \phi_0 \Rightarrow \nu > \nu_0$ ($\because \phi_0 = h\nu_0$) So greater the work function (ϕ_0), higher is the minimum frequency (threshold frequency) required to emit photo electron. **Or** i) Correct curve – (ii) Correct region	1 1 1 2 2 1

iii)

(*i*) $n_f = 2, \quad n_i = 3$ *Balmer series*

$n_i = 2, \quad n_f = 1$ *Lyman series*



(*ii*) $\frac{1}{\lambda_B} = R\left[\frac{1}{2^2} - \frac{1}{3^2}\right] = R\left[\frac{1}{4} - \frac{1}{9}\right] = \frac{5}{36}R$

...where λ_B is the wavelength for Balmer series.
λ_L is the wavelength for Lyman series.

and $\frac{1}{\lambda_L} = R\left(\frac{1}{1^2} - \frac{1}{2^2}\right) = R\left[\frac{1}{1} - \frac{1}{4}\right] = \frac{3}{4}R$

$\therefore \frac{\lambda_B}{\lambda_L} = \frac{36}{5} \times \frac{3}{4} = \frac{27}{5}$

$\therefore$ ***Ratio*** $= \lambda_B : \lambda_L =$ **27 : 5**

2

KVS(RO) JAIPUR
CLASS-XII
SESSION-2023-2024
SAMPLE PAPER GROUP-C
SUBJECT: - PHYSICS (BLUE PRINT)

NAME OF UNIT/CHAPTER		MCQ (1 M)	AR (1 M)	SA- I (2 M)	SA-II (3 M)	CSB (4 M)	LONG ANS (5 M)	TOTAL
I	Electrostatics							
	Electric Charges and Fields	1(1)					5(1)	
	Electrostatic Potential and Capacitance				3(1)			16(7)
II	Current Electricity	1(1)	1(1)	2(1)	3(1)			
III	Magnetic Effect of Current & Magnetism							
	Moving Charges and Magnetism	1(1)			3(1)		5(1)	
	Magnetism and Matter							17(7)
IV	EMI & AC							
	Electromagnetic Induction	1(1)	1(1)	2(1)				
	Alternating Current					4(1)		
V	Electromagnetic Waves	1(1)		2(1)				
VI	Optics							
	Ray Optics and Optical Instruments	1(3)				4(1)		18(10)
	Wave Optics	1(1)	1(1)		3(2)			
VII	Dual Nature of Matter	1(2)	1(1)	2(1)				
VIII	Atoms & Nuclei							12(7)
	Atoms				3(1)			
	Nuclei	1(1)			3(1)			
IX	Electronic Devices			2(1)			5(1)	7(2)
	TOTAL	1(12)	1(4)	2(5)	3(7)	4(2)	5(3)	70(33)

SAMPLE QUESTION PAPER (GROUP-C)
CLASS: XII
SESSION: 2023-24
SUBJECT: PHYSICS (THEORY)

Maximum Marks: 70 **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. All the sections are compulsory.

(3) 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 4 marks each, and Section E contains three long questions of five marks each.

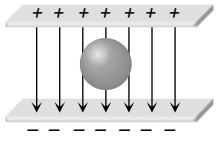
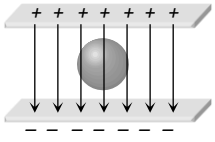
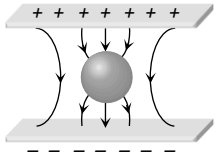
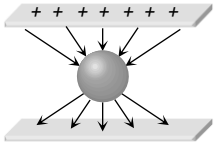
(4) There is no overall choice. However, an internal choice has been provided in one question in section B, one question in section C, one question in each CBQ In section D and all three questions in section E. You have to attempt only one of the choices in such questions.

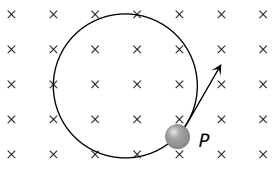
5. Use of calculators is not allowed.

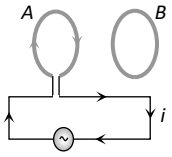
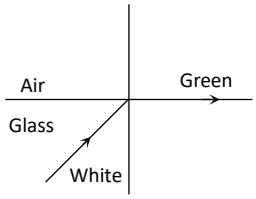
(6) You may use the following values of physical constants where ever necessary

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. $\mu_0 = 4\pi \times 10^{-7}$ Tm$\boldsymbol{A^{-1}}$
v. $h = 6.63 \times 10^{-34}$ Js
vi. $\varepsilon_0 = 8.854 \times 10^{-12}$ $\boldsymbol{C^2N^{-1}m^{-2}}$
vii. Avogadro's number = 6.023 X $\mathbf{10^{23}}$ per gram mole

SECTION A

Q.No.			Marks
1	An uncharged sphere of metal is placed in between two charged plates as shown. The lines of force look like		1
	(A)  A	(B)  B	
	(C)  C	(D)  D	

2	In Young's double slit experiment, if one of the slit is closed fully, then in the interference pattern (A) A bright fringe will be observed, no interference pattern will exist (B) The bright fringes will become more bright (C) The bright fringes will become fainter (D) None of the above	1
3	A photon collides with a stationary hydrogen atom in ground state inelastically. Energy of the colliding photon is 10.2 *eV*. After a time, interval of the order of micro second another photon collides with same hydrogen atom inelastically with an energy of 15 *eV*. What will be observed by the detector (A) 2 photon of energy 10.2 *eV* (B) 2 photons of energy of 1.4 *eV* (C) One photon of energy 10.2 *eV* and an electron of energy 1.4 *eV* (D) One photon of energy 10.2 *eV* and another photon of 1.4 *eV*	1
4	According to Einstein's photoelectric equation, the plot of the kinetic energy of the emitted photo electrons from a metal versus the frequency, of the incident radiation gives a straight line whose slope (A) Is the same for all metals and independent of the intensity of the radiation (B) Depends on the intensity of the radiation (C) Depends both on the intensity of the radiation and the metal used (D) Depends on the nature of the metals used	1
5	Choose the incorrect statement (A) EM waves are produced by accelerated charge (B) Heat radiations are a type of EM waves (C) Speed of EM waves in vacuum is the same for all intensities and frequencies (D) Speed of EM waves is same in all media	1
6	A particle having a charge of $10.0\mu C$ and mass $1\mu g$ moves in a circle of radius 10 cm under the influence of a magnetic field of induction $0.1T$. When the particle is at a point P, a uniform electric field is switched on so that the particle starts moving along the tangent with a uniform velocity. The electric field is (A) 0.1 *V/m* (B) 1 *V/m* (C) 10 *V/m* (D) 100 *V/m* 	1

7	Two circular coils *A* and *B* are facing each other as shown in figure. The current *i* through *A* can be altered (A) There will be repulsion between *A* and *B* if *i* is increased (B) There will be attraction between *A* and *B* if *i* is increased (C) There will be neither attraction nor repulsion when *i* is changed (D) Attraction or repulsion between *A* and *B* depends on the direction Of current. If does not depend whether the current is increased or decreased. 	1
8	What is the angular momentum of an electron in Bohr's hydrogen atom whose energy is – 0.544 *eV*. (A) $\frac{h}{\pi}$ (B) $\frac{2h}{\pi}$ (C) $\frac{5h}{2\pi}$ (D) $\frac{7h}{2\pi}$	1
9	Which one of the following statements is true (a) An object situated at the principle focus of a concave lens will have its image formed at infinity (b) Concave mirror can give diminished virtual image (c) Given a point source of light, a convex mirror can produce a parallel beam of light (d) The virtual image formed in a plane mirror can be photographed	1
10	A car has a fresh battery of e.m.f. 12 *V* and internal resistance of 0.05 Ω. If the starter motor draws a current of 90 *A*, the terminal voltage when the starter is on will be (A) 12 *V* (B) 10.5 *V* (C) 8.5 *V* (D) 7.5 *V*	1
11	White light is incident on the interface of glass and air as shown in the figure. If green light is just totally internally reflected then the emerging ray in air contains (A) Yellow, orange, red (B) Violet, indigo, blue (C) All colours (D) All colours except green 	1
12	In an astronomical telescope in normal adjustment, a straight black line of length *L* is drawn on the objective lens. The eyepiece forms a real image of this line. The length of this image is *l*. The magnification of the telescope is (A) $\frac{L}{l}$ (B) $\frac{L}{l}+1$ (C) $\frac{L}{l}-1$ (D) $\frac{L+l}{L-l}$	1

(Q.NO. 13-16) Two statements are given-one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below.

(A) If Both A and R are true and R is the correct explanation of A

(B) If Both A and R are true and R is NOT the correct explanation of A

(C) If A is true but R is false (D) If both A and R are false

13	Assertion: Kinetic energy of photo electrons emitted by a photosensitive surface depends upon the intensity of incident photon. Reason: The ejection of electrons from metallic surface is possible with frequency of incident photon below the threshold frequency	1
14	Assertion: The drift velocity of electrons in a metallic wire will decrease, if the temperature of the wire is increased. Reason: On increasing temperature, conductivity of metallic wire decreases.	1
15	Assertion: Faraday's laws are consequences of conservation of energy. Reason : In a purely resistive ac circuit, the current lags behind the e.m.f. in phase.	1
16	Assertion: In Young's experiment, the fringe width for dark fringes is different from that for bright fringes. Reason: In Young's double slit experiment the fringes are performed with a source of white light; then only black and bright fringes are observed.	1

SECTION B

17	Draw a graph showing the variation of stopping potential with frequency of incident radiation in relation to photoelectric effect. Deduce an expression for the slope of graph using Einstein's photo electric equation. OR If the frequency of incident radiation on a photocell is doubled for the same intensity, what changes will you observe in (i) kinetic energy of photo electrons emitted (ii) photoelectric current and stopping potential? Justify your answer in each case.	2
18	Explain with the help of a labelled diagram, the working principle of an ac generator.	2
19	Electromagnetic waves with wavelength (i) λ1 is suitable for radar systems used in aircraft navigation. (ii) λ2 is used to improve visibility in runways during fog and mist conditions. (iii) λ3 is used to kill germs in water purifiers. Identify and name the part of the electromagnetic spectrum to which these radiations belong. Also arrange these wavelengths in ascending order of their magnitude.	2
20	How does the resistivity of (i) a conductor and (ii) a semiconductor vary with temperature? Give reasons	2
21	A diode having potential difference 0.5 *V* across its junction which does not depend on current, is connected in series with resistance of 20 Ω across source. If 0.1 *A* passes through resistance then what is the voltage of the source.	2

SECTION C

22	How will you convert a galvanometer into an ammeter of range 0 - I amperes? What is the effective resistance of an ammeter? Derive formula for it?	3

23	State Bohr's postulate for the permitted orbits for the electron in a hydrogen atom. Use this postulate to prove that the circumference of the n^{th} permitted orbit for the electron can contain exactly 'n' wavelengths of the de-Broglie wavelength associated with the electron in that orbit.	3
24	If a nucleus $_{26}Fe^{56}$ splits into two nuclei of $_{13}Al^{28}$, would the energy be released or needed for this purpose to occur? Given m ($_{26}Fe^{56}$) = 55.934944&m ($_{13}Al^{28}$) = 27.98191, 1u = 931MeV/c^2 Calculate the energy in MeV.	3
25	Define wavefront. Using Huygen's principle to verify the laws of reflection. OR State Huygen's postulates of wave theory. Using this verify the laws of refraction.	3
26	Describe the formula for the equivalent EMF and internal resistance for the parallel combination of two cells with EMF E_1 and E_2 and internal resistances r_1 and r_2 respectively. What is the corresponding formula for the series combination?	3
27	Give reasons for the following: (a)We need coherent sources for sustained interference. (b) The amplitudes of interfering waves must be equal or nearly equal. (c) The separation between two coherent sources must be as small as possible but not zero.	3
28	Define Electric dipole moment. Derive the formula for the electric potential energy of an electric dipole in a uniform electric field. State the conditions for stable and unstable equilibrium.	3

SECTION D

CASE STUDY BASED QUESTIONS

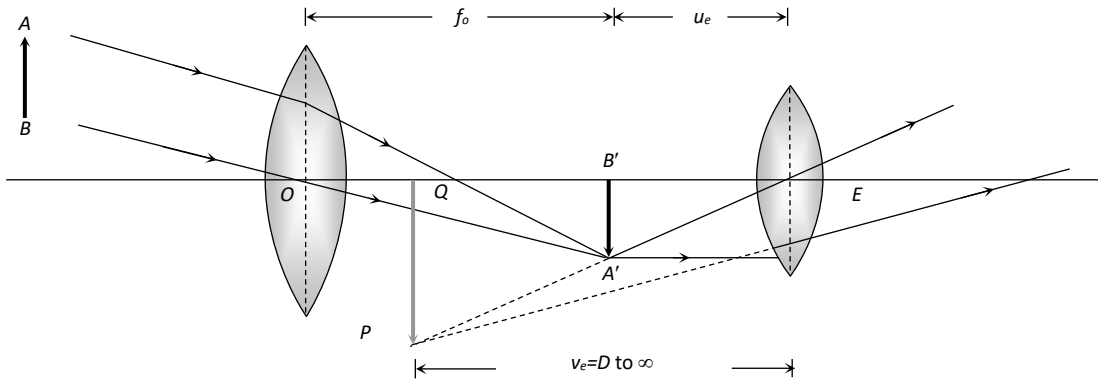
29

Astronomical Telescope

4

It is an optical instrument used to increase the visual angle of distant large objects. Telescopes mainly are of two types viz. astronomical and terrestrial.

It consists of two converging lenses placed coaxially with objective having large aperture and a large focal length while the eye- piece having smaller aperture and focal length. The separation between eye- piece and objective can be varied.



1. An astronomical telescope has an objective and eye-piece lens of powers 0.5 *D* and 20 *D* respectively, its magnifying power will be
   (a) 8 (b) 20 (c) 30 (d) 40
2. The magnifying power of a simple microscope can be increased if we use an eye-piece of
   (a) Higher focal length (b) Smaller focal length
   (c) Higher diameter (d) Smaller diameter
3. Linear magnification of simple microscope is 5.Its focal length is
   (a) 4.25 cm (b) 5.75 cm (c) 6.25 cm (d) 7 cm
4. Large aperture of telescope are used for
   (a) Large image (b) Greater resolution
   (c) Reducing lens aberration (d) Ease of manufacturing

OR

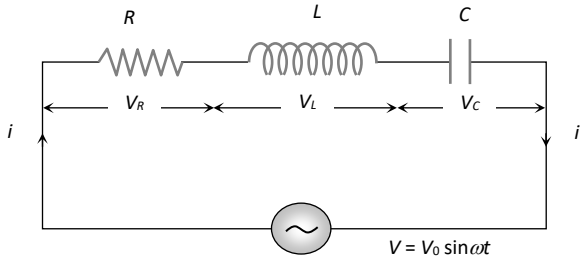
4. The aperture of the objective lens of a telescope is made large so as to
   (a) Increase the magnifying power of the telescope
   (b) Increase the resolving power of the telescope
   (c) Make image aberration less
   (d) Focus on distant objects

30

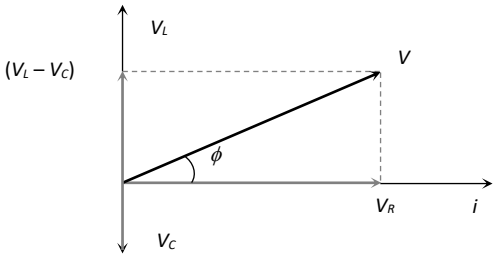
Series *RLC*-Circuit

4

When a pure resistance R, pure inductor L and an ideal capacitor of capacitance C is connected in series to a source of alternating e.m.f., then current at any instant through the three elements has the same amplitude and is represented as $I = I_o \sin wt$. However, voltage across each element has a different phase relationship with the current as shown in graph. The effective resistance of RLC circuit is called impedance (2) of the circuit and the voltage leads the current by a phase angle



$V_R = iR$, $V_L = iX_L$, $V_C = iX_C$



Phasor diagram

1.The phase angle between e.m.f. and current in *LCR* series ac circuit is

(a) Between 0 to $\pi/2$ (b) $\pi/4$

(c) $\pi/2$ (d) π

2. Power delivered by the source of the circuit becomes maximum, when

(a) $\omega L = \omega C$ (b) $\omega L = \frac{1}{\omega C}$

(c) $\omega L = -\left(\frac{1}{\omega C}\right)^2$ (d) $\omega L = \sqrt{\omega C}$

3. In a *LCR* circuit having *L* = 8.0 *henry*, *C* = 0.5 μF and *R* = 100 *ohm* in series. The resonance frequency in *per second* is

(a) 600 *radian* (b) 600 *Hz*

(c) 500 *radian* (d) 500 *Hz*

OR

3. In *LCR* circuit, the capacitance is changed from *C* to 4*C*. For the same resonant frequency, the inductance should be changed from *L* to

(a) 2*L* (b) *L* / 2

(c) *L* / 4 (d) 4 *L*

4. The phase difference between e.m.f. and current in *LCR* series ac circuit at resonance is

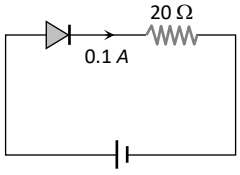
(a) 0 (b) $\pi/4$ (c) $\pi/2$ (d) π

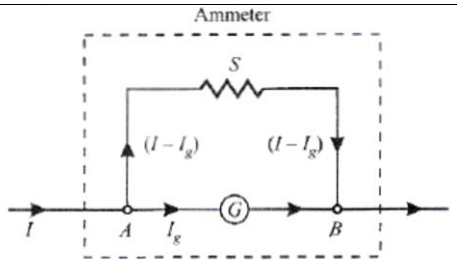
SECTION E

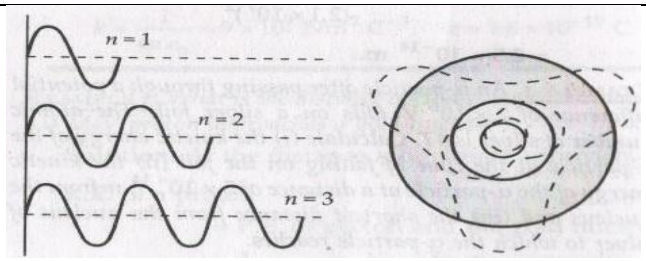
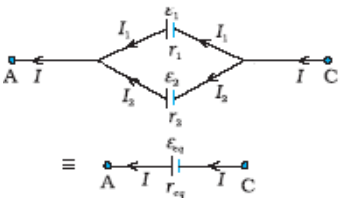
31	(A)State Gauss's law in electrostatics. Using Gauss Theorem, show mathematically that for a point outside a shell, the field due to a uniformly charged thin shell is the same as if the entire charge of the shell is concentrated at the centre. (B)An infinite non-conducting sheet has a surface charge density $\sigma = 0.10\ \mu C/m^2$ on one side. How far apart are equipotential surfaces whose potentials differ by 50 *V* OR (A)Define relaxation time of the free electrons drifting in a conductor. How is it related to the drift velocity of free electrons? Use this relation to deduce the expression for the electrical resistivity of the material. (B) Two cells of EMF 1V, 2V and internal resistances 2Ω and 1Ω respectively are connected in (i) series, (ii) parallel. What should be the external resistance in the circuit so that the current through the resistance be the same in the two cases? In which case more heat is generated in the cells?	5
32	(A)State Biot- Savart law and apply it to find the magnetic field due to a circular loop carrying current at a point on the axis. (B) A magnet is parallel to a uniform magnetic field. If it is rotated by 60°, the work done is 0.8 *J*. How much work is done in moving it 30° further? OR (A)Distinguish between Para, Ferro and Diamagnetic Materials. (At least three properties) (B)Find the work done to rotate a bar magnet in uniform magnetic field from (i)Θ=0 to Θ=90 (ii) Stable to unstable equilibrium	5
33	(A)What is semiconductor diode. How a diode can be made forward and reverse bias. Draw its V-I characteristic curve. (B)Discuss working of full wave rectifier with circuit diagram. Draw its input & output wave forms. OR (A)Difference between insulator, conductor and semiconductor on the basis of Energy band diagram. (B)Difference between n-type and p-type semiconductor on the basis of energy band diagram. (C)Define the depletion layer and barrier potential.	5

Class: XII
SESSION: 2023-2024
MARKING SCHEME
KV RO JPR SAMPLE QUESTION PAPER (THEORY) GROUP C
SUBJECT: PHYSICS

Q.NO.	1	2	3	4	5	6	7	8
ANS	C	A	C	A	D	C	A	C
Q.NO.	9	10	11	12	12	14	15	16
ANS	D	D	A	A	D	B	C	D

Q. No.		Marks
17	Correct Graph Correct Explanation and Derivation OR Correct Explanation	½ 1½ 1 1
18	**AC generator:** It is a device which converts mechanical energy in to electrical energy. **Principle:** It is based on the principle of **electromagnetic induction,** i,e, whenever there is change in magnetic flux linked with a coil, an emf is induced in the coil At any instant the magnetic flux linked with the coil = B.A Induced emf in the coil $\in = -N\frac{d\phi}{dt}$	1
19	λ1 –Microwave λ2 – infrared λ3- ultraviolet Ascending order – λ3<λ2<λ1	½ ½ ½ ½
20	$\rho = \frac{m}{ne^2\tau} \Rightarrow \quad \rho\alpha\frac{1}{n}$ and $\rho\alpha\frac{1}{\tau}$ (i) For a conductor, the density of free e's is almost independent of temperature but the frequency of collision of e's increases with increase in temperature. Therefore, the relaxation time decreases. Hence the resistivity of a conductor increases with increase in temperature (conductivity decreases). (ii) On increasing the temperature of a semiconductor, the density of free e's increases and the relaxation time decreases. But the increase in 'n' is large than the decrease in 'τ'. Hence the resistivity of a semiconductor decreases with increase in temperature (conductivity increases).	2 2
21	$V' = V + IR$ = 0.5 + 0.1 × 20 = 2.5 V 	2
22	An ammeter is connected in series to a circuit. So, it must have very small resistance so that it does not affect the current. Therefore, to convert a galvanometer into an ammeter, a low resistance, called shunt, is connected in parallel with the galvanometer coil.	1+2

	 Let R_G be the resistance of galvanometer and I_g be the current with which galvanometer gives full scale deflection. A shunt of resistance S is connected in parallel with it. To measure maximum current I, the maximum current through galvanometer must be I_g and hence rest current I - I_g should pass through the shunt. As galvanometer and shunt are in parallel, the potential difference across them is equal. So, $I_g G = (I - I_g)S$ or $S = \frac{I_g G}{(I - I_g)}$ The effective resistance of the ammeter becomes $R_A = \frac{GS}{G+S}$	
23	(i) An atom is a hollow sphere ($\approx 10^{-10}$m) consists of a small massive central core in which entire positive charge and almost the whole mass of the atom are concentrated. This core is called the nucleus ($\approx 10^{-15}$m). (ii) Electrons revolve around the nucleus in various circular orbits, for which the necessary centripetal force is provided by the electrostatic force of attraction between electron and nucleus. (iii) Electrons can revolve only in those circular orbits in which the angular momentum of an electron is an integral multiple of $\frac{h}{2\pi}$; h being the Planck's constant. i,e, mvr = n $\frac{h}{2\pi}$ where n = 1,2,3,4,----------& is principal quantum number. This is called Bohr's quantisation condition of angular momentum. While revolving in these permissible orbits, an electron does not radiate energy. These non-radiating orbits are called stationary orbits. (v) An atom can emit or absorb radiation in the form of discrete energy photons only when an electron jumps from a higher to a lower orbit or from a lower to a higher orbit respectively. i,e, $h\nu = E_2 - E_1$ where h is called Planck's constant.	½ ½ ½ 1 ½

	 But $\lambda = \frac{h}{mv}$ ⇨ $2\pi r = n\frac{h}{mv}$ ⇨ $mvr = n\frac{h}{2\pi}$, n= 1,2,3 --- This is famous Bohr's quantisation condition for angular momentum.	
24	$m(_{26}Fe^{56}) + Q \rightarrow 2\,(_{13}Al^{28})$ $\Delta m = 2 \times (27.98191)\ u - 55.934944\ u$ $= 0.02888\ u$ Energy released, = 0.02888 x 931MeV = 26.88728 MeV	3
25	Correct Definition Correct Explanation OR Correct Definition Correct Explanation	1 2 1 2
26	$I = I_1 + I_2$ ---------(1) Terminal p.d. across first cell, $V = E_1 - I_1 r_1 \Rightarrow I_1 = \frac{E_1 - V}{r_1}$ Terminal p.d. across second cell, $V = E_2 - I_2 r_2 \Rightarrow I_2 = \frac{E_2 - V}{r_2}$  Putting the values of I_1 & I_2 in (1) $I = \frac{E_1 - V}{r_1} + \frac{E_2 - V}{r_2} = \frac{E_1}{r_1} + \frac{E_2}{r_2} \quad -V\left(\frac{1}{r_1} + \frac{1}{r_2}\right) \Rightarrow V = \frac{E_1 r_2 + E_2 r_1}{r_1 + r_2} - I\frac{r_1 r_2}{r_1 + r_2}$ ---------- (2) If we replace the combination by a single cell, between *A* and C of emf E_{eq} and internal resistance r_{eq}, then $V_{eq} = E_{eq} - Ir_{eq}$ ---------- (3) Comparing (2) & (3), $E_{eq} = \frac{E_1 r_2 + E_2 r_1}{r_1 + r_2}$ and $r_{eq} = \frac{r_1 r_2}{r_1 + r_2}$ For series combination, $E_{eq} = E_1 + E_2$ and $r_{eq} = r_1 + r_2$	$2\frac{1}{2}$ $\frac{1}{2}$
27	(a) the positions of maxima minima will be fixed only in case of coherent sources. (b) for getting a sharp contrast between maxima and minima (c) this is to ensure broad fringe width for easier observation of the phenomenon. In case of zero separation central maxima will occupy the entire screen so higher order maxima and minima will not be observable.	1 1 1
28	Correct Definition Correct Explanation Correct Value	½ 2 ½

29	(1)D (2)B (3)C (4)B **OR** (4)A	4
30	(1)A (2)B (3)C **OR** (3)C (4)A	4
31	(A)Correct Statement CORRECT EXPLAINATION (B) $E = \frac{V}{d} \Rightarrow \frac{\sigma}{2\varepsilon_0} = \frac{V}{d} \Rightarrow d = \frac{V \times 2\varepsilon_0}{\sigma} = \frac{50 \times 2 \times 8.85 \times 10^{-12}}{0.1 \times 10^{-6}}$ = 8.85×10^{-3} *m* = 8.88 *mm* **OR** (A)Correct Statement Correct Explanation (B)For series combination, $I_S = \frac{3}{3+R}$ and For parallel combination, $I_P = \frac{\frac{5}{3}}{\frac{2}{3}+R} = \frac{5}{3R+2}$ Given $I_S = I_P \Rightarrow R = \frac{9}{4}$ = 2.25 Ω . In series combination more heat is generated in the cells.	1 2 2 1 2 2
32	(A) Correct Statement Correct Explanation (B) $W = MB(\cos\theta_1 - \cos\theta_2)$ When the magnet is rotated from 0° to 60°, then work done is 0.8 *J* $0.8 = MB(\cos 0° - \cos 60°) = \frac{MB}{2}$ $\Rightarrow \quad MB = 1.6\ N - m$ In order to rotate the magnet through an angle of 30°, *i.e.*, from 60° to 90°, the work done is $W' = MB(\cos 60° - \cos 90°) = MB\left(\frac{1}{2} - 0\right)$ $= \frac{MB}{2} = \frac{1.6}{2} = 0.8\ J$ Any three difference Correct Answer	1 2 2 3 2
33	semiconductor diode is basically a p-n junction with metallic contacts provided at the ends for external voltage. Forward bias: In forward bias, the p-type is connected with the positive terminal and the n-type is connected with the negative terminal. Reverse bias: In reverse bias, the p-type is connected with the negative terminal and the n-type is connected with the positive terminal. Correct Explanation & Graph Correct Working Principle OR (A)Correct Difference between insulator, conductor and semiconductor on the basis of Energy band diagram. (B)Correct Difference between n-type and p-type semiconductor (C)Correct Definition	1 1 1 2 1 2 2

KVS(RO) JAIPUR
CLASS-XII
SESSION-2023-2024
SAMPLE PAPER GROUP-D

UNIT	Name Of Unit	MCQ (1-Mark)	Assertion /Reasoning (1-Mark)	SA (2-Marks)	SA (3-Marks)	Case Based Question (4-Marks)	Long Answer. (5-Marks)	TOTAL 70(33)
UNIT 1	ELECTROSTATICS	2(2)	1(1)		3(1)		5(1)	16(7)
UNIT 2	CURRENT ELECTRICITY			2(1)	3(1)			
UNIT 3	MAGNETIC EFFECT OF CURRENT AND MAGNETISM	2(2)	1(1)	2(1)				17(9)
UNIT 4	EMI & A.C	2(2)		2(1)	3(1)		5(1)	
UNIT 5	E.M. WAVES	1(1)		2(1)				18(8)
UNIT 6	OPTICS	2(2)	1(1)		3(1)	4(1)	5(1)	
UNIT 7	DUAL NATURE OF RADIATION AND MATTER	2(2)		2(1)				12(7)
UNIT 8	ATOM AND NUCLEI	1(1)	1(1)		6(2)			
UNIT 9	ELECTRONIC DEVICES				3(1)	4(1)		7(2)
		12(12)	4(4)	10(5)	21(7)	8(2)	15(3)	70(33)

SUBJECT: - PHYSICS (BLUE PRINT)

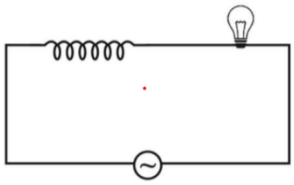
SAMPLE QUESTION PAPER (GROUP-D)
CLASS: XII
SESSION: 2023-24
SUBJECT: PHYSICS (THEORY)

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

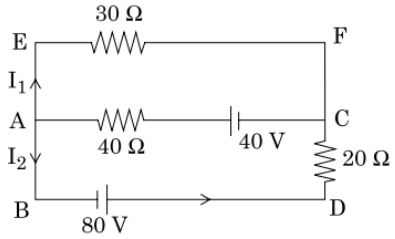
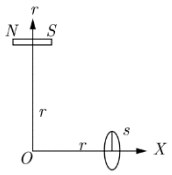
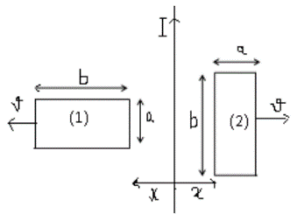
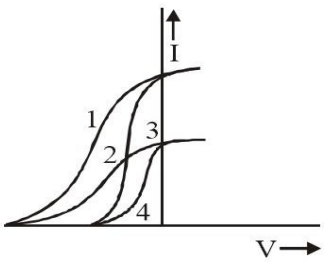
General Instructions

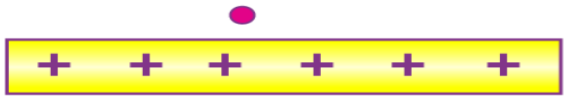
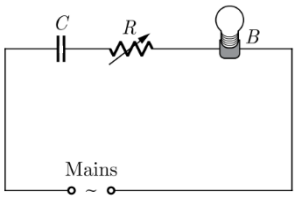
(1) There are 33 questions in all. All questions are compulsory.
(2) This question paper has five sections: Section A, Section B, Section C, Section D and Section E.
(3) All the sections are compulsory.
(4) Section A contains sixteen questions, twelve MCQ and four Assertion Reasoning based of 1 mark 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.
(6) Use of calculators is not allowed.
(7) You may use the following values of physical constants where ever 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. $\mu_0 = 4\pi \times 10^{-7}$ Tm$\boldsymbol{A^{-1}}$
v. $h = 6.63 \times 10^{-34}$ Js
vi. $\varepsilon_0 = 8.854 \times 10^{-12}$ $\boldsymbol{C^2N^{-1}m^{-2}}$
vii. Avogadro's number = 6.023 X $\mathbf{10^{23}}$ per gram mole

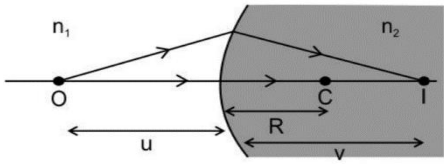
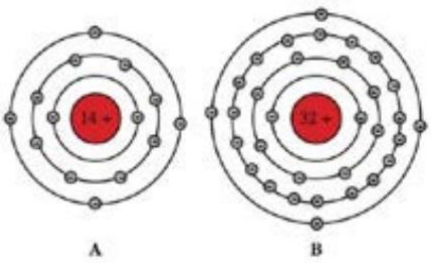
SECTION-A		
Q.No	Questions	Marks
1	If there were only one type of charge in the universe, then (a) $\oint \vec{E} \cdot \vec{ds} \neq 0$ on any surface. (b) $\oint \vec{E} \cdot \vec{ds} = 0$ if the charge is outside the surface. (c) $\oint \vec{E} \cdot \vec{ds}$ could not be defined. (d)$\oint \vec{E} \cdot \vec{ds} = q/\epsilon_0$ if charges of magnitude q were outside the surface.	1
2	Consider a uniform electric field in the $\hat{z}$ direction. The potential is a constant (a) for any x for a given z. (b) for any y for a given z. (c) on the x-y plane for a given z (d) All of these	1
3	Two concentric and coplanar circular loops P and Q have their radii in the ratio 2:3. Loop Q carries a current 9 A in the anticlockwise direction. For the magnetic field to be zero at the common centre, loop P must carry (a) 3A in clockwise direction (b) 9A in clockwise direction (c) 6 A in anti-clockwise direction (d) 6 A in the clockwise direction	1
4	A circular current carrying coil produces a magnetic field B_0 at its centre. The coil is rewound so as to have 3 turns and the same current is pass through it. The new magnetic field at the centre is	1

	(a)3 B_0 (b) $B_0/3$ (c) $B_0/9$ (d) $9B_0$	
5	An iron cored coil is connected in series with an electric bulb with an AC source as shown in figure. When iron piece is taken out of the coil, the brightness of the bulb will (a) decrease (b) increase (c) remain unaffected (d) fluctuate 	
6	When current in a coil change from 5A to 2A in 0.1sec, average voltage of 50V is produce. The self-inductance of the coil is (a)1.67H (b)6H (c)0.02H (d)0.002H	1
7	Which of the following waves have a maximum frequency? (a)infrared waves (b)gamma rays (c)microwaves(d)radio waves	1
8	**The refractive angle of a prism for a monochromatic light is 60^0 and refractive index is $\sqrt{2}$. For minimum deviation, the angle of incidence will be** (a) 60^0 (b) 45^0 (c) 30^0 (d) 75^0	1
9	If the refractive index for water is 4/3 and the velocity of light in vacuum is 3×10^{10} cm s^{-1}, the time taken by light in travelling a distance of 500 m in water is (a) 2.22×10^{-1} s (b) 2.22×10^{-6} s (c) 2.22×10^{-8} s (d) 2.22×10^{-10} s.	1
10	The wavelength of a photon needed to remove a proton from a nucleus which is bound to the nucleus with 1 MeV energy is nearly (a) 1.2 nm (b) 1.2×10^{-3} nm (c) 1.2×10^{-6} nm (d) 1.2×10^{1} nm	1
11	A proton and an alpha particle are accelerated by the same potential difference. The ratio of their De-Broglie wavelengths λ_p/λ_α is (a) 1 (b) 2 (c) $\sqrt{8}$ (d) $1/\sqrt{8}$	1
12	Which property of nuclear force explains that the binding energy per nucleon is nearly constant for the mass number of nuclei between $20 < A < 170$? (a) Strong nuclear force (b) Spin dependence (c) Non-central nature of nuclear force (d) Short range property of nuclear force	1
	For questions 13 to 16 ,Two statements are given-one labelled Assertion and the other labelled Reason. Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below. **(a) Both A and R are true and R is the correct explanation of A** **(b) Both A and R are true and R is NOT the correct explanation of A** **(c) A is true but R is false** **(d) A is false and R is also false**	
13	**Assertion-** Intensity of light remains same in total internal reflection because all the light is reflected back in the same medium. **Reason-** The critical angle can be defined only when light goes from rarer medium to a denser medium.	1
14	**Assertion-** The total energy of revolving electron in any stationary orbit is negative. **Reason-**Energy is a scalar quantity. It can have positive or negative values.	1
15	**Assertion-** The current loop also behaves as a magnetic dipole **Reason-** The magnetic moment of the dipole is dependent on current flowing through it.	1
16	**Assertion:** The drift velocity of electrons in a metallic wire will decrease, if the temperature of the wire is increased. **Reason:** On increasing temperature, conductivity of metallic wire will increase.	1

SECTION-B

17	 Use Kirchhoff's rule to calculate the current in arm AC of the given circuit.	2
18	A small magnet of magnetic moment M, is placed at a distance r from the origin O with its axis parallel to X -axis as shown. A small coil, if one turn is placed on the X -axis, at the same distance from the origin, with the axis of the coil coinciding with X -axis. For what value of current in the coil does a small magnetic needle, kept at origin, remains undeflected? What is the direction of current in the coil? 	2
19	Electromagnetic waves with wavelength (i) $\lambda_1$are used to treat muscular strain (ii) λ_2 are used by a FM radio station for broadcasting (iii) λ_3 are used to detect fracture in bones (iv) λ_4 are absorbed by the ozone layer of the atmosphere. Identify and name the part of the electromagnetic spectrum to which these radiations belong.	2
20	Figure shows two identical rectangular loops (1) and (2), placed on a table along with a straight long current carrying conductor between them. (i)What will be the direction of induced currents in the loops when they are pulled away from the conductor with the same velocity? (ii) Will the emf induced in the two loops be equal? 	2
21	The given graph shows the variation of photoelectric current I versus applied voltage V for two different photosensitive materials and for two different intensities of the incident radiations. Identify the pairs of curves that corresponds to different materials but same intensity of incident radiation. 	2

	SECTION-C	
22	(i) Define the term drift velocity. (ii) On the basis of electron drift, derive an expression for resistivity of an conductor in terms of number density of free electrons and relaxation time. On what factors does resistivity of a conductor depend?	3
23	A particle of mass 5×10^{-6}g is kept over a large horizontal sheet of charge of density 4.0×10^{-6} C/m^2 (figure). What charge should be given to this particle so that if released, it does not fall down? How many electrons are to be removed to give this charge? How much mass is decreased due to the removal of these electrons? 	3
24	A capacitor C, a variable resistor R and a bulb B are connected in series to the AC mains in the circuit as shown in the figure. The bulb glows with some brightness. How will the glow of the bulb change if (i) a dielectric slab is introduced between the plates of the capacitor keeping resistance R to be the same (ii) the resistance R is increased keeping the same capacitance?  **OR** State the condition under which the phenomenon of resonance occurs in a series LCR circuit. Plot a graph showing the variation of current with frequency of an AC source in series LCR circuit	3
25	Draw a labelled circuit diagram of a junction diode as a full wave rectifier. Explain its underlying principle and working. Depict the input and output wave forms.	3
26	(a)Draw a ray diagram to show the refraction of light through a glass prism. Hence derive the relation $\mu = \frac{\sin(\frac{A+\delta_m}{2})}{\sin\frac{A}{2}}$ (b)A ray of light incident on an equilateral glass prism propagates parallel to the base line of the prism inside it. Find the angle of incidence of this ray. Given refractive index of material of glass prism is $\sqrt{3}$.	3
27	A hydrogen atom initially in its ground state absorbs a photon and goes to the excited state with energy 12.75 eV. Calculate the longest wavelength of the radiation emitted and identify the series to which it belongs. (Take Rydberg constant R $=1.1\text{x}10^{-7}\text{m}^{-1}$)	3
28	(a) Show that nuclear density in a given nucleus is independent of mass number. (b)Compare the radii and mass density of two nuclei with mass numbers 1 and 27 respectively.	3
	SECTION-D	
29	**Case study-1** Refraction at a curved refracting surface of radius of curvature R is governed by curved surface formula that is given as $\frac{n_2}{v} - \frac{n_1}{u} = \frac{n_2 - n_1}{R}$ .....(1) For a plane refracting surface, the curved surface formula gets modified as:	4

	$n_2/v = n_1/u$ .....(2)  Lens maker formula is the relation between radii of curvature and refractive index of a lens and help us to form a lens of desired focal length. $\frac{1}{f}=(n_{21}-1)\left(\frac{1}{R_1}-\frac{1}{R_2}\right)$ (i)Air bubble in water behaves as (a)sometimes concave, sometimes convex lens (b)concave lens (c)convex lens (d)always refracting surface (ii) The focal length of a biconvex lens of radii of each surface 50cm and refractive index 1.5 is (a)40.4cm(b)75cm(c)50cm(d)80cm (iii)We combine two lenses, one is convex and other is concave having focal lengths f1 and $f_2$and their combine focal length is F. Combination of the lenses behaves like concave lens, if (a)$f_1>f_2$(b)$f_1=f_2$(c)$f_1<f2$(d)$f_1\leq f_2$ (iv)An object is immersed in a fluid. In order that the object becomes invisible, it should (a)behaves as a perfect reflector. (b)absorb all light falling on it. (c)have refractive index one (d)have refractive index exactly matching with that of the surrounding fluid **Or** (iv)A convex lens and a concave mirror are emerged in water, focal length of which device/devices would change (a) Convex lens (b)Concave Mirror (c)Both (d)None	
30	**Case study-2** Anita was thinking that C, Si and Ge have same lattice structure, but C is insulator while Si and Ge intrinsic semiconductors. For its answer, she met her friend Parul. Parul explained him that the four bonding electrons of C, Si and Ge lie respectively in the second, third and fourth orbit. So, energy required to take out an electron from these atoms known as ionisation energy IE will be least for Ge, followed by Si and highest for C. Hence number of free electrons for conduction in Ge and Si are significant while negligible small for C  	4

	(i) Energy band gap in a pure semiconductor is of the order of (a) 1eV (b) 0eV (c) 10eV (d)nothing can be said **(ii)**How many types of current carriers are present in a semiconductor? (a) 1 (b) 2 (c) 1 or 2 (d)more than 2 **(iii)**Which is better semiconductor silicon or germanium? (a)silicon (b) germanium (c) both have equal resistivity (d)data is insufficient **(iv)**With increase in temperature resistivity of semiconductor is (a)Increases(b)Decreases(c)remain same (d)Depends on its nature **OR** **(iv)**When a pure semiconductor is doped. Its conductivity (a)Increases (b)Decreases(c) remain same (d)Depends on its nature	
	SECTION-E	
31	(i)An electric dipole is held in a uniform electric field. Using suitable diagram show that it does not undergo any translatory motion. Derive the expression for the torque acting on it. (ii) What would happen if the field in non-uniform? (iii) What would happen if the external electric field is increasing (a) parallel to Electric dipole moment and (b) anti-parallel to Electric dipole moment? **OR** (i)State Gauss's law in electrostatics. (ii) "The outward electric flux due to charge +Q is independent of the shape and size of the surface which encloses it" Give two reasons to justify this statement. (iii) An electric field along x-axis is given by $\vec{E} = 100\hat{\imath}$ N/C for x > 0 and $\vec{E} = -100\hat{\imath}$ N/C for x <0. A right circular cylinder of length 20cm and radius 5cm lies parallel to the x-axis, with its center at the origin and one face at x = + 10cm, the other face at x = -10cm. Calculate the net outward flux through the cylinder.	5
32	(i)State Ampere's circuital law and using it find magnetic field due to straight infinite current carrying wire. (ii)Draw a graph between magnetic field and perpendicular distance of observation point from the wire	5

	(iii)A long straight wire in the horizontal plane carries a current of 15A in north to south direction. Find the magnitude and direction of magnetic field at a point 2.5m east of the wire. **OR** (a)With the help of a diagram, Explain the working of a moving coil galvanometer. Justify the necessity of using radial magnetic field in it (b)A galvanometer can be converted into a voltmeter to measure up to (i)V volt by connecting a resistance of 2 kΩ in series with the galvanometer. (ii)2V volt by connecting a resistance of 5 kΩ in series with the galvanometer Calculate the resistance to be connected in series with the galvanometer to convert it into a voltmeter to measure up to V/2 volt.	
33	(a) State Huygens's principle. With the help of a diagram, show how a plane wave is reflected from a surface. Hence verify the law of reflection. (b)What is the shape of wave front in each of the following cases (i)Light diverging from a point source (ii)Light emerging out of a convex lens when point source is placed at its focus (iii)The portion of the wave-front of light from a distant star intercepted by the earth. **OR** (i)Draw a labelled ray diagram to show the image formation by an astronomical telescope in normal adjustment. (ii) Define magnifying power of an astronomical telescope in normal adjustment (i,e, when the final image is formed at infinity). (iii) A small telescope has an objective lens of focal length 144cm and an eyepiece of focal length 6cm.What is the magnifying power of the telescope? What is the separation between objective and eyepiece?	5

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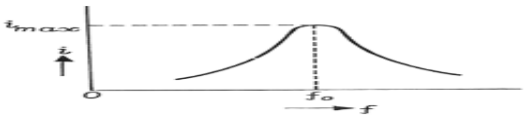
MARKING SCHEME (Set-D)

Q.No	1	2	3	4	5	6	7	8
Ans	b	d	d	d	b	a	b	b
Q.No	9	10	11	12	13	14	15	16
Ans	b	b	c	d	c	b	b	c

Q.No.	Questions	Marks
17	For the mesh EFCAE $-30I_1+40-40(I_1+I_2)=0$ or $-7I_1-4I_2=-4$ or $7I_1+4I_2=4$....(i) For mesh ACDBA $40(I_1+I_2)-40+20I_2-80=0$ or $40I_1+60I_2-120=0$ or $2I_1+3I_2=6$.....(ii) Solving (i) and (ii), we get $I_1=-12/13$ A and $I_2=34/13$ A ∴ Current through arm AC=$(I_1+I_2)=22/13$ A	½ ½ ½ ½
18	his happens when the magnetic field of a bar magnet is equal and opposite to the magnetic field of coil. $\overrightarrow{\lvert B_m \rvert} = \lvert \vec{B}_e \rvert$ $\frac{\mu_0}{4\pi}\frac{M}{r^3} = \frac{\mu_0}{4\pi}\frac{I\pi x^2}{(r^2+x^2)^{3/2}}$ $I = \frac{M(r^2+x^2)^{3/2}}{\pi x^2}$ Current is in anticlockwise direction, as seen from the Origin.	½ ½ ½ ½
19	(i)Infraraed(ii)Microwave(iii)X Rays(iv)UV	½(each) ½x4=2
20	(i) in loop (1) - Anticlockwise in loop (2) – Clockwise (ii) (ii) No, emf will not be equal because the rate of change of magnetic flux in the two loops are different	½+½ 1
21	Curves 1 and 2 correspond to similar materials while curves and 4 represent different materials, since the value of stopping potential for 1,2 and 3, 4 are the same,For the given frequency of the incident radiation, the stopping potential is independent of its intensity So, the pairs of curves (1 and 3) and (2 and 4) correspond to different materials but same intensity of incident radiations.	1+1

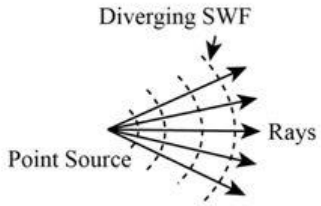
22	(i)The average velocity with which the free electron drift under the influence of an electric field. (ii)$V_d=-eE\tau/m$....(i) Current flowing through the conductor --- $I=nAV_de$....(ii) from equation (i) and (ii). $I=nA(eE\tau/m)e \Longrightarrow I=nAe^2E\tau/m$....(iii) If V is potential difference applied across the two ends of the conductor, then $E=V/l$ Putting this E in equation (iii), $I=nAe^2V\tau/ml \Longrightarrow V/I= ml/ne2A\tau$ According to ohm's law, V/I=R (resistance of the conductor) $R=ml/ne2A\tau$....(iv) But, $R=\rho l/A$.....(v) Comparing (iv) and (v) $\rho=ne^2\tau/m$ Resistivity of a conductor depends on the following factors: (1) It is inversely proportional to the number of free electrons per unit volume (n) of the conductor. (2) It is inversely proportional to the average relaxation time (τ) of the free electrons in the conductor.	½+1.5+1
23	The electric field in the front of the sheet is $E=\sigma/\varepsilon_0$ After solving $E= 2.26 \text{ X } 10^5$ N/C If a charge q is given to the particle the electric force qE acts in the upward direction. It will balance the weight of the particle if $q \text{ x} 2.26 \text{ X } 10^5 = 5X10^{-9} \text{ X } 9.8$ $q=21.68x10^{-14}C=2.27x10^{-13}C$ The no of electron removed $N=q/e = 1.42x10^6$ Mass decrease due to removal of these electron $\triangle m = 1.42x\ 10^6x9.1x10^{-31} =1.29x10^{-24}$kg	0.5+0.5+1+1
24	(i)As the dielectric slab is introduced between the plates of the capacitor, its capacitance will increase. Hence, the potential drop across the capacitor will decrease (V = Q/C). As a result, the potential drop across the bulb will increase (since both are connected in series). So, it brightness will increase. (ii) As the resistance (R) is increased, the potential drop across the resistor will increase. As a result, the potential drop across the bulb will decrease (since both are connected in series). So its brightness will decrease. **OR** (i) In a series LCR circuit, resonance occurs when reactance of the inductor and capacitor are equal. Condition is $X_L=X_C$(XL is inductive reactance and XC is capacitive reactance.) (ii) 	**1.5+1.5** **1.5+1.5**

25	Correct circuit diagram. principle working. input and output wave forms.	½ ½ 1 1
26	(i)Correct diagram Correct derivation (ii)So angle of reflection =30^0 , μ_g =$\sqrt{3}$ given So from snell's law $\mu_a$sini=$\mu_g$sinr sini=$\sqrt{3}$sin30^0 and i=60^0	½ 1.5 1
27	The energy of the photon=12.75eV The energy in the excited state =-13.6+12.75 =0.85eV 0.85 = 13.6/n^2 or n^2 = 13.6/0.85 or n^2 = 16 or n =4 $\frac{1}{\lambda} = R\left(\frac{1}{n_f^2} - \frac{1}{n_i^2}\right)$ For λ to be maximum $n_f = 2$ $\frac{1}{\lambda_{max}}$= R($\frac{1}{4} - \frac{1}{9}$) or λ_{max}=36/5R or $\lambda_{max} = 6566A^0$ and it belongs to Balmer Series	½ ½ 1 1
28	(a) correct derivation (b)radii 1/3 and mass density 1/1	1 1+1
29	(i)b(ii)c(iii)a(iv)d or (iv)a	1+1+1+1
30	(i)a(ii)b(iii)b(iv)a or (iv)a	1+1+1+1
31	(i)Correct diagram **Force** : Force on +q is F=+qE Force on –q is F=-qE Hence net force on the dipole F=+qE-qE =0 **Torque** :Two equal and opposite forces +qE and –qE forms a couple which tries to rotate the dipole. Torque due to this couple = either force X perpendicular distance = PEsinθ=$\vec{P}X\vec{E}$ (ii) If the electric field is non-uniform, the net force on the dipole will not be zero hence there will be the translator motion of the dipole. (iii) (a) Net force will be in the direction of increasing electric field. (b) Net force will be in the direction opposite to the increasing field **OR** (i)Correct Statement (ii) The outward electric flux due to the charge enclosed inside a surface is the number of electric field lines coming out of the surface. The outward electric flux due to charge +Q is independent of the shape and size of the surface, which encloses it because of the following reasons:(a) Number of electric field lines coming out from a closed surface enclosing the charge depends on the charge enclosed by the surface, which remains constant with shape and size of the conductor.	1+½+½ +1+1+1 1+2+2

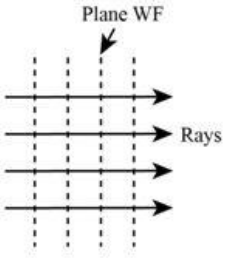
	(b)Number of electric field lines coming out from a closed surface enclosing the charge is independent of the position of the charge inside the closed surface. (iii) From the figure, we can see that on each face the electric field E and small area elements S are parallel. Therefore, flux, through right surface $\phi_1 = 100\Delta s$ flux, through left surface $\phi_2 = 100\Delta s$ flux, through curved surface $\phi_3 = 100\Delta s$ Therefore, outward flux on the side of the cylinder $\phi = 0.785 + 0.785 + 0 = 1.57 Nm^2C^{-1}$	
32	i)Correct Statement and correct derivation (ii)Correct Graph (iii) Current, I=50A Distance, r=2.5 m Magnetic field, $B=\mu_o I/2\pi r$ $B=4.0\times10^{-6}T$ According to maxwell's right hand, the direction of field is upward. **OR** (a)Correct diagram Correct working of a moving coil galvanometer. Correct justification of the necessity of using radial magnetic field (b)According to the formula, R = V/Ig – G where V is the potential difference across the terminals of the voltmeter Ig is the current in the galvanometer G is the resistance of the galvanometer Case 1: Resistance R_1 is connected to measure voltage V Hence, R_1 =2000= V /I_g – G ----------Eqn (1) Case 2: Resistance R2 is connected to measure voltage V/2 Hence, R_2 =5000= 2V/I_g – G ----------Eqn (2) Eqn (2) – Eqn (1) gives 3000=V/I_g From eq1 2000=3000-G or G=1000Ω Case 3: Resistance R_3 is connected to measure voltage V/2 Hence, R_3 = V /2I_g – G ----------Eqn (3) or R_3 = 3000/2 -1000=500Ω	0.5+2 1 1.5 1+1+1 1+1
33	(a)Correct Statement Huygens's principle and diagram and correct derivation	0.5+1+2

(b)

(i)Since, the locus of all points equidistant from the point source is a sphere therefore, the shape of the wavefront in case of light diverging from a point source will be spherical.
The shape of the wavefront is shown in figure below.



ii)When a point source is placed at the focus of a convex lens, the rays of light coming out of the lens are parallel. Hence, the geometrical shape of wavefront will be a plane wave front.
The shape of the wavefront is shown in figure below.

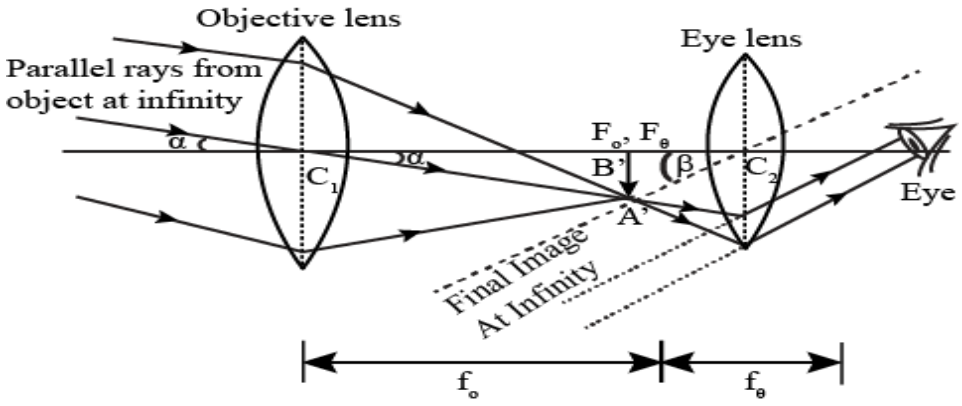


iii)Star is considered as a point source of light. Since, it is very far away from earth, so the spherical wavefronts of star reaching to the earth are very large spheres. As we see only a small area of this large sphere therefore, it looks like a plane wavefront.

0.5+0.5+0.5

OR

(i)



1+2+2

(ii)correct derivation Define of magnifying power of an astronomical telescope in normal adjustment (i,e, when the final image is formed at infinity). (iii)Focal length of the objective lens f_0=144cm
Focal length of the eyepiece lens f_e=6cm
The magnifying power of the telescope is
$m=f_0/f_e = 144/6 = 24$
the separation between the objective lens and eyepiece is
$f_0+f_e = 144+6 =150$cm

KVS(RO) JAIPUR
CLASS-XII
SESSION-2023-2024
SAMPLE PAPER GROUP-E
SUBJECT: - PHYSICS (BLUE PRINT)

Time: 3 hrs. **Class – XII** **MM – 70**

S. No.	Unit	MCQ (1mark)	Assertion Based Question (1mark)	SA I (2marks)	SA II (3marks)	Case Study Question (4 Marks)	LA (5marks)	TOTAL
1	Electrostatics	2(2)	-	2(1)	-	-	5(1)	16(6)
2	Current Electricity		-		3(1)	4(1)	-	
3	Magnetic effect of current & Magnetism	1(1)	1(1)	2(1)	3(1)	-	-	17(8)
4	Electromagnetic Induction and Alternating Current	2(2)	-	-	3(1)	-	5(1)	
5	Electromagnetic Waves	1(1)	-	2(1)	-	-	-	18(11)
6	Optics	3(3)	2(2)	4(2)	6(2)			
7	Dual nature of radiation and matter	1(1)	1(1)		3(1)	-	-	12(6)
8	Atoms and Nuclei	2(2)	-	-	-	-	5(1)	
9	Electronic Devices	-	-	-	3(1)	4(1)	-	7 (2)
	Total	12(12)	4(4)	10(5)	21(7)	8(2)	15 (3)	70 (33)

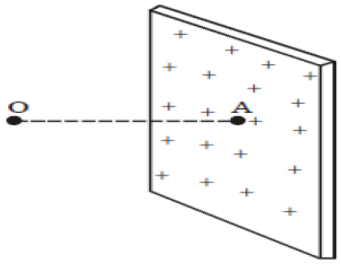
SAMPLE QUESTION PAPER (GROUP-E)
CLASS: XII
SESSION: 2023-24
SUBJECT: PHYSICS (THEORY)

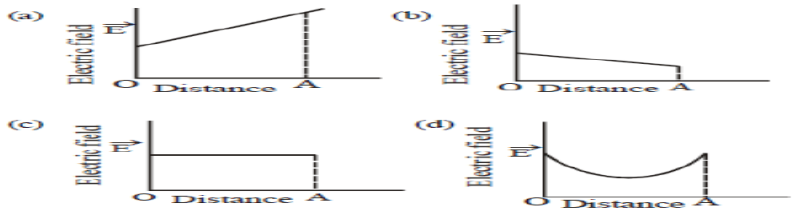
Maximum Marks: 70 Marks **Time Allowed: 3 hours.**

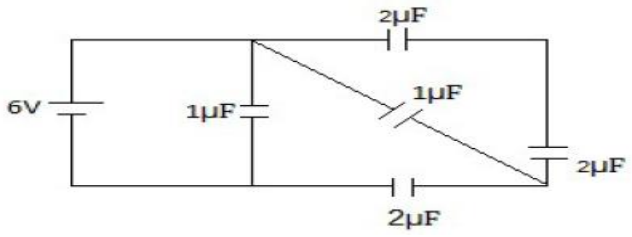
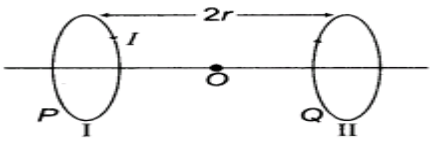
General Instructions

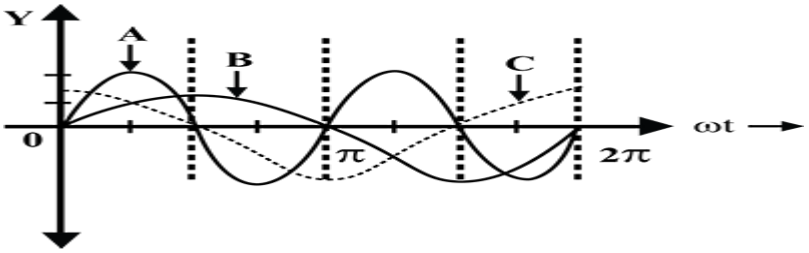
(1) There are 33 questions in all. All questions are compulsory
(2) This question paper has five sections: Section A, Section B, Section C, Section D and Section E. All the sections are compulsory.
(3) Section A contains eighteen MCQ of 1 mark each, Section B contains seven questions of two marks each,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

SECTION – A

1.	A hemisphere is uniformly charged positively. The electric field at a point on a diameter away from the centre is directed (a) perpendicular to the diameter (b) parallel to the diameter (c) at an angle tilted towards the diameter (d) at an angle tilted away from the diameter	1
2.	The north pole of a long bar magnet was pushed slowly into a short solenoid connected to a galvanometer. The magnet was held stationary for a few seconds with the north pole in the middle of the solenoid and then withdrawn rapidly. The maximum deflection of the galvanometer was observed when the magnet was (a) moving towards the solenoid (b) moving into the solenoid (c) at rest inside the solenoid (d) moving out of the solenoid	1
3.	If the rms current in a 50 Hz ac circuit is 5 A, the value of the current 1/300 seconds after its value becomes zero is (a) $5\sqrt{2}$ A (b) $5\sqrt{3/2}$ A (c) 5/6 A (d) $5/\sqrt{2}$ A	1
4.	Figure shows the part of an infinite plane sheet of charge.  	1

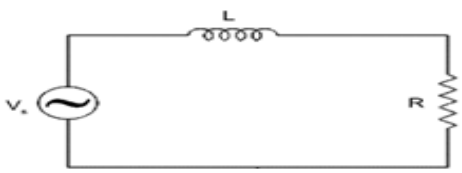
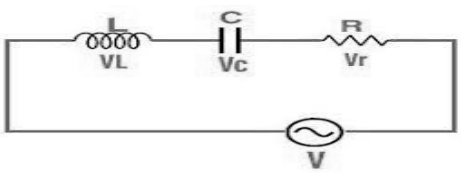
	Which of the following graphs correctly shows the behaviour of electric field intensity as we move from point O to A.  	
5.	In electromagnetic induction, the induced charge is independent of (a) change of flux (b) time. (c) resistance of the coil (d) None of these	1
6.	The oscillating electric and magnetic field vectors in an electromagnetic wave are (a) perpendicular to each other and opposite in phase. (b) parallel to each other and opposite in phase. (c) perpendicular to each other and in the same phase. (d) parallel to each other and in the same phase.	1
7.	For a total internal reflection, which of the following is correct? (a) Light travels from rarer to denser medium. (b) Light travels from denser to rarer medium. (c) Light travels in air only. (d) Light travels in water only.	1
8.	Which of the following phenomena is used in optical fibres? (a) Total internal reflection (b) Scattering (c) Diffraction (d) Refraction	1
9.	Wavefront is the locus of all points, where the particles of the medium vibrate with the same (a) phase (b) amplitude (c) frequency (d) period	1
10.	When a radiation of wavelength λ falls on a photosensitive surface, the maximum kinetic energy of photoelectrons is K. For radiation of wavelength 2λ, the maximum kinetic energy is (a) K/2 (b) 2K (c) <K/2 (d) >K/2	1
11.	In the α-particle scattering experiment, the shape of the trajectory of the scattered α -particles depend upon: (a) only on impact parameter. (b) only on the source of α-particles. (c) both impact parameter and source of α-particles. (d) impact parameter and the screen material of the detector.	1

12.	Which property of nuclear force explains that the binding energy per nucleon is nearly constant for the mass number of nuclei between $20 < A < 170$? (a) Strong nuclear force (b) Spin dependence (c) Non-central nature of nuclear force (d) Short range property of nuclear force	1
	For questions 13 to 16, Two statements are given-one labelled Assertion and the other labelled Reason. Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below. (a) Both A and R are true and R is the correct explanation of A (b) Both A and R are true and R is NOT the correct explanation of A (c) A is true but R is false (d) A is false and R is also false	
13.	Assertion: If the current in a solenoid is reversed in direction while keeping the same magnitude, the magnetic field energy stored in the solenoid remains unchanged. **Reason:** Magnetic field energy density is proportional to the magnetic field.	1
14.	Assertion: A convex lens may be diverging. Reason: The nature of a lens depends upon the refractive index of material of the lens and the surroundings.	1
15.	Assertion: In Young's double slit experiment if wavelength of incident monochromatic light is just doubled, number of bright fringes on the screen will increase. Reason: Maximum number of bright fringes on the screen is directly proportional to the wavelength of light used.	1
16.	Assertion: The photoelectrons produced by a monochromatic light beam incident on a metal surface have a spread in their kinetic energies. Reason: The work function of the metal is its characteristics property.	1
	SECTION -B	
17.	Find total energy stored in capacitors given in the circuit. 	2
18.	Two identical circular loops P and Q, each of radius r and carrying equal currents are 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 the net magnetic field at O. 	2

	OR A wire of length L is bent round in the form of a coil having N turns of same radius. If a steady current I flows through it in clockwise direction, then find the magnitude and direction of the magnetic field produced at its centre.	
19.	Compare the following (i) Wavelengths of the incident solar radiation absorbed by the earth's surface and the radiation re-radiated by the earth. (ii) Tanning effect produced on the skin by UV radiation incident directly on the skin and that coming through glass window.	2
20.	Write two characteristics of image formed when an object is placed between the optical centre and focus of a thin convex lens. Draw the graph showing variation of image distance v with object distance u in this case.	2
21.	Why is interference pattern not detected, when the two coherent sources are far apart?	2
	SECTION -C	
22.	Two cells of emf 1.5 V and 2V and internal resistance 1Ω and 2Ω are connected in parallel to pass a current in the same direction through an external resistance of 5 Ω. (a) Draw Circuit Diagram. (b) Using Kirchhoff's laws, calculate the current through each branch of the circuit and p.d. across the 5 Ω resistor. **OR** Plot a graph showing the variation of current density (j) versus the electric field (E) for two conductors of different materials. What information from this plot regarding the properties of the conducting material, can be obtained which can be used to select suitable materials for use in making (i) standard resistance and (ii) connecting wires in electric circuits?	3
23.	Compare Dia- magnetic, Para -magnetic and Ferro- magnetic material based on (i) permeability, (ii) susceptibility with suitable examples.	3
24.	A device X is connected to an ac source V = V_0 sin wt. The variation of voltage, current and power in one cycle is shown in the following graph.  (a) Identify the device X. (b)Which of the curves and C represent the voltage, current and the power consumed in the circuit? Justify your answer. (c)How does its impedance vary with frequency of the ac source? Show graphically.	3
25.	(i)The refractive index of diamond is much greater than that of glass. How does a diamond cutter make use of this fact? (ii) If a ray of light propagates from a rarer to a denser medium, how does its frequency change? (iii) Two identical glass (μ_g=3/2) equiconvex lenses of focal length f are kept in contact. The space between the two lenses is filled with water (μ_w=4/3). What is the focal length of the combination?	1+0.5+1.5

	OR How is a wave front defined? Using Huygens' construction, draw a figure showing the propagation of a plane wave refracting at a plane surface separating two media. Hence, verify Snell's law of refraction.	1+2
26.	Obtain the expression for the wavelength of De -Broglie wave associated with an electron accelerated from rest through a potential V. Plot the graph of de Broglie wavelength (ƛ)as a function of $1/\sqrt{V}$.	2+1
27.	An object is placed (i) 10cm and (ii) 5 cm in front of a concave mirror of radius of curvature 15cm. Find the position, nature and magnification of the image in each case.	1+1+1
28.	a) Explain, with the help of a circuit diagram, the working of a p-n junction diode as a half-wave rectifier. b) Write two characteristics features to distinguish between n-type and p-type semiconductors.	1.5+1.5
	SECTION – D	
29.	**Case Study Question** Whenever an electric current is passed through a conductor, it becomes hot after some time. The phenomenon of the production of heat in a resistor by the flow of an electric current through it is called heating effect of current or Joule heating. Thus, the electrical energy supplied by the source of emf is converted into heat. In purely resistive circuit, the energy expended by the source entirely appears as heat. But if the circuit has an active element like a motor, then a part of energy supplied by the source goes to do useful work and the rest appears as heat. Joule's law of heating forms the basis of various electrical appliances such as electric bulb, electric furnace, electric press etc. (i) Which of the following is correct statement? (a) Heat produced in a conductor is independent of the current flowing. (b) Heat produced in a conductor varies inversely as the current flowing. (c) Heat produced in a conductor varies directly as the square of the current flowing. (d) Heat produced in a conductor varies inversely as the square of the current flowing. (ii) If the coil of a heater is cut to half, what would happen to heat produced? (a) Doubled (b) Halved (c) Remains same (d) Becomes four times. (iii) A 25 W and 100 W are joined in series and connected to the mains. Which bulb will glow brighter? (a) 100 W (b) 25 W (c) Both bulbs will glow brighter (d) None will glow brighter (iv) A rigid container with thermally insulated wall contains a coil of resistance 100 Ω, carrying 1 A. Change in its internal energy after 5 min will be (a) 0 kJ (b) 10 kJ (c)20 kJ (d) 30 kJ	1 1 1 1

	OR (iv) The heat emitted by a bulb of 100 W in 1 min is (a) 100 J (b) 1000 J (c) 600 J (d) 6000 J	1
30.	**Read the paragraph and answer the below questions:** Materials are classified on the basis of their conductivity as metals, semiconductors and insulators. Metals are having low resistivity and high conductivity. While semiconductors are having resistivity and conductivity in between metals and insulators. And finally, insulators are those which are having high resistivity or very low conductivity. Semiconductors may exist as elemental semiconductors and also compound semiconductors. Si and Ge are elemental semiconductor and CdS, GaAs, CdSe, anthracene, polypyrene etc. are the compound semiconductors. Each electron in an atom has different energy level and such different energy levels continuing forms the band of energy called as energy bands. Those energy band which has energy levels of Valence electrons is called as Valence band. And the energy band which is present above the Valence band is called as conduction band. On the basis of energy bands materials are also defined as metals, semiconductors and insulators. In case of metals, conduction band and Valence band overlaps with each other due to which electrons are easily available for conduction. In case of insulators, there is some energy gap between conduction band and Valence band due to which no free electrons are easily available for conduction. And in semiconductors, there is a small energy gap between conduction band and Valence band and if we give some external energy then electron from Valence band goes to conduction band due to which conduction will be possible. These semiconductors are classified as intrinsic semiconductors and extrinsic semiconductors also. I) In case of p-type semiconductors___ a) $n_h << n_e$ b) $n_h = n_e$ c) $n_h >> n_e$ d) $n_h = n_e = 0$ II) An intrinsic semiconductor behaves like _____ at T = 0K. a) conductor b) metal c) non-metal d) insulator III) If the energy band gap $E_g > 3$ eV then such materials are called as a) conductors b) semiconductors c) insulators d) superconductors IV)The energy band gap is maximum in which of the following? a) Metals b) Superconductors c) Insulators d) Semiconductors	1 1 1 1

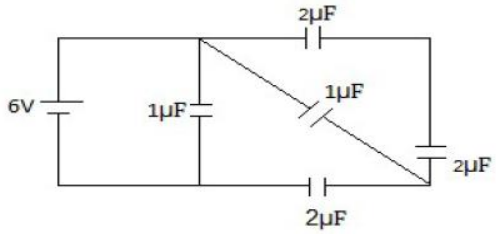
	OR In semiconductors at room temperature, which of the following is likely to happen? a) The valence band is partially empty and the conduction band is partially filled b) The valence band is filled and the conduction band is partially filled c)The valence band is filled d) The conduction band is empty	1
	SECTION – E	
31.	a) Define the equipotential surface. Derive an expression for the capacitance of a parallel plate capacitor of plate area 'A' and separation between plate 'd' b) Three Capacitors of capicatances 2pF, 3pF and 4pF are connected in parallel. (i) What is the total Capacitance of the Combination? (ii)Determine the charge on each capacitor if the combination is connected to a 100V supply? OR a) Deduce an expression for the electric potential due to an electric dipole at a point which lies on a line making angle 'θ' with the axis of dipole? b) Depict the equipotential surface due to (i) an electric dipole (ii) two identical positive charges separated by a distance	1+2 2 3+2
32.	a) State Bohr's three postulates regarding structure of hydrogen atom b) Determine the distance of the closest approach when an alpha particle of kinetic energy 4.5MeV strikes a nucleus of Z=80, stops, and reverses its direction. OR a) Write two characteristics of nuclear force. b) Plot the variation of potential energy between two nucleons with the separation between nucleons. Mark the attractive and repulsive force region in the graph. c) Prove that density of nuclear matter is independent of mass number of nuclei.	3+2 1+2+2
33.	a) Define self-inductance. Is it scalar or vector? Write its S I unit. b) Current in a coil change from +2A to −2A in 0.05s and emf of 8V is induced in the coil. Calculate the self-inductance of the coil. c) Define back emf and deduce the relation work done against back emf. OR Define wattless current. a) Derive the formula for average power dissipation across L-C-R circuit. c) Compare power factors of given circuit. $X_L = 3R$ $X_L = 3R$ $X_C = R$   	1.5 1.5 2 1+2+2

KENDRIYA VIDYALAYA SANGHTHAN (REGIONAL OFFICE JAIPUR)
SAMPLE QUESTION PAPER
CLASS XII PHYSICS (2023-24)
MARKING SCHEME
SECTION-A

1	2	3	4	5	6	7	8
a	d	a	c	b	c	b	a
9	10	11	12	13	14	15	16
a	c	a	d	c	a	d	b

SECTION -B

17



C_2 and C_3 are in series

$\frac{1}{c'} = \frac{1}{2} + \frac{1}{2} = 1$

$c' = 1\mu f$

c' & C_4 are in ||

$C'' = 1 + 1 = 2\mu f$

C'' & c_5 are in series

$\frac{1}{c'''} = \frac{1}{2} + \frac{1}{2} \Rightarrow c''' = 1\mu f$

c''' & c_1 are in ||

$C_{eq} = 1 + 1 = 2\mu f$

Energy stored

$U = \frac{1}{2} cv^2 = \frac{1}{2} \times 2 \times 10^{-6} \times 6^2$

$= 36 \times 10^{-6} J$

2

18

Relevant formula

Correct magnetic field

OR

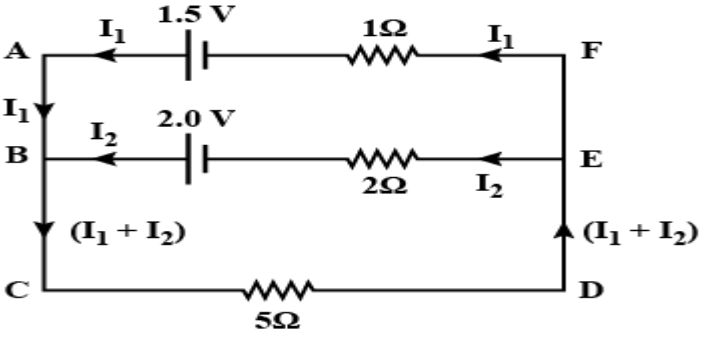
$L = N \times 2\pi r \Rightarrow \quad r = \frac{L}{2\pi N}$

$B = \frac{\mu_0 NI}{2r} = \frac{\mu_0 NI}{2\,(L\ /\ 2\pi N)} \quad \Rightarrow \quad B = \frac{\mu_0 \pi N^2}{L} I$

1

1

2

19	. **Complete answer:** (1) In the solar system, any planet which absorbs energy is able to transmit that energy (not more than the absorbed energy) and it transmits energy in the form of radiation. Thus, the wavelength of the incident solar radiation which is absorbed by the surface of the earth is equal to the wavelength of the ray re-radiated by the earth. (2) Tanning effect is of great importance for direct UV (Ultraviolet) radiation. When our skin is exposed to UV radiation then it increases the production of melanin. The melanin is produced in our body in order to prevent skin from further damage. Melanin is nothing but pigment that colours our hairs, eyes and skin and this increased amount of melanin pigment causes skin tone to become dark. However, glass windows are very efficient in blocking most of the ultraviolet rays, however ultraviolet rays still manage to penetrate at some extent through the glass windows. The entrance of ultraviolet rays through glass windows can cause skin damage and other skin problems that could lead to skin irritation.	1 1
20	Answer: Two characteristics: 1. Virtual image will be formed on the same side of object. 2. Image formed will be enlarged. Explanation: As you can see from the diagram when the object is placed in between optical centre and focus of the lens image thus formed is virtual and magnified. we can verify is use the lens equation: consider object is placed at f/2 distance from the optical centre (just like in above diagram) Using lens formula, $\frac{1}{v}-\frac{1}{u}=\frac{1}{f}$ $\frac{1}{v}-\frac{1}{-f/2}=\frac{1}{f}$ $\frac{1}{v}+\frac{2}{f}=\frac{1}{f}$ $\frac{1}{v}=\frac{1}{f}-\frac{2}{f}$ $\frac{1}{v}=\frac{-1}{f}$ $v=-f$ this means that the image formed is on the same side as the object (virtual). Magnification = $\frac{-v}{u}=-\frac{-f}{\frac{f}{2}}=2$, which mean image is magnified.	1+1
21	When the distance d between the two coherent sources is large, the fringe width ($\beta \propto 1/d$) becomes too small to be detected. The interference pattern cannot be observed.	2
	SECTION -C	
22	(a)  	1

	(b) Suppose l1 are l2 current drawn from cells ε1 and ε2 respectively, then according to Kirchhoff's junction law, current in R=5Ω is $=l_1+l_2$ Applying Kirchhoff's second law to mesh ABFEA, $1\times l_1+1.5-5(l_1+l_2)=0$ $\Rightarrow 6l_1+5l_2=1.5$ Applying Kirchhoff's second law to mesh CDEFC $2l-2+2-5(l_1+l_2)=0$ $\Rightarrow 5l_1+7l_2=2$.....(ii) Solving equation (i) and (ii), we get $I_1=1/34$ A, $I_2=9/34$ A $I=I_1+I_2=1/34+9/34=10/34$A Potential difference across R=5Ωresistor $(I_1+I_2)R=10/34\times 5=25/17$ volt **OR** correct graph Slope of this graph gives conductivity for standard resistance-material having lower slope for connecting wires-material having more slope is required	1 1 1 1 0.5 0.5
23	Proper comparison with suitable example	3
24	a) Phase difference between V and I is π/2. So the device can be a capacitor. 1 b) Curve A represents power P=VI , where the amplitude is equivalent to the multiplication of amplitudes of V and I curve. Curve B is sine curve and represents voltage and curve C is a cosine curve representing the current. Full cycle of the graph consist of two positive and two negative symmetrical area. So, the average power consumed in the circuit is zero. 1½ c) correct graph ½	3
25.	(i)correct answer (ii) correct answer (iii)3f/4 OR Complete correct answer	1 0.5 1.5 1+2
26	Correct answer	2+1
27	v=−30cm, m=−v/u=-3, Image is real, inverted and magnified and it forms at a distance of 30 cm in front of mirror. v=+15cm, m=3, image is virtual, erect and magnified and it forms at distance of 15cm behind the mirror	1.5 1.5
28	a) correct diagram and explanation b) Any two correct difference	1.5+1.5

	SECTION - D	
29	**Case Study Question** 1. C 2. B 3. B 4. D or D	1+1+1+1
30	1. C 2. D 3. C 4. C OR A	1+1+1+1
31	**SECTION – E** A. Correct definition Correct expression B. Three Capacitors of capicatances 2pF,3pF and 4PF are connected in Parallel. i) 9 pF ii) Since all the capacitance are in parallel, therefore voltage across each will remain same =100V So Charge on each capacitor is given by: Q1=C1V=2 pF×100 V=200 pC Q2=C2V=3 pF×100 V=300 pC Q3=C3V=4 pF×100 V=400 pC OR a) correct derivation b) correct diagram	1+1 1 1 1 3 2
32	a) correct statement b) 5.14 x 10^{-14}m Or a)Two characteristics b) correct graph, and marked region c) Nuclear density, $\rho = \frac{Mass\ of\ nucleus}{Volume\ of\ nucleus} = \frac{mA}{\frac{4}{3}\pi R^3} = \frac{mA}{\frac{4}{3}\pi A R_0^3}$ $\rho = \frac{3m}{4\pi R_0^3} = constant = 10^{17} kgm^{-3}$	1+1+1 2 1 2 2
33	a) correct define. scalar and unit b) e=Ldi/dt⟹ L=0.2H c) correct definition and derivation **or** a) correct definition b) correct formula derivation c)1/√2	1.5 1.5 2 1 2 2

KVS(RO) JAIPUR
CLASS-XII
SESSION-2023-2024
SAMPLE PAPER GROUP-F
SUBJECT: - PHYSICS (BLUE PRINT)

Time: 3 hrs. **Class – XII** **MM – 70**

S. No.	Unit	MCQ (1mark)	Assertion Based Question (1mark)	SA I (2marks)	SA II (3marks)	Case Study Question (4 Marks)	LA (5marks)	TOTAL
1	Electrostatics	3	-	1	-	-	1	16(7)
2	Current Electricity	1	-		-	-	1	
3	Magnetic effect of current & Magnetism	2	-	-	2	-	-	17(09)
4	Electromagnetic Induction and Alternating Current	3	-		2	-	-	
5	Electromagnetic Waves	1	-	1	-	-	-	18(7)
6	Optics	-	1	1	1	1	1	
7	Dual nature of radiation and matter	1	1		1	-	-	12(7)
8	Atoms and Nuclei	1	1	1	1	-	-	
9	Electronic Devices	-	1	1	-	1	-	7 (3)
	Total	12(12)	4(4)	10(5)	21(7)	8(2)	15 (3)	70 (33)

SAMPLE QUESTION PAPER (GROUP-E)
CLASS: XII
SESSION: 2023-24
SUBJECT: PHYSICS (THEORY)

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

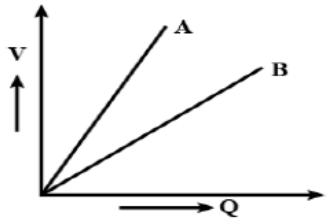
General Instructions:

(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 andSection E.
(3) All the sections are compulsory.
(4) Section A contains sixteen questions, twelve MCQ and four Assertion Reasoning basedof 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 SectionD and all three questions in Section E. You have to attempt only one of the choices insuch questions.
(6) Use of calculators is not allowed.
(7) You may use the following values of physical constants where ever 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. $\mu_0 = 4\pi \times 10^{-7}$ TmA^{-1}
v. $h = 6.63 \times 10^{-34}$ Js
vi. $\xi_0 = 8.854 \times 10^{-12}$ $C^2N^{-1}m^{-2}$
vii. Avogadro's number = 6.023 X 10^{23} per gram mole

Section A

Q.No.	Questions	Marks
1.	An AC source is connected to a resistance. Phase difference between applied voltage and current in the circuit is given as: (a) 0 (b) $\pi/3$ (c) $\pi/4$ (d) $\pi/6$	1
2.	Angle between electric field and magnetic field in an electromagnetic wave is: (a) 0 (b) $\pi/2$ (c) $\pi/4$ (d) $\pi/6$	1
3.	Unit of inductive reactance is: (a) Ampere (b) Ohm (c) Ohm. Metre (d) Weber	1
4.	An electrical dipole is placed in an uniform electric field with the dipole axis making an angle θ with the direction of electrical field. The orientation of the dipole for stable equilibrium is (a) π/6 (b) π/3 (c) 0 (d) π/2	1
5.	At the centre of a cubical box + Q charge is placed. The value of total flux that is coming out a wall is (a) $\frac{Q}{\varepsilon_0}$ (b) $\frac{Q}{3\varepsilon_0}$ (c) $\frac{Q}{6\varepsilon_0}$ (d) $\frac{Q}{4\varepsilon_0}$	1

6.	The graph shows the variation of voltage 'V' across the plates of two capacitors A and B versus increase of charge 'Q' stored on them. which of the two capacitors has higher capacitance?  (a) A (b) B (c) both have same (d) none	1
7.	A current pass through a wire of non-uniform cross section. Which of the following quantities are independent of cross section (a) the charge crossing (b) Drift velocity (c) current density (d) free electron density	1
8.	An electron is projected with uniform velocity along the axis of a current carrying long Solenoid. Which of the following is true? (a) The electron will be accelerated along the axis. (b) The electron path will be circular about the axis. (c) The electron will experience a force at 45° to the axis and hence execute a helical path. (d) The electron will continue to move with uniform velocity along the axis of the solenoid.	1
9.	A wire in the form of a circular loop, of one turn carrying a current, produces magnetic induction B at the centre. If the same wire is looped into a coil of two turns and carries the same current, the new value of magnetic induction at the centre is (a) B (b) 2 B (c) 4 B (d) 8 B	1
10.	According to Faraday 's law of electromagnetic induction (a) Electric field is produced by time varying magnetic flux. (b) Magnetic field is produced by time varying electric flux. (c) Magnetic field is associated with a moving charge. (d) None of these	1
11.	When a yellow light is incident on a surface, no electrons are emitted while green light can emit electrons. If the red light is incident on the surface, then: (a) no electrons are emitted (b) electrons of lower energy are emitted (c) electrons of higher energy are emitted (d) none of the above	1
12.	Balmer series lies in which spectrum? (a) visible (b) ultraviolet (c) infrared (d) X-rays	1

Two statements are given-one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below.

(a) Both A and Rare true and R is the correct explanation of A

(b) Both A and R are true and R is NOT the correct explanation of A

(c) A is true but R is false

(d) A is false and R is also false

13.	**Assertion**: If objective and eye lenses of a microscope are interchanged then it can work as telescope. **Reason**: The objective of telescope has small focal length.	1

14.	**Assertion:** The kinetic energy of photoelectrons emitted from metal surface does not depend on the intensity of incident photon. **Reason:** The ejection of electrons from metallic surface is not possible with frequency of incident photons below the threshold frequency.	1
15.	**Assertion**: An N-type semiconductor has a large number of electrons in its conduction band. **Reason**: An N-type semiconductor is obtained by doping an intrinsic semiconductor with a pentavalent impurity which behaves as a donor.	1
16.	**Assertion**: Light nuclei tend to diffuse together. **Reason**: When light nuclei diffuse to form a heavier nucleus, its binding energy per nucleon increases.	1

Section B

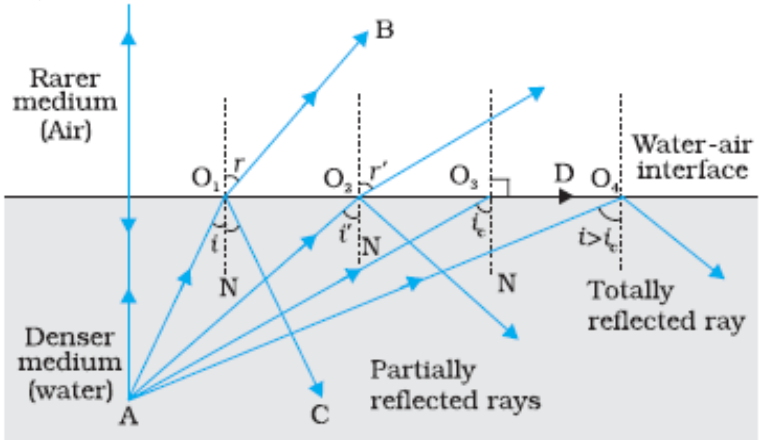
17.	Write two characteristic features to distinguish between n- type and p-type semiconductors.	2
18.	Write formula of the wavelengths of emitted photons when electrons jump in second orbit of hydrogen atom. Name the spectral series associated with emitted radiation when electron in a hydrogen atom jumps from n = ∞ to n = 2. OR Write formula of the wavelengths of emitted photons when electrons jump in first orbit of hydrogen atom. Name the spectral series which lies in UV-region in emission spectrum of hydrogen atom.	2
19.	A narrow slit is illuminated by a parallel beam of monochromatic light of wavelength λ equal to 6000 Å and the angular width of the central maximum in the resulting diffraction pattern is measured. When the slit is next illuminated by light of wavelength λ', the angular width decreases by 30%. Calculate the value of the wavelength λ'.	2
20.	Two large parallel plane sheets have uniform charge densities + σ and−σ. Determine the electric field (i) between the sheets, and (ii) outside the sheets.	2
21.	Electromagnetic waves with wavelength (i) λ_1 is suitable for radar systems used in air craft navigation. (ii) λ_2 is used to kill germs in water purifiers. (iii) λ_3 is used to improve visibility in runways during fog and mist conditions. Identify and name the part of the electromagnetic spectrum to which these radiations belong. Also arrange these wavelengths in ascending order of their magnitude.	2

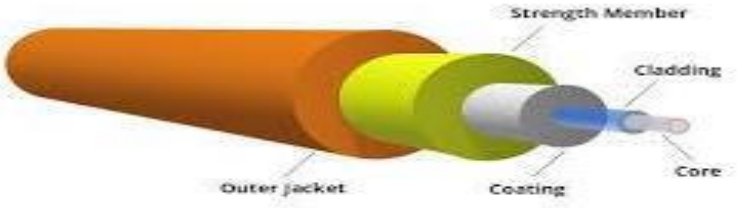
Section C

22.	Write three points of differences between para-, dia- and ferro-magnetic materials, giving one example of each.	3
23.	A long wire is bent into a circular coil of one turn and then into a circular coil of smaller radius having n identical turns of secondary coil. If the same current passes in both the cases, find the ratio of the magnetic fields produced at the centre in the two cases.	3
24.	Derive an expression for the inductive reactance of an inductor L, when connected across an a.c. source. Also draw graph between inductive reactance and frequency of a.c. source. OR Derive an expression for the capacitive reactance of a capacitor C, when connected across an a.c. source. Also draw graph between capacitive reactance and frequency of a.c. source.	3
25.	The radii of curvature of the faces of a double convex lens are 10cm and 15 cm. If the focal length of the lens is 12 cm, find the refractive index of the material of the lens. OR Two lenses, one convex lens of focal length 20 cm and second concave lens of focal length 15 cm, are kept together coaxially. Find the focal length and identify the nature of their equivalent lens.	3
26.	Sketch the graphs showing variation of the stopping potential with frequency of incident radiation for two photosensitive materials A and B having threshold frequencies as ν_1 and $\nu_2(\nu_1 > \nu_2)$: (i) In which case is the stopping potential is more and why? (ii) Does the slope of the graph depend on the nature of the material used? Explain.	3

27.	(a) State the principle of ac generator. (b) Explain with the help of a well labelled diagram, its working and obtain the expression for the emf generated in the coil. OR (a) State the principle of a transformer. (b) Explain with the help of a well labelled diagram, its working and obtain the expression for output ac voltage in terms of number of turns in primary coil (N_P) and secondary coil (N_S).	3
28.	(a) Define mass defect. (b) Calculate the mass defect of a nitrogen nucleus (${}^{14}_{7}N$) from the following data: - Mass of proton=1.00727 u, mass of neutron =1.00866 u and mass of Nitrogen nucleus (${}^{14}_{7}N$) = 14.00307 u	3

Section D

29.	**Case study: p-n junction diode:** Read the following paragraph and answer the questions p-n junction is a semiconductor diode. By adding precisely, a small quantity of pentavalent impurity. Part of the p-Si wafer can be converted into n-Si. There are several processes by which a semiconductor can be formed. A thin layer is developed at the p- n junction which is devoid of any charge carrier but has immobile ions. It is called depletion layer. At the junction a potential barrier appears, which does not allow the movement of majority charge carriers across the junction in the absence of any biasing of the junction. p-n junction offers low resistance when forward biased and high resistance when reverse biased. (i) Approximate width of depletion layer is (a) 1 cm (b) 1 mm (c) 1 μm (d) 1 m (ii) Width of depletion region in a p-n junction diode ..... when the junction is forward biased (a) increases (b) decreases (c) remains same (d) none of the above (iii) Width of depletion region in a p-n junction diode ..... when the junction is reverse biased (a) increases (b) decreases (c) remains same (d) none of the above (iv) The processes that occur during the formation of a p-n junction. (a) diffusion (b) drift (c) both of above (d) none of the above	4
30.	Case study: Optical Fibres:  	4



An optical fibre is a structure comprising of thin rod of high-quality glass of refractive index n_1 surrounded by a medium of refractive index n_2. Very little light is absorbed by the glass. Light getting in at one end undergoes repeated total internal reflection, even when the fibre is bent, and emerges at the other end. All rays with angle of incidence θi greater than critical angle θc are confined inside optical fibre. Numerical aperture (NA) of structure is defined as sin α.

(i) Which type of signals are transmitted by the optical fibres?
(a) electrical (b) sound (c) light (d) none of the above

(ii) In an optical fiber---
(a) cladding have more refractive index (b) core have more refractive index
(c) both have same refractive index (d) none of the above

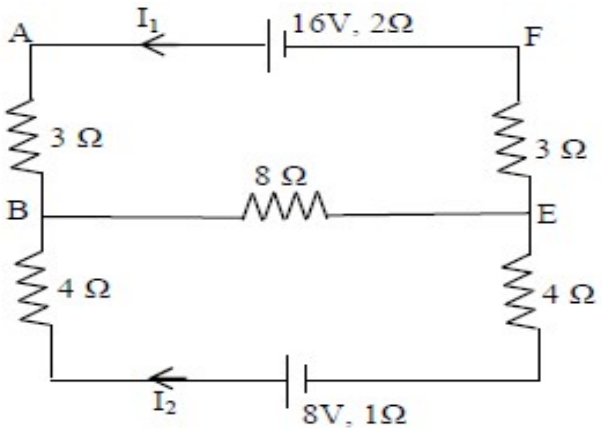
(iii) Necessary conditions for total internal reflection is--
(a) Ray should travel from denser to rarer medium
(b) incident angle must be greater than critical angle
(c) both of above
(d) none of the above

(iv) Optical fibre works on the principle of
(a) reflection (b) refraction (c) diffraction (d) TIR

OR

Relation between refractive index and critical angle is
(a) $n_{21} \sin C = 1$ (b) $n_{21} = \sin C$ (c) $n_{12} \sin C = 1$ (d) none of the above

Section E

31	(a) State the two Kirchhoff's rules used in the analysis of electric circuits and explain them. (b) Apply Kirchoff's Laws to determine the currents I_1 and I_2 in the circuit as shown in the Figure given below: -  OR (a) Derive the equation of the balanced state in a Wheatstone bridge using Kirchhoff's laws. (b) Write the relation of resistivity in terms of relaxation time and explain graphically how resistivity of following materials depends on temperature. (i) metals (ii) constantan & (iii) semiconductors.	5

32	(a) State Gauss' law in electrostatics. Use this law to drive an expression for the electric field due to an infinitely long straight wire of linear charge density λ Cm^{-1}. (b) A wire AB of length L has linear charge density $\lambda = k x$, where x is measured from the end A of the wire. This wire is enclosed by a Gaussian hollow surface. Find the expression for the electric flux through this surface. OR (a) Write a relation for electric field at a point from a point charge and draw electric field lines due to unit positive point charge. (b) Derive a relation between electric field intensity and potential difference using two equipotential surfaces. (c) Three-point charges of 10 μC each are placed at three vertices of an equilateral triangle of side 1 m. Find electric field at the centre of the triangle.	5
33	(a) Draw a labelled ray diagram showing the formation of image by a Cassegrain telescope (reflecting type). Write the expression for its magnifying power. (b) Write any three advantages of reflecting type telescope over refracting type. (c) Find magnifying power of a telescope if focal length of its primary and secondary mirrors are 50.0 cm and 1.0 cm respectively. OR (a) A point object is placed in rare medium at the principal axis of a convex refracting surface. Draw the correct ray diagram of real image formation and obtain relation among distance of object (u), distance of image (v) & radius of curvature (R) of the spherical surface. (b) Light from a point source in air falls on a spherical glass surface (n = 1.5 and radius of curvature = 20 cm). The distance of the light source from the glass surface is 100 cm. At what position the image is formed?	5

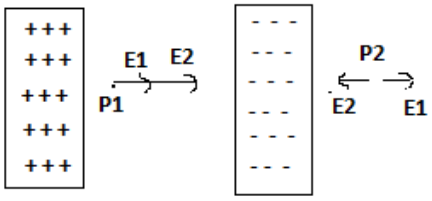
PHYSICS
Workshop group - F

Time: 3 hrs. Class – XII MM – 70

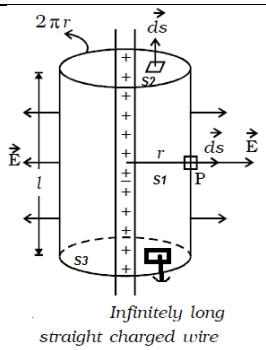
MARKING SCHEME

Section – A

1	2	3	4	5	6	7	8
a	b	b	c	c	b	d	d
9	10	11	12	13	14	15	16
c	a	a	a	c	b	a	a

	Section – B	
17	Two distinguishing feature is of 1mark each	1,1
18	Formula Balmer series OR Formula Lymen Series	1 1 1 1
19	Angular width $2\phi = 2\lambda/d$ Given $\lambda = 6000$ Å In Case of new λ (assumed λ' here), angular width decreases by 30% New angular width = $0.70\ (2\ \phi)$ $2\ \lambda'/d = 0.70\ X\ (2\ \lambda/d)$ $\therefore \lambda' = 4200$ Å	 ½ ½ ½ ½
20	 Electric field Inside the sheets at point P_1 $EP_1=E_1+E_2=\sigma/2\epsilon_0+\sigma/2\epsilon_0=\sigma/\epsilon_0$ Electric field outside the sheets at point P_2 $EP_2 = E_1-E_2=\sigma/2\epsilon_0-\sigma/2\epsilon_0=0$	1 ½ ½
21	λ1 -Microwave λ2 - ultraviolet λ3- infrared Ascending order - $\lambda2<\lambda3<\lambda1$	½ ½ ½ ½
	Section – C	
22	Three differences one example of each	½, ½, ½ ½, ½, ½

23	Case-i : $B = \mu_0 I/2R$ $l = 2\pi R \rightarrow R = l/2\pi$ $B1 = \mu_0 I/2R = \mu_0 \pi I/l$ .....(i) Case-ii $l = n \times 2\pi r \rightarrow r = l/2\pi n$ $B2 = \mu_0 nI/2r = \mu_0 n^2 I/l$ .....(ii) $\therefore B1/B2 = 1/n^2$	½ ½ ½ ½
24	Derivation of instantaneous current $i=i_O \sin(\omega t - \pi/2)$ Reactance $X_L = \omega L$ Graph	1 ½ ½ 1
25	equivalent focal length nature	2,1
26	Plot the graph Calculate slope for the two and show that it is independent to the nature	1 1,1
27	(a) Principle (b) Diagram, Working with expression OR (a) Principle (b) Diagram, Working with expression	1 1,1 1 1,1
28	(a) mass defect (b) Mass defect=$7(m_p) + 7(m_n) - m_N$ =0.11243 amu	1 2
	Section – D	
29	(i) c (ii) b (iii) a (iv) c	1+1+1+1
30	(i) c (ii) b (iii) c (iv) d OR a	1+1+1+1
31	(a) Junction rule: At any junction, the sum of the currents entering the junction is equal to the sum of currents leaving the junction Loop rule: The algebraic sum of changes in potential around any closed loop involving resistors and cells in the loop is zero (b) Correct values of I_1 & I_2 with proper solution OR (a) Derivation of $\frac{P}{Q} = \frac{R}{S}$ (b) correct relation (i)correct graph, (ii) correct graph, (iii) correct graph	1 1 3 3 ½, ½,½,½
32	*(a) (i)The total electric flux through a closed surface is equal to the total (net) electric* *(ii) charge inside the surface, divided by ε_0* $$\varphi = \frac{q}{\varepsilon_o}$$ *By symmetry, the magnitude of the electric field will be the same at all points on the curved surface S1 of the cylinder and directed radially outward. $\vec{E}$ and $\overrightarrow{ds}$ are along the same direction.* *. $\vec{E}$ and $\overrightarrow{ds}$ are right angles to each other, through the plane caps S2 and S3* *Total flux through the Gaussian surface,* $\varphi = \oint \vec{E} \cdot \overrightarrow{ds} = \oint_{S1} Edscos0 + \oint_{S2} Edscos90 + \oint_{S3} Edscos90$	1 2

	$= \oint_{S1} E ds + 0 + 0$ $= = E (2\pi rl)$ (∵The surface area of the curved part is $2\pi rl$) The net charge enclosed by Gaussian surface is, $q = \lambda l$ ∴By Gauss's law, $\varphi = \frac{q}{\varepsilon 0} = \frac{\lambda l}{\varepsilon 0}$ $E\ (2\pi rl) = \frac{\lambda l}{\varepsilon_o}$ or $E = \frac{\lambda}{2\pi\varepsilon_o r}$  Infinitely long straight charged wire (b) $dq = \lambda dx = kxdx$ $Q = \int_0^l kxdx = \frac{kl^2}{2}$ $\phi = \frac{Q}{\xi_0} = \frac{kl^2}{2\xi_0}$ OR (a) correct relation and correct diagram (b) correct derivation with figure (c) zero	2 1+1 1 ½ , ½ 1
33	(a) correct ray diagram and formula (b) Any three advantages (c) correct formula and solution OR (a) correct diagram and derivation (b) correct solution	1 ½ , ½ ½, ½ ,½ ½ ,1 3 2

KVS(RO) JAIPUR
CLASS-XII
SESSION-2023-2024
SAMPLE PAPER GROUP-G
SUBJECT: - PHYSICS (BLUE PRINT)

S.No.	UNIT	Unit	MCQ (1mark)	Assertion Based Question (1Marks)	VSA (2marks)	SA (3marks)	Case Study Question (4 Marks)	LA (5marks)	TOTAL
1	I	Electrostatics	2(2)	1(1)	-----	3(1)	4(1)	-	9(4)
2		Current Electricity	1(1)	----	2(1)	3(1)	-		7 (2)
3	II	Magnetic effect of current& Magnetism	2(2)	----	2(1)	3(1)	-	5 (1)	7(4)
4		Electromagnetic Induction and Alternating	1(1)	1(1)	------	3 (1)	-	----	10(4)
5	III	Electromagnetic Waves	1 (1)	-------	------	3(1)	-	-	4(2)
6		Optics	3(3)	1 (1)	2(1)	3 (1)	-	5 (1)	14(7)
7	IV	Dual nature of radiation and matter	1 (1)	------	------	3(1)	-	-	4(2)
8		Atoms and Nuclei	1(1)	-----	2(1)	------		5 (1)	8(4)
9	V	Semi-Conductors & Electronic Devices	-----	1 (1)	2 (1)	------	4 (1)	-	7 (4)
		Total	**12(12)**	**4(4)**	**10(5)**	**21(7)**	**8 (2)**	**15 (3)**	**70 (33)**

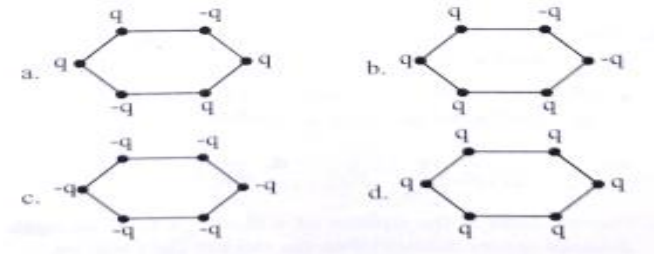
SAMPLE QUESTION PAPER (GROUP-G)
CLASS: XII
SESSION: 2023-24
SUBJECT: PHYSICS (THEORY)

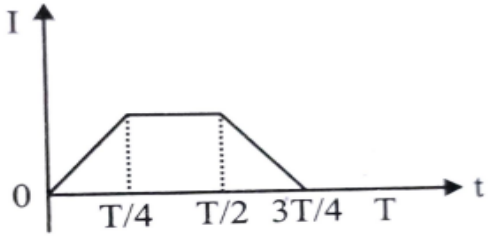
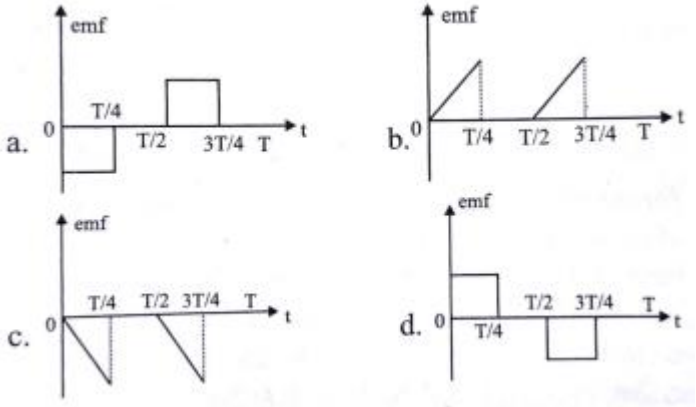
Maximum Marks: 70 Marks **Time Allowed: 3 hours.**

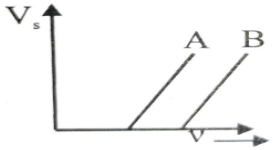
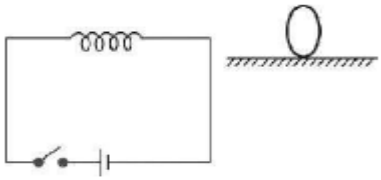
General Instructions:-

(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.
(6) Use of calculators is not allowed.
(7) You may use the following values of physical constants where ever 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. $\mu_0 = 4\pi \times 10^{-7}$ TmA^{-1}
   v. $h = 6.63 \times 10^{-34}$ Js
   vi. $\varepsilon_0 = 8.854 \times 10^{-12}$ $C^2N^{-1}m^{-2}$
   vii. Avogadro's number = 6.023 X 10^{23} per gram mole

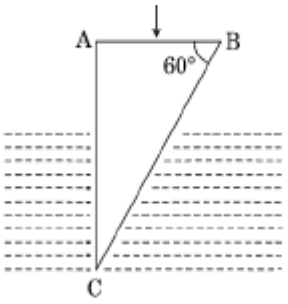
SECTION A

Q.No.		Marks
01	In which of the following cases the electric field at the centre is not zero?  	**1**
02	An electric dipole of moment $\vec{p}$ is placed in a uniform electric field $\vec{E}$. Then (i) the torque on the dipole is $\vec{p} \times \vec{E}$ (ii) the potential energy of the system is $\vec{p}.\vec{E}$ (iii) the resultant force on the dipole is zero. Choose the correct option. **(a) (i), (ii) and (iii) are correct** **(b) (i) and (iii) are correct and (ii) is wrong** **(c) only (i) is correct** **(d) (i) and (ii) are correct and (iii) is wrong**	**1**

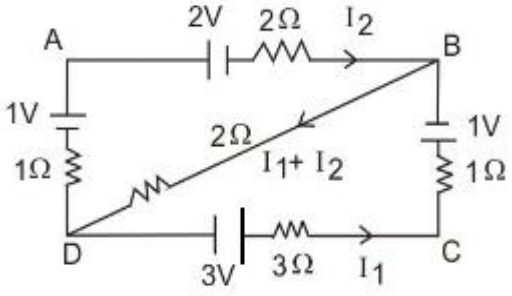
03	In a Wheatstone bridge, all the four arms have equal resistance R. if resistance of the galvanometer arm is also R, then equivalent resistance of the combination is a)R b) 2R c)R/2 d)R/4	**1**
04	An ammeter of resistance 0.2 ohm and range 10 mA is to be used to read potential difference up to 1V. It can be converted into a voltmeter of desired range by connecting (a) 96 ohms in series (b) 92 ohms in parallel (c) 99.8 ohm in series (d) 90 ohms in parallel	**1**
05	When a ferromagnetic material is heated above the curie temperature it becomes: (a) Diamagnetic (b) Paramagnetic (c)Strongly charged (d) Non-Magnetic	**1**
06	The current I in a coil varies with time as shown in figure below.  The variation of induced emf with time would be : 	**1**
07	An EM wave is propagating in a medium with a velocity v = v **i.** The instantaneous oscillating electric field of this wave is along + y axis. Then the direction of oscillating magnetic field of the EM wave will be along : (a) – y axis (b) z axis (c) - z axis (d) - x axis	**1**
08	The length of astronomical telescope is adjusted for parallel light is 90 cm. If the magnifying power of telescope is 17 ,then the focal length of eyepiece and objective lens is respectively : (a)10 cm & 80 cm (b) 85 cm & 5 cm (c) 5 cm & 85 cm (d) 70 cm & 20 cm	**1**
09	Which of the following is correct for light diverging from point source. (a)The intensity decreases in proportion with squared of distance. (b)The wavefront is parabolic (c) The intensity of the light does not depend of the distance. (d) None of the these	**1**

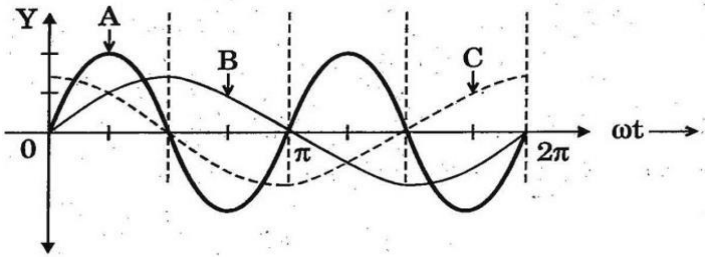
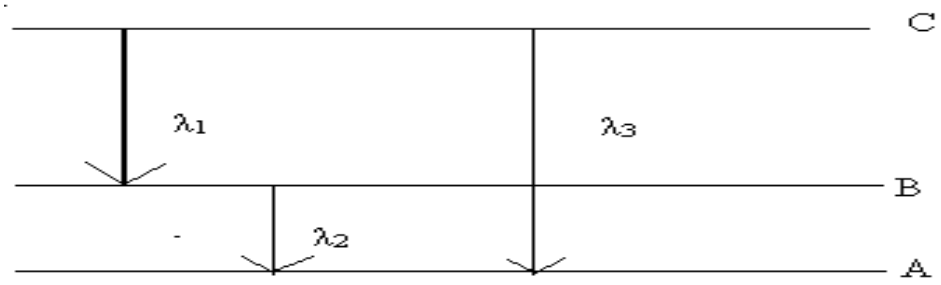
10	In an experiment of single slit diffraction, the width of a slit 1.2μm and the angular width of centre maximum is observed to be equal to $\frac{\pi}{3}$ find the wavelength of light (a)6 A^0 (b)60 A^0 (c) 600A^0 (d) 6000A^0	
11	The stopping potential as a work function of frequency of incident radiation is plotted for two different photo electric surfaces A and B. The graphs show the work function of A is  (a) greater than that of B (b) smaller than that of B (c) same as that of B (d)no comparison can be done from given graph	**1**
12	A nucleus of mass number 189 splits into two nuclei having mass no125 and 64.the ratio of radius of daughter nuclei respective is (a)25:16 (b)1:1 (c)4:5 (d) 5:4	**1**
	Two statements are given-one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below. **a) Both A and R are true and R is the correct explanation of A** **b) Both A and R are true and R is NOT the correct explanation of A** **c) A is true but R is false** **d) A is false and R is also false**	
13	**Assertion**: A small metallic sphere is placed at the centre of a large charged spherical shell and two are the connected by a wire. The charge will not flow from outer sphere to inner sphere **Reason: A** charged conductor is placed inside the hollow conductor and two are connected by the wire. The whole charge will flow on the outer surface of the outer conductor	1
14	**Assertion:** Figure shows a horizontal solenoid connected to a battery and a switch. A copper ring is placed on a smooth surface, the axis of the ring being horizontal. As the switch is closed, the ring will move away from the solenoid. **Reason :** Induced emf in the ring, e=-dΦ/dt 	**1**
15	**Assertion:** White light falls on a double slit with one slit is covered by a green filter. The bright fringes observed are of green colour. **Reason:** The fringes observed are coloured.	1
16	**Assertion:** When two semiconductor of p and n type are brought in contact, they form p-n junction which act like a rectifier. **Reason :** A rectifier is used to convent alternating current into direct current.	

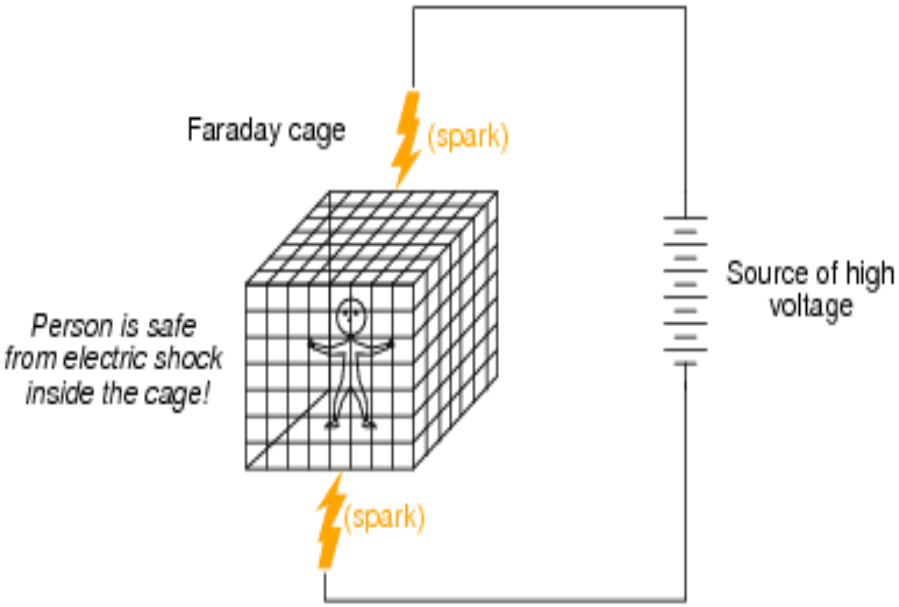
SECTION B

17	Derive an expression for the resistivity of a good conductor, in terms of the relaxation time of electrons. Or The resistance of a given piece of wire is 10Ω. What will happen to its resistance & resistivity when its length is doubled?	2
18	An electron beam is moving between two parallel plates having electric field 1.125×10^{-6} V/m. A magnetic field 3×10^{-10}T is also applied, so that beam of electrons does not deflect. What is the velocity of the electron?	2
19	A ray of light is incident normally on the face AB of a right-angled glass prism of refractive index = 1·5. The prism is partly immersed in a liquid of unknown refractive index. Find the value of refractive index of the liquid so that the ray grazes along the face BC after refraction through the prism. 	2
20	Draw a plot of the binding energy per nucleon as a function of mass number for a large number of **2≤A≤240** nuclei. How do you explain the constancy of binding energy per nucleon in the range **30≤A≤170** nuclei using the property that nuclear force is short-ranged?	2
21	Draw the circuit diagram of full wave rectifier and also draw its input and output wave forms. **OR** How is forward biasing different from reverse biasing in a p-n junction diode?	2

SECTION C

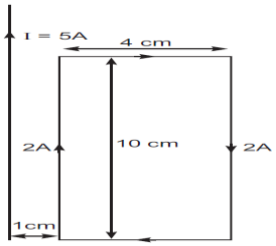
22	**a)** Use Gauss's theorem to find the electric field due to a uniformly charged infinitely large plane thin sheet with surface charge density **(b)** An infinitely large plane thin sheet has a uniform surface charge density. Obtain the expression for the amount of work done in bringing a point charge q from infinite to a point, distance r , in front of the charged plane sheet.	
23	State Kirchoff's laws of current distribution in an electrical network. Using these rules determine the current between B and D in the circuit diagram as shown in the figure below. 	3

24	A bar magnet of magnetic moment 1.5 J T^{-1} lies aligned with the direction of a uniform magnetic field of 0.22 T (a) What is the amount of work required by an external torque to turn the magnet so as to align its magnetic moment: (i) normal to the field direction, (ii) opposite to the field direction? (b) What is the torque on the magnet in cases (i) and (ii) ? OR A short bar magnet of magnetic moment m = 0.32 JT^{-1} is placed in a uniform magnetic field of 0.15 T. If the bar is free to rotate in the plane of the field, which orientation would correspond to its (a) stable, and (b) unstable equilibrium? What is the potential energy of the magnet in each case?	3
25	A device 'X' is connected to an ac source $V = V_0 \sin t$. The variation of voltage, current and power in one cycle is shown in the following graph :  **(a)** Identify the device 'X'. **(b)** Which of the curves A, B and C represent the voltage, current and the power consumed in the circuit? Justify your answer. **(c)** How does its impedance vary with frequency of the ac source? Show graphically.	3
26	a) A parallel plate capacitor is being charged by a time varying current. Explain briefly how Ampere's circuital law is generalized to incorporate the effect due to the displacement current. b) Name the part of electromagnetic spectrum whose wavelength lies in the range of 10^{-10} m. Give its one use.	3
27	Obtain Lens makers formula using the expression $n_2/v - n_1/u = (n_2 - n_1)/R$, here the ray of light propagating from a rarer medium of refractive index (n_1) to a denser medium of refractive index (n_2) is incident on the convex side of spherical refracting surface of radius of curvature R.	3
28	(a) State Bohr's quantization condition for defining stationary orbits. How does de-Broglie hypothesis explain the stationary orbits? (b) Find the relations between the three wavelengths λ_1, λ_2 and λ_3 from the energy level diagram shown below.  	

29	**Case Study :** ***Read the following paragraph and answer the questions*** Faraday cages shield their contents from static electric fields. An electric field is a force field surrounding a charged particle, such as an electron or proton. These cages often look distinctly, well, cage like. Some are as simple as chain-link fences or ice pails. Others use a fine metallic mesh. Regardless of their exact appearance, all Faraday cages take electrostatic charges, or even certain types of electromagnetic radiation, and distribute them around the exterior of the cage.  (i). Which of the following material can be used to make a Faraday cage? a) Plastic b) Glass c) Copper d) Wood (ii). Example of a real-world Faraday cage is a) car b) plastic box c) lightning rod d) metal rod (iii). What is the electrical force inside a Faraday cage when it is struck by lightning? a) The same as the lightning b) Half that of the lightning c) Zero d) A quarter of the lightning (iv). An isolated point charge +q is placed inside the Faraday cage. Its surface must have charge equal to- a) Zero b) +q c) –q d) +2q **OR** A point charge of 2C is placed at centre of Faraday cage in the shape of cube with surface of 9 cm edge. The number of electric field lines passing through the cube normally will be- a) 1.9×10^5 Nm^2/C entering the surface b) 1.9×10^5 Nm^2/C leaving the surface c) 2.0×10^5 Nm^2/C leaving the surface d) 2.0×10^5 Nm^2/C entering the surface	4

30	**Case Study:** ***Read the following paragraph and answer the questions*** A pure semiconductor germanium or silicon, free of every impurity is called intrinsic semiconductor. At room temperature, a pure semiconductor has very small number of current carriers (electrons and holes). Hence its conductivity is low. When the impurity atoms of valency five or three are doped in a pure semiconductor, we get respectively n-type or p-type extrinsic semiconductor. In case of doped semiconductor $n_e n_h$ = n_i^2 Where n_e and n_h are the number density of electron and hole charge carriers in a pure semiconductor. The conductivity of extrinsic semiconductor is much higher than that of intrinsic semiconductor. 1)How can a p-type semiconductor be converted into n- type semiconductor? a) adding pentavalent impurity b) adding trivalent impurity c)not possible d) heavy doping 2). Which of the following is true about n type semiconductor? a) concentration of electrons is less than that of holes. b) concentration of electrons is more than that of holes. c)concentration of electrons equal to that of holes. d)None of these 3)Which of the following is true about p type semiconductor? a) concentration of electrons is less than that of holes. b) concentration of electrons is more than that of holes. c)concentration of electrons equal to that of holes. d)None of these 4)Which of the following is the reason about diffusion current? a) diffusion of holes from p to n b) diffusion of electrons from n to p c) both (a) and (b) d) None of these **OR** What are the processes that occur during formation of a p-n junction? a) drift b) diffusion c) both (a) and (b) d)None of these	4

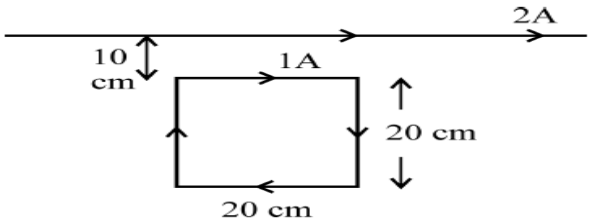
SECTION E

31	(a) Write the expression for the force,$\vec{f}$, acting on a charged particle of charge 'q', moving with a velocity $\vec{v}$ in the presence of both electric field $\vec{E}$ and magnetic field ***B*** . Obtain the condition under which the particle moves undeflected through the fields. (b) A rectangular loop of size l × b carrying a steady current I is placed in a uniform magnetic field. Prove that the torque acting on the loop is given by =$\vec{m} \times \vec{B}$, where $\vec{m}$ is the magnetic moment of the loop. (b)A rectangular loop of wire of size 4 cm × 10 cm carries a steady current of 2A. A straight long wire carrying 5A current is kept near the loop as shown. If the loop and the wire are coplanar, find **the** magnitude and direction of the force on the loop due to the current carrying wire. 	5

OR

a) Derive the expression of force between two infinitely long parallel current carrying conductors, hence define one ampere of current.

b) A square loop of side 20 cm carrying current of 1A is kept near an infinite long straight wire carrying a current of 2A in the same plane as shown in the figure. Calculate the magnitude and direction of the net force exerted on the loop due to the current carrying conductor.



32 (a)Draw a ray diagram to show refraction of a ray of monochromatic light passing through a glass prism. Deduce the expression for the refractive index of glass in terms of angle of prism and angle of minimum deviation. 5

b) 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, find its new focal length.

OR

(a)With the help of a suitable ray diagram, derive the mirror formula for a concave mirror

(b)Use the mirror equation to show that

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

(ii) An object is placed between pole and the focus of a concave mirror produces a virtual and enlarged image.

33 (a)State two important properties of photon which are used to write Einstein's photoelectric equation. Define (i) stopping potential and (ii) threshold frequency, using Einstein's equation and drawing necessary plot between relevant quantities. 5

(b)If light of wavelength 412·5 nm is incident on each of the metals given below, which ones will show photoelectric emission and why?

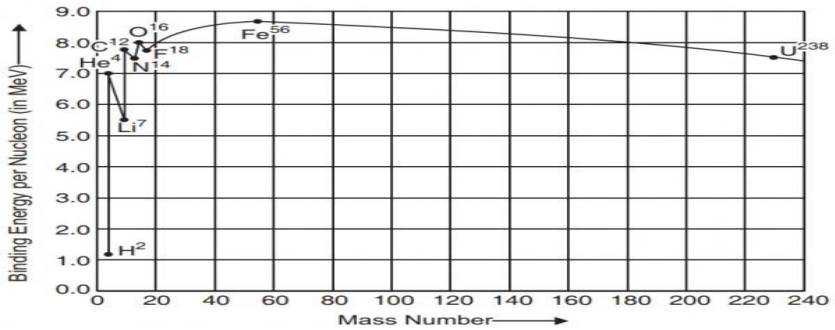
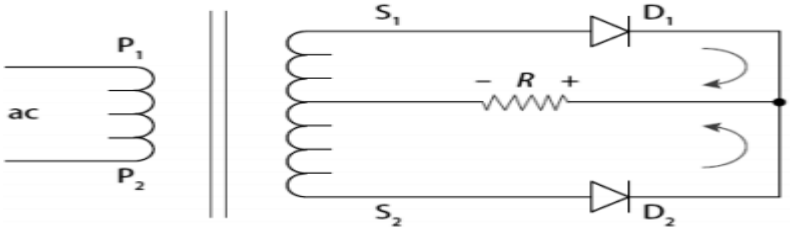
Metal	Work Function (eV)
Na	1·92
K	2·15
Ca	3·20
Mo	4·17

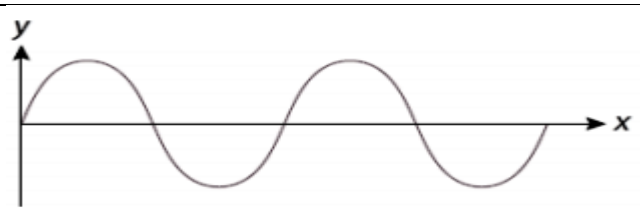
OR

(i) Using Rutherford model of the atom, derive the expression for the total energy of the electron in hydrogen atom. What is the significance of total negative energy possessed by the electron? Also write the conclusions of **α** scattering experiment.

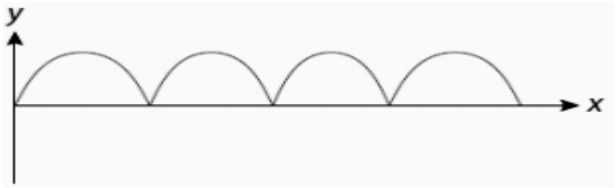
(ii) A hydrogen atom initially in the ground state absorbs a photon which excites it to the n = 4 level. Estimate the frequency of the photon.

S.NO	SECTION –A	MARKS
1	B	1
2	A	1
3	A	1
4	C	1
5	B	1
6	A	1
7	B	1
8	C	1
9	A	1
10	D	1
11	B	1
12	D	1
13	A	1
14	(A)When switch is closed, the magnetic flux through the ring will increase and so ring will move away from the solenoid so as to compensate this flux. This is according to Lenz's law	1
15	(C) Interference will take place in green light only	1
16	(B) Study of junction diode characteristics shows that the junction diode offers a low resistance path, when forward biased and high resistance path when reverse biased. This feature of the junction diode enables it to be used as a rectifier.	1
17	I=Ane V_d=$AneeE\tau/m$ [V_d= $eE\tau/m$] $V/I = ml/Ane^2\tau$ or, R=$ml/Ane2\tau$ (a) Resistance of a conductor is directly proportional to its length R α l .....(4) (b) Resistance inversely proportional to Area of cross section of a conductor R α $1/A$ .....(5) From (4) & (5) R α l/A R= ρ lA .....(6) Where ρ= constant, known as specific resistance or resistivity of the material of a conductor. Its value depends upon the nature of the material & its temperature (not dimension). I t depends on no. density of a free electrons, and relaxation time The resistivity of the material of the conductor tells us about the tendency (limit) of the material to oppose the flow of current Also, on comparing eq. (3) & (6), we have ρ = $m/ne^2\tau$ .....(7)This is the required eq. of resistivity in terms of mass & charge of electron , number density of electrons and relaxation time. OR R=40Ω and ρ remains same	1 1 1+1

18	$F_e=F_m$ ie, $qE=qvB$ or $v=E/B$ Given, $E=1.125\times10^{-6}N/m$, $B=3\times10^{-10}T$ $V=\frac{3\times10^{-10}}{1.125\times10^{-6}}$ $=3.75\times10^{3}$ =3750m/s	1 1
	SECTION- B	
19	Here i=60∘ From Snell's law, μgsin i=μlsin 90∘⇒1.5sin60∘=μl ∴μl=1.3 So the refractive index of the liquid is 1.3.	½ ½ 1
20	The variation of binding energy per nucleon versus mass number is shown in figure.  Since nuclear forces are short-ranged, every nucleon interacts with their neighbours only. Therefore, binding energy per nucleon remains constant.	1+1
21	Circuit diagram of full-wave rectifier is depicted in the following figure:  The ac voltage to be rectified is connected to primary P1P2 of the step-down transformer. The S1S2 is secondary of the step-down transformer. Here, S1 is connected to p-side of p-n junction diode D1 and S2 is connected to p-side of p-n junction diode D2. Output is taken across load resistance R. Working of a full-wave rectifier: • During positive half cycle of ac input voltage: Suppose P1 is negative and P2 is positive. By induction, S1 is positive and S2 is negative. Therefore, diode D1 is forward biased and diode D2 is reverse biased. Forward current flows through diode D1 in the direction shown in the following figure and output is taken across load resistance R. •	½ + 1/2 1



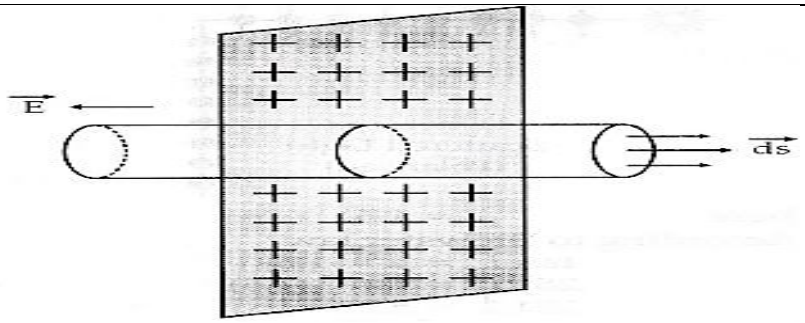
During negative half cycle of ac input voltage: Suppose P1 is positive and P2 is negative. By induction, S1 is negative and S2 is positive. Therefore, diode D2 is forward biased. Forward current flows through the diode. Forward current flows thought diode D2 in the directions shown in the figure and the output is taken across load resistance R. • During both half cycles, current flows through R. Output is continuous. That is why, it is called full-wave rectifier.



Or

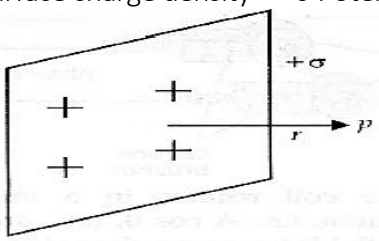
1. Forward Bias: (i) Within the junction diode the direction of applied voltage is opposite to that of built-in potential. (ii) The current is due to diffusion of majority charge carriers through the junction and is of the order of milliamperes. (iii) The diode offers very small resistance in the forward bias.
2. Reverse Bias: (i) The direction of applied voltage and barrier potential is same. (ii) The current is due to leakage of minority charge carriers through the junction and is very small of the order of μ A. (iii) The diode offers very large resistance in reverse bias.

22



(a) The symmetry of the situation suggests that vector E is perpendicular to the plane a Gaussian surface through P like a cylinder of flat caps parallel to the plane and one cap passing through P The plane is the plane of symmetry for the Gaussian surface

(b) Sheet has surface charge density = +σ Potential at a distance from the plate = V = Ed



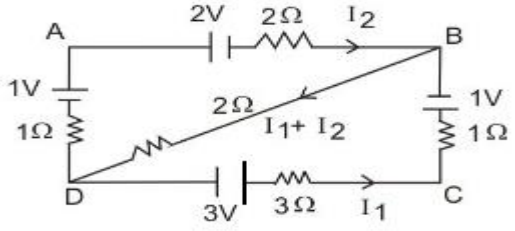
$$= \frac{\sigma}{2\epsilon_0} d \qquad \left(E = \frac{\sigma}{2\epsilon_0}\right)$$

∴ Amount of work done in bringing a charge q from ∞ to P

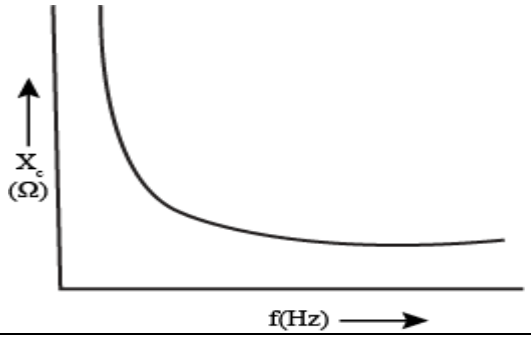
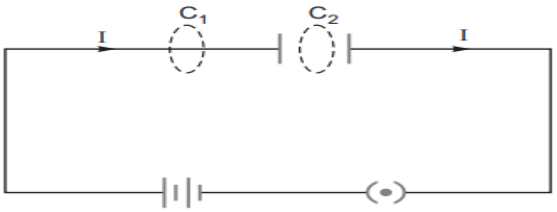
$$= W = qV$$

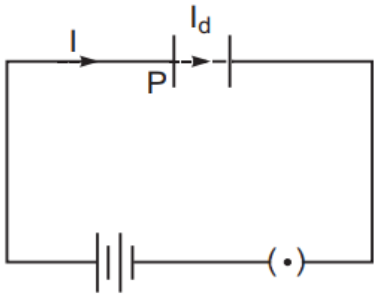
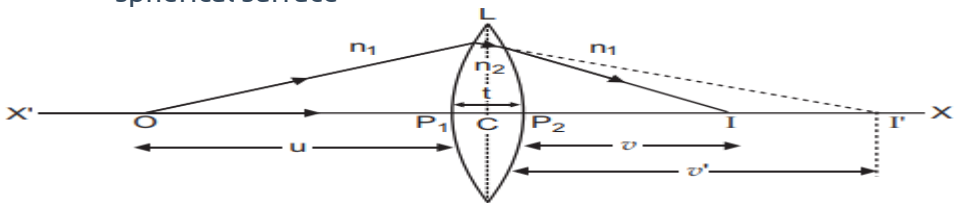
$$= q\frac{\sigma}{2\epsilon_0} d$$

1+1

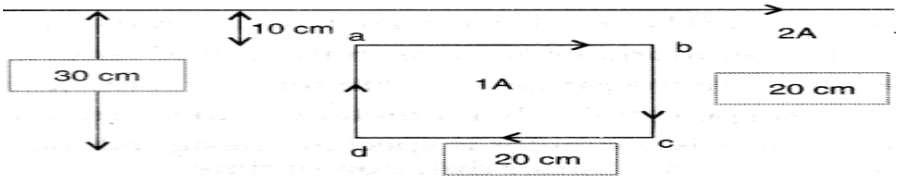
23	(c) First law or Current law or function law : It states, "In any electrical network, the algebraic sum of currents meeting at a point (or junction) is zero." (d) Second law or Voltage law or Loop law : It states, "In a closed circuit, the algebraic sum of the products of the current and the resistance in each of the conductors in any closed path (or mesh) in a network plus sum of emf in that path is equal to zero.  Consider the loop $ABDA$ Apply KVL to $ABDA$ $1-2-2I_2-2(I_1+I_2)-1\times I_2=0$ $-2I_1-5I_2=1$ _____(1) Apply KVL to $DCBD$ $3-3I_1-1\times I_1-1-2(I_1+I_2)=0$ $-6I_1-2I_2=-2$ $6I_1+2I_2=2$ _____(2) Solve (1) and (2) multiply (1) $\times 3$ $\Rightarrow -6I_1-15I_2=3$ _____(3) Add (3) & (2) $-13I_2=5$ $I_2=\frac{-5}{13}$ From (1)	½ ½ ½ ½ ½ ½ ½

	$-2I_1 - 5\left(\frac{-5}{13}\right) = 1$ $-2I_1 = 1 - \frac{25}{13}$ $-2I_1 = \frac{-12}{13}$ $I_1 = \frac{6}{13}$ Therefor current through the branch BD $= I_1 + I_2$ $= \frac{6}{13} - \frac{5}{13} = \frac{1}{13}A$ Magnitude voltage across BD $= \frac{1}{13} \times 2 = 0.153\ volt$	
24	(a) M = 1.5 JT^{-1} B = 0.22 T The work done to rotate the magnet from the position θ1 to θ2 is given by MB(cos θ1 – cos θ2) (i) θ1 = 0°, θ2 = 90° ∴ W = 1.5 x 0.22 (cos0°- cos 90°) 1.5 x 0.22 (1 - 0) = 1.5 x 0.22 = 0.33 J (ii) θ1 =0° θ2 = 180° ∴ W = 1.5 × 0.22 (cos0° – cos180°) 1.5 x 0.22 (1-(-1)) = 1.5 x 0.22 × 2 = 0.665 J (b) The torque acting on the magnet is given by (i)τ = MB sin θ θ = 90° τ = 1.5 x 0.22 x sin 90° τ =1.5 x 0.22 × 1 = 0.33 Nm (ii)θ = 180° τ = 1.5 x 0.22 x sin 180 °=0 OR (a) When is parallel to g, the magnet is in stable equilibrium (b) U = -MB = -0.32 x 0.15 = -4.8 x 10-2 J (b) When → M is antiparallel to g, the magnet is in unstable equilibrium. U = MB = 0.32 x 0.15 = 4.8 x 10-12 J.	½ ½ ½ ½ ½ 1 ½ 1
25	a) X is capacitor. (b)B → Voltage. C → Current A → Power Consumed	1 1 1

	(c) $X_c = \frac{1}{\omega c} = \frac{1}{2\pi\nu c}$ $x_c \propto \frac{1}{\nu}$  	½ ½ ½
	SECTION- C	
26	Displacement current and generalised Ampere's Circuital Law: Consider a parallel plate capacitor, being charged by a battery. A time varying current is flowing through the capacitor. If we consider only the conduction current I, then we apply Ampere's Circuital Law to two closed loops C1 and C2, then we get  $\oint_{C_1} \vec{B}\cdot\vec{dl} = \mu_0 I \quad ...(i)$ and $\oint_{C_2} \vec{B}\cdot\vec{dl} = 0 \quad ...(ii)$ Since there cannot be any conduction current in region between the capacitor plates. As C1 and C2 are very close, we must expect $\oint_{C_1} \vec{B}\cdot\vec{dl} = \oint_{C_2} \vec{B}\cdot\vec{dl} \quad ...(iii)$. But this condition is violated by equations (i) and (ii). Hence Ampere's Circuital Law seems to be inconsistent in this case. Therefore, Maxwell postulated the existence of displacement current which is produced by time varying electric field. If s (t) is the surface charge density on capacitor plates and q(t) is the charge, then time varying electric field E(t) = σ(t)/ε0 = q(t)/Aε0, where A is area of each plate. $\frac{dE}{dt} = \frac{1}{A\varepsilon_0}\frac{dq(t)}{dt}$ or $\frac{dq(t)}{dt} = \varepsilon_0 A \frac{dE}{dt}$ This is expression for displacement current (Id). Applying Kirchhoff's first law at power P, we get I = Id Hence, equation (i) and (ii) take the	1/2 1/2 ½ ½

	$\oint_{C_1} \vec{B}\cdot\vec{dl} = \mu_0 I$ and $\oint_{C_2} \vec{B}\cdot\vec{dl} = \mu_0 I_d = \mu_0 I$ The total current is the sum of the conduction current and displacement current. Thus, modified form of Ampere's circuital law  $\oint \vec{B}.\vec{dl} = \mu_0(I + I_d) = \mu_0\left(I + \varepsilon_0 A\frac{dE}{dt}\right)$ But EA = Electric flux ϕ_E $\therefore \quad \oint \vec{B}.\vec{dl} = \mu_0(I + \mu_0\varepsilon_0\frac{d\phi_E}{dt})$ (c) X-ray; used to study crystal structure	½+1/2
27	Lens Maker's Formula: Suppose L is a thin lens. The refractive index of the material of lens is n2 and it is placed in a medium of refractive index n1. The optical centre of lens is C and X ' X is principal axis. The radii of curvature of the surfaces of the lens are R1 and R2 and their poles are P1 and P2. The thickness of lens is t, which is very small. O is a point object on the principal axis of the lens. The distance of O from pole P1 is u. The first refracting surface forms the image of O at I' at a distance v' from P1. From the refraction formula at spherical surface  $\frac{n_2}{v'} - \frac{n_1}{u} = \frac{n_2 - n_1}{R_1} \quad ...(i)$ The image I' acts as a virtual object for second surface and after refraction at second surface, the final image is formed at I. The distance of I from pole P2 of second surface is v. The distance of virtual object(I') from pole P2 is (v'). For refraction at second surface, the ray is going from second medium (refractive index n2) to first medium (refractive index n1), therefore from refraction formula at spherical surface $\frac{n_1}{v} - \frac{n_2}{(v')} = -\frac{n_2 - n_1}{R_2} \quad ...(ii)$ Adding equations (i) and (ii), we get $\frac{n_1}{v} - \frac{n_1}{u} = (n_2 - n_1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$ or $\frac{1}{v} - \frac{1}{u} = \left(\frac{n_2}{n_1} - 1\right)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$	1 2

28	$L = \frac{nh}{2\pi}$ *i.e.* angular momentum of orbiting electron is quantised.] According to de-Broglie hypothesis Linear momentum $(p) = \frac{h}{\lambda}$ And for circular orbit $L = r_n p$ where 'r_n' is the radius of $= \frac{rh}{\lambda}$ Also $L = \frac{nh}{2\pi}$ $\frac{rh}{\lambda} = \frac{nh}{2\pi}$ $2\pi r_n = n\lambda$ **(ii)** $E_C - E_B = \frac{hc}{\lambda_1}$ **...(i)** $E_B - E_A = \frac{hc}{\lambda_2}$ **...(ii)** $E_C - E_A = \frac{hc}{\lambda_3}$ **...(iii)** Adding (i) & (ii) $E_C - E_A = \frac{hc}{\lambda_1} + \frac{hc}{\lambda_2}$ **...(iv)** Using equation (iii) and (iv) $\frac{hc}{\lambda_3} = \frac{hc}{\lambda_1} + \frac{hc}{\lambda_2}$ $\Rightarrow \frac{1}{\lambda_3} = \frac{1}{\lambda_1} + \frac{1}{\lambda_2}$	½ ½ 2
29	(i) C (ii) A (iii) C (iv) C OR C	1 1 1 1
30	(i) A (ii) B (iii) A (iv) C OR C	1 1 1 1

	SECTION- D	
31	(a) $F_e=F_m$ **ie, qE=qvB** **or v=E/B** (b) CORRECT DIAGRAM **CORRECT EXPRESSION OF TORQUE** **(B)** (i) Torque 'τ' = MB sinθ where θ = 0° Therefore, τ = 0 [∴ As M and B are parallel] (ii) Force acting on the loop Direction: $\|F\| = \frac{\mu I_1 I_2}{2\pi} l\left(\frac{1}{r_1}-\frac{1}{r_2}\right)$ $= 2\times10^{-7}\times2\times5\times10^{-1}\left(\frac{1}{10^{-2}}-\frac{1}{5\times10^{-2}}\right)$ $= \frac{20\times10^{-8}}{10^{-2}}\left(1-\frac{1}{5}\right)\text{N} = 20\times10^{-6}\times\frac{4}{5}\text{N} = 1.6\times10^{-5}\text{ N.}$ Towards the conductor or attractive OR (a)Derivation of expression Correct definition of one ampere (b)  Here $I_1 = 2A;\ I_2 = 1A$ $d_1 = 10\text{ cm};\ d_2 = 30\text{ cm}$ $\mu_0 = 4\pi\times10^{-7}\text{ Tm A}^{-1}$ We have $F = \frac{\mu_0 I_1 I_2}{2\pi d} l$ ∴ Net force on sides *ab* and *cd* $= \frac{\mu_0 2\times1}{2\pi}\times20\times10^{-2}\left[\frac{1}{10\times10^{-2}}-\frac{1}{30\times10^{-2}}\right]\text{N}$ $= 4\times10^{-7}\times20\left[\frac{20}{10\times30}\right]\text{N}$ $= \frac{16}{3}\times10^{-7}\text{ N}$ $= 5.33\times10^{-7}\text{ N}$ This net force is directed towards the infinitely long straight wire. Net force on sides bc and da = zero .'. Net force on the loop = 5.33 x 10-7 N The force is directed towards the infinitely long straight wire.	1 1/2 1+1/2 1 1 2 1
32	(a)Correct Ray diagram Correct expression of refractive index of glass in terms of angle of prism and angle of minimum deviation	1 1+1

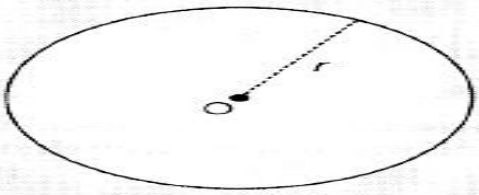
	(b) $$f_l = \frac{\frac{a}{a}\frac{n_g}{n_l} - 1}{\frac{a}{a}\frac{n_g}{n_l} - 1} \times f_a$$ $$= \frac{1.6 - 1}{\left(\frac{1.6}{1.3} - 1\right)} \times 20 \text{ cm}$$ $$= \frac{0.6 \times 1.3}{0.3} \times 20 \text{ cm}$$ $$= 52 \text{ cm}$$ **OR** (a)ray diagram, derive the mirror formula for a concave mirror (b) (i)correct expression (ii)correct expression	1.5 1 1 1+2 1+1
33	(a) State two important properties of photon Define (i) stopping potential and (ii) threshold frequency, graph Given $\lambda = 412.5 \text{ nm} = 412.5 \times 10^{-9} \text{ m}$ $\therefore$ Energy of light is given by $E_\lambda = \frac{hc}{\lambda} = \frac{6.626 \times 10^{-34} \times 3 \times 10^8}{412.5 \times 10^{-9}} \text{ Joule} = \frac{6.626 \times 10^{-34} \times 3 \times 10^8}{412.5 \times 10^{-9} \times 1.6 \times 10^{-19}} eV$ (b) $E_\lambda = 3.012 \text{ eV} \approx 3.01 \text{ eV}$ Now for photoelectric emission, we should have the energy of incident light higher than the work function of the metal. Since work function of Na and K is less than $\mathbf{E_\lambda}$ so these metals Na and K show photoelectric emission. But for Ca and Mo, the work function is more than $\mathbf{E_\lambda}$ so these metals Ca and Mo, do not show photoelectric emission.	1 ½+1/2 1 ½ ½ 1

OR

(i)

$$\frac{mv^2}{r} = \frac{1}{4\pi\varepsilon_0}\frac{Ze^2}{r^2} \qquad 1/2$$

$$\Rightarrow \quad mv^2 = \frac{1}{4\pi\varepsilon_0}\frac{Ze^2}{r}$$



Total energy = P.E. + K.E.

$$= -\frac{1}{4\pi\varepsilon_0}\frac{Ze^2}{r} + \frac{1}{2}mv^2 = \frac{-1}{4\pi\varepsilon_0}\frac{Ze^2}{r} + \frac{1}{8\pi\varepsilon_0}\frac{Ze^2}{r} \qquad 1$$

$$= -\frac{1}{2}\cdot\frac{1}{4\pi\varepsilon_0}\frac{Ze^2}{r} = -\frac{1}{8\pi\varepsilon_0}\frac{Ze^2}{r} \qquad 1/2$$

The Negative sign implies that electron - nucleus form abound system
conclusions of **α** scattering experiment

1

Now if atom is excited to $n = 4$ level, then we have

$$E_4 = -\frac{13\cdot6}{4^2} = -\frac{13\cdot6}{16} = -0\cdot85 \text{ ev} \qquad \left(\because \quad E_n = -\frac{E_g}{n^2}\right).$$

1

Now if v is the frequency of photon then

$$hv = E_4 - E_g \quad \text{OR} \quad v = \frac{E_4 - Eg}{h}$$

$$\text{OR} \quad v = \frac{\left[-0.85 - (-13.6)\right] ev}{6.63\times10^{-34}\text{ J-s}} = \frac{12.75\times1.6\times10^{-19}\text{ Jule}}{6.63\times10^{-34}\text{ Jule - sec}}$$

$$\boxed{v = 3.08\times10^{15}\,Hz}$$

1

KVS(RO) JAIPUR
CLASS-XII
SESSION-2023-2024
SAMPLE PAPER GROUP-G
SUBJECT: - PHYSICS (BLUE PRINT)

UNITS	NAME OF CHAPTERS	MCQ 1 MARK	A &R 1 MARK	2 MARKS	3- MARKS	4- MARKS	5- MARKS	Weightage
I	Chapter–1: Electric Charges and Fields	1(1)		2(1)			5(1)	16(8)
	Chapter–2: Electrostatic Potential and Capacitance		1(1)					
II	Chapter–3: Current Electricity	2(2)		2(1)	3(1)			
III	Chapter–4: Moving Charges and Magnetism	1(1)			3(1)		5(1)	17(6)
	Chapter–5: Magnetism and Matter					4(1)		
IV	Chapter–6: Electromagnetic Induction	1(1)			3(1)			
	Chapter–7: Alternating Current							
V	Chapter–8: Electromagnetic Waves	1(1)		2(1)				18(9)
VI	Chapter–9: Ray Optics and Optical Instruments	1(1)	1(1)		3(1)	4(1)		
	Chapter–10: Wave Optics	1(1)		2(1)	3(1)			
VII	Chapter–11: Dual Nature of Radiation and Matter	2(2)			3(1)			12(7)
VIII	Chapter–12: Atoms		1(1)		3(1)			
	Chapter–13: Nuclei	1(1)		2(1)				
IX	Chapter–14: Semiconductor Electronics devices	1(1)	1(1)				5(1)	7(3)
	TOTAL	12(12)	4(4)	10(5)	21(7)	8(2)	15(3)	70(33)

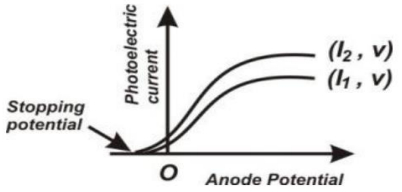
SAMPLE QUESTION PAPER (GROUP-H)
CLASS: XII
SESSION: 2023-24
SUBJECT: PHYSICS (THEORY)

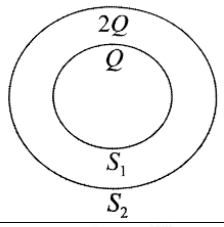
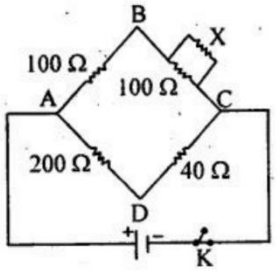
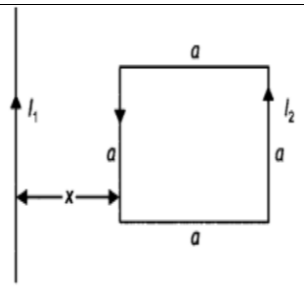
Maximum Marks: 70 Marks **Time Allowed: 3 hours.**

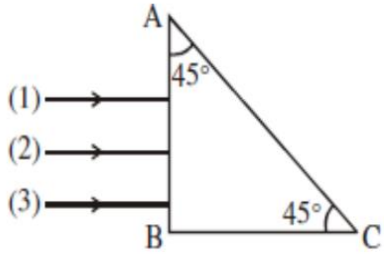
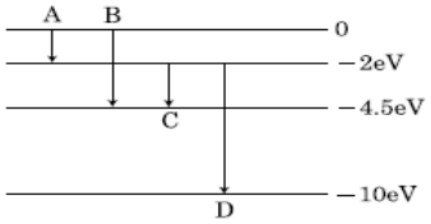
General Instructions:

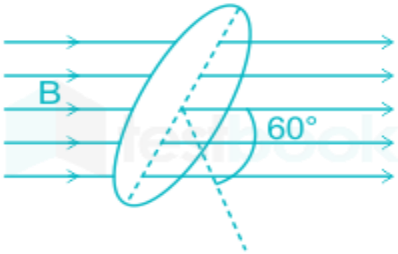
(1) There are 33 questions in all. All questions are compulsory.
(2) This question paper has five sections: Section A, Section B, Section C, Section D and Section E.
(3) All the sections are compulsory.
(4) Section A contains sixteen questions, twelve MCQ and four Assertion Reasoning based of 1 mark 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.
(6) Use of calculators is not allowed.
(7) You may use the following values of physical constants where ever 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. $\mu_0 = 4\pi \times 10^{-7}$ Tm$\boldsymbol{A^{-1}}$
v. $h = 6.63 \times 10^{-34}$ Js
vi. $\varepsilon_0 = 8.854 \times 10^{-12}$ $\boldsymbol{C^2N^{-1}m^{-2}}$
vii. Avogadro's number = 6.023 X $\mathbf{10^{23}}$ per gram mole

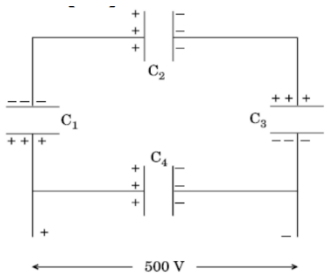
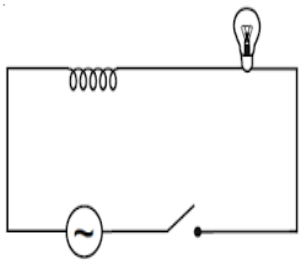
	SECTION -A	
1	If the sizes of charged bodies are very small compared to the distance between them, we treat them as (a)zero charges (b) point charges (c) single charges (d) No charges	1
2	In the series combination of two or more resistances (a) The current through each resistance is same (b) The voltage through each resistance is same (c) Neither current nor voltage is same (d) Both current and voltage through each resistance are same	1
3	A cell supplies a current of 0.9 A through a 2 Ω resistor and a current of 0.3 A through 7 Ω resistor. The internal resistance of the cell is (a) 2.0 Ω (b) 1.5 Ω (c) 1.0 Ω (d) 0.5 Ω	1
4	An induced emf is produced when a magnet is plunged into a coil the strength of induced emf is in depended of (a) The strength of the magnet (b) Number of turns of the coil (c) The resistivity of the wire of the coil (d) Speed with which the magnet is move	1
5	The characteristic feature of light which remains unaffected on refraction is (a) speed (b) frequency (c)wavelength (d)velocity of light	1

6	What is the effect on the angular width of interference fringes in a Young's double slit experiment when the screen moved near to the plane of slits. (a) increases (b) decreases (c) constant (d) not defined	1
7	Which of the following transport by EM waves: (a) charge & momentum (b) frequency & wavelength (c) energy & momentum (d) wavelength & energy	1
8	Following graph shows the variation of photoelectric current with anode potential for two light beams of same wavelength but different intensity. Find the correct relation:  (a) $I_1 > I_2$ (b) $I_1 = I_2$ (c) $I_1 < I_2$ (d) $I_1 \leq I_2$	1
9	In a p-type silicon, which of the following statement is true: (a) Electrons are majority carriers and trivalent atoms are the dopants. (b) Electrons are minority carriers and pentavalent atoms are the dopants. (c) Holes are minority carries and pentavalent atoms are the dopants. (d) Holes are majority carries and trivalent atoms are the dopants	1
10	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) Mass of alpha particle is more than mass of electron (c) Most of the part of an atom is empty space (d) Alpha particles move with high velocity	1
11	When radiation of given frequency is incident upon different metals, the maximum kinetic energy of electrons emitted – (a) decrease with increase of work function (b) increase with increase of work function (c) remains same with the increase of work function (d) does not depend upon work function	1
12	Two wires of same length are shaped into a square and a circle if they carry same current, ratio of magnetic moment is: (a) 2: π (b) π : 2 (c) π : 4 (d) 4: π	1
	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: - Electric field is always normal to the equipotential surfaces and along the direction of decreasing order of potential. Reason: - Negative gradient of electric potential is electric field.	1
14	Assertion: In optical fibre, Diameter of core is kept small. Reason: smaller diameter Ensure the angle of incidence is greater than critical angle.	1
15	Assertion: Nuclear force is same between neutron-proton, proton-proton & neutron-neutron. Reason: Nuclear force is charge independent.	1

16	Assertion: An N-type semiconductor has a large number of electrons but still it is electrically neutral. Reason: An N-type semiconductor is obtained by doping an intrinsic semiconductor with a tetravalent impurity.	1
	SECTION-B	
17	$S_1$and S_2 are two concentric hollow spheres containing charges as shown in the figure. Find the ratio of flux coming-out from $S_1$and S_2 	2
18	In the adjoining figure represents a balanced Wheatstone bridge circuit then find the value of X.  **OR** Two cells of emf 1.5V and 2V having internal resistances 0.2Ω and 0.3 Ω respectively are connected in parallel. Calculate the emf and internal resistance of the equivalent cell.	2
19	Write the following radiations in ascending order in respect of their frequencies; X-rays, Microwaves, UV rays and radio waves.	2
20	Write down two conditions to obtain the sustained interference fringe pattern of light	2
21	Show that nuclear density is independent of the size of nucleus.	2
	SECTION-C	
22	A wire of resistance are R and length L is stretched to thrice its length what will be the new value of resistance and resistivity.	3
23	A square coil of side 10 cm consists of 20 turns and carries a current of 12 A. The coil is suspended vertically, and the normal to the plane of the coil makes an angle of 30° with the direction of a uniform horizontal magnetic field of magnitude 0.80 T. What is the magnitude of torque experienced by the coil.	3
24	(a) Define mutual inductance and write its SI unit. (b) A square loop of side 'a' carrying a current l_2 is kept at distance x from an infinitely long straight wire carrying a current l_1 as shown in the figure. Obtain the expression for the resultant force acting on the loop. 	3
25	Obtain the expression for refraction through convex spherical refractive surface when the object is placed in rarer medium and image formed is real. **OR** (a) Write two essential conditions of total internal reflection.	3 1 2

	(b) Three rays of different colours fall normally on one of the sides of an isosceles right-angled prism as shown. The refractive index of prism for these rays is,1.39,1.47 and1.52 respectively. Find which of these rays get internally reflected and which get only refracted from. Trace the path of rays. Justify your answer.  	
26	Derive Snell's law on the basis of Huygen's wave theory when light is travelling from a denser to a rarer medium.	3
27	Justify how does the stopping potential in photoelectric emission depends upon- (i) intensity of the incident radiation (ii) frequency of incident radiation (iii) distance between light source and cathode in a photocell ?	3
28	(a) Define binding energy of a nucleus. (b) The energy levels of a hypothetical atom are shown below. Which of the shown transitions will result in the emission of photon of wavelength 275nm?  	3
	SECTION-D (CASE STUDY BASED)	
29	All magnets, no matter what their shape, have two regions called magnetic poles with the magnetism both in and around a magnetic circuit producing a definite chain of organised and balanced pattern of invisible lines of flux around it. These lines of flux are collectively referred to as the "magnetic field" of the magnet. The shape of this magnetic field is more intense in some parts than others with the area of the magnet that has the greatest magnetism being called "poles". At each end of a magnet is a pole. These lines of flux (called a vector field) cannot be seen by the naked eye, but they can be seen visually by using iron fillings sprinkled onto a sheet of paper or by using a small compass to trace them out. The lines which go to make up a magnetic field showing the direction and intensity are called Lines of Force or more commonly "Magnetic Flux" as shown below Lines of Force from a Bar Magnets Magnetic Field As shown above, the magnetic field is strongest near to the poles of the magnet were the lines of flux are more closely spaced. The general direction for the magnetic flux flow is from the North (N) to the South (S) pole. In addition, these magnetic lines form closed loops that leave at the north pole of the magnet and enter at the south pole. Magnetic poles are always in pairs. However, magnetic flux does not actually flow from the north to the south pole or flow anywhere for that matter as magnetic flux is a static region around a magnet in which the magnetic force exists. In other words, magnetic flux does not flow or move it is just there and is not influenced by gravity. (i). Pick out the SI unit of magnetic flux. (a) Ampere (b) Tesla meter (c) Weber (d) Maxwell (ii) Identify the correct dimensions of magnetic flux. (a) $[M^3 L^2 A^{-1} T^{-2}]$ (b) $[M L^2 A^{-1} T^{-2}]$ (c) $[M^2 L^2 A^{-1} T^{-2}]$ (d) $[M L^2 A^{-1} T^2]$ (iii) Calculate the magnetic flux when the magnetic field is perpendicular to the surface area. (a) Minimum (b) Maximum (c) Zero (d) Depends on the surface area	

	(iv) Which type of physical quantity is magnetic flux (a) Scalar b) Vector c) Isotropic d) Isentropic **Or** (iv). The following figure represents area= $0.5m^2$ situated in uniform magnetic field B= $2wb/m^2$ then the value of magnetic flux will be  (a) 2 weber (b) $\sqrt{3}$ weber (c) $\frac{\sqrt{3}}{2} weber$ (d) 0.5 *weber*	
30	Rinky was watching her favourite TV programme KBC. Suddenly the picture started shaking on the TV Screen. She asked her elder brother to check the dish antenna. Her brother found nothing wrong with the antenna. A little later, Rinky again noticed the same problem on the TV Screen. At the same time she heard the sound of a low flying aircraft passing over their house. She asked her brother again. His brother being a Physics student explained the cause of shaking the picture on the TV Screen when aircraft passes over head  (i) Why does the picture started shaking when a low-lying aircraft passes overhead (a) Due to Interference (b) Due to reflection (c) Due to refraction (d) Due to polarization (ii)Which of the following does not show any interference pattern? (a) Soap bubble (b) Excessively thin film (c) A thick film (d) Wedge Shaped film (iii)The main principle used in Interference is _____ (a) Heisenberg's Uncertainty Principle (b) Superposition Principle (c) Quantum Mechanics (d) Fermi Principle (iv) When Two waves of same amplitude add constructively, the intensity becomes _____ (a) Double (b) Half (c) Four Times (d) One-Fourth **OR** The shape of the fringes observed in interference is _____ (a) Straight (b) Circular (c) Hyperbolic (d) Elliptica	1 1 1 1

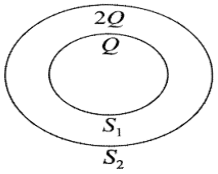
	SECTION-E	
31	(a) Using Gauss's law, obtain the expression for electric field intensity at a point due to an infinitely large, plane sheet of charge of charge density σ C/m^2. (b) Given a uniform electric field =6x10^3 $\hat{\imath}$ N/C, Find the flux of this field through a square of 10 Cm on a side whose plane is parallel to Y-Z plane. What would be the flux through the same square if the plane makes an angle 30^0 with the x- axis? OR (a) Derive the expression for the capacitance of a parallel plate capacitor having plate area A and plate separation d when a dielectric slab of dielectric constant K is introduced between plates. (b) A network of four capacitors each of 10μF capacitance is connected to a supply 500 V as shown in the figure. Determine the – (i) equivalent capacitance of the network and (ii) charge on each capacitor. 	5
32	(a) For a given alternating current I = I$_0$sinωt, derive the expression for r.m.s. value of current. (b) A light bulb and an open coil inductor are connected to an ac source through a key as shown in figure. The switch is closed and after sometime, an iron rod is inserted into the interior of the inductor. The glow of the light bulb (a) increases; (b) decreases; (c) is unchanged, as the iron rod is inserted. Give your answer with reasons  OR (a) A series LCR circuit is connected to an a.c. source having voltage V=V$_0$sinωt. Using phasor diagram, write expressions for impedance, instantaneous current and its phase relationship to the applied voltage. Also draw graphs of and versus for the circuit (b) In a series LCR circuit connected to a variable frequency 230 V source. L = 5.0 mH, C = 8μF, R = 40 Ω. Find the resonance frequency (c) Obtain the impedance of the circuit and the rms potential drops across the resistance for above given value.	5
33	(a) Distinguish between metal, insulator and semiconductor on the basis of energy band theory (b) I-V characteristics of P-N junction diode. OR (a) Explain the working of full wave rectifier with appropriate diagram. (b) A semiconductor has equal electron and hole concentration of 6×10^8 m^{-3}. On doping with certain impurity, electron concentration increases to 9×10^{12} m^{-3}. Calculate the new hole concentration in the semiconductor.	

MARKING SCHEME
SAMPLE QUESTION PAPER-H
SUBJECT: PHYSICS (THEORY)

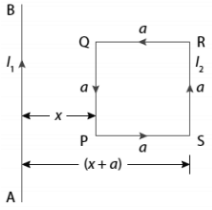
SECTION -A

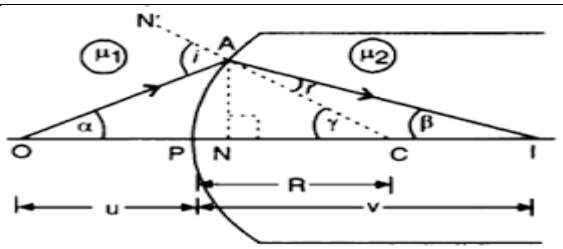
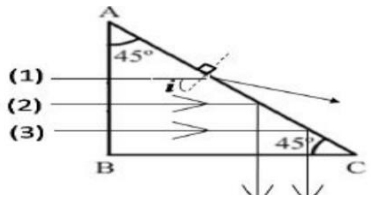
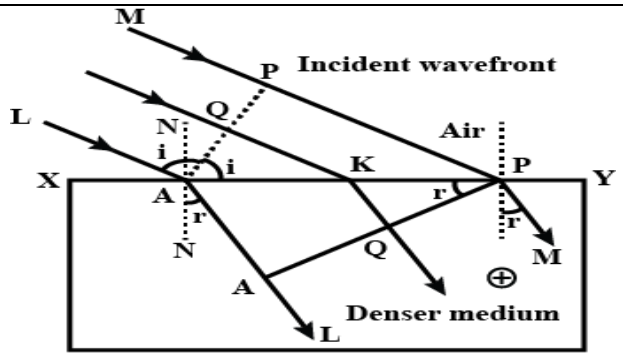
Q.NO	1	2	3	4	5	6	7	8
ANS	B	A	D	C	B	C	C	C
Q.NO.	9	10	11	12	13	14	15	16
ANS	D	C	A	C	A	A	A	C

SECTION-B

17	1/3 Using gauss law 	2
18	25 ohm (application of whaetstone bridge) OR E_{eq}= 1.7V and r_{eq} =0.12 Ω	2
19	Radio waves, Microwaves ,UV rays ,X-ray	2
20	(i) Phase difference should be constant (ii) Light should be monochromatic	1 1
21	$\rho = \frac{Nuclear\ mass}{Nuclear\ Volume} = \frac{m\ A}{\frac{4}{3}\pi r^3 A}$ $\rho = \frac{m}{\frac{4}{3}\pi r^3} = 2.9\ X\ 10^{17} kgm^{-3}$= constant Clearly, The Density of nucleus is independent of the mass number & size of the nucleus.	1 1

SECTION-C

22	ρ'=ρ R'= 9R	3
23	τ = n BIAsinθ Where, A = Area of the square coil = .1 × .1 = 0.01 m2 So, τ = 20 × 0.8 × 12 × 0.01 × sin30° = 0.96 N m Hence, the magnitude of the torque experienced by the coil is = 0.96 N m	3
24	(a)Mutual inductance equals the magnetic flux associated with a coil when unit current flows in its neighbouring coil. (b) Force per unit length between two parallel straight conductors $F_1 = \frac{\mu_0 I_1 I_2}{2\pi x} a$ Force on the part of the loop which is parallel to infinite straight wire and at a distance x from it $F_2 = \frac{\mu_0 I_1 I_2}{2\pi(x+a)} a$ (away from the infinitely long wire) Net force $F = F_1 - F_2$ $F = \frac{\mu_0 I_1 I_2}{2\pi x(x+a)} a^2$(away from the infinite straight line) 	1 1 1

25	 orrect derivation **OR** (a) For total internal reflection to take place (i) light must travel from a denser medium to a rarer medium and (ii) (ii) the angle of incidence inside the denser medium must be greater than the critical angle (b) μ(refractive index) is greater than $\sqrt{2}$ for TIR so that ray (2) and (3) undergo  TIR	1 2 1 2
26	 Correct derivation	1 2
27	(i) stopping potential does not depend on intensity (ii) stopping potential α frequency (iii) stopping potential does not depend on the distance between the light source and the cathode in a photocell	1 1 1
28	Correct definition Calculation Transition B will be possible because energy gap should be 4.5MeV	1 1 1
	SECTION-D (CASE STUDY BASED)	
29	(i) (c) (ii) (b) (iii) (b) (iv) (a) Or (iv) (d)	4
30	(i) (a) (ii) (b) (iii) (b) (iv) (c) or (iv))c)	4
	SECTION-E	
31	Correct derivation E_1 = 60 N m^2/C E_2= 30 N m^2/C **OR** Correct derivation Equivalent capacitance = $\frac{40}{3}$ μF charge on $C_4 = 5x10^{-3}$ C charge on C_1, C_2 and $C_3 = \frac{5}{3}x10^{-3}$ C	3 1 1 3 1 1

32	Correct derivation As an iron rod is inserted, inductance of inductor will increase. Hence impedance will increase, so current will decrease and power of bulb will decrease. **OR** Expression Phasor diagram Resonance frequency = 7.9×10^{-6} Hertz Z=R=40 ohm V= 230 Volt	3 2 1 1 1 1 1
33	(a) Correct explanation (b) I-V characteristics (forward and reverse bias) OR (a) Correct explanation Diagram (b) Calculation for Hole concentration = $4 \times 10^{4}\ m^{-3}$	3 2 2 1 2

KVS(RO) JAIPUR
CLASS-XII
SESSION-2023-2024
SAMPLE PAPER GROUP-I

S. No.	UNIT	MCQ (1Mark)	Assertion reasoning (1 Mark)	SA 1 (2 Marks)	SA 2 (3 Marks)	Case Based Question (4 Marks)	Long Ans (5 Marks)	Total
1.	**UNIT – I** Electrostatics **UNIT – II** Current Electricity	2(2)	2(2)		1(3)	1(4)	1(5)	7(16)
2.	**UNIT – III** Magnetic effects of current and Magnetism **UNIT – IV** Electromagnetic Induction and Alternating currents	2(2)	1(1)	3(6)	1(3)		1(5)	8(17)
3.	**UNIT – V** Electromagnetic Waves **UNIT – VI** Optics	4(4)		1(2)	1(3)	1(4)	1(5)	8(18)
4.	**UNIT – VII** Dual Nature of Radiation and Matter **UNIT – VII** Atoms and Nuclei	3(3)	1(1)	1(2)	2(6)			7(12)
5.	**UNIT – IX** Electronic devices	1(1)			2(6)			3(7)
	TOTAL	12(12)	4(4)	5(10)	7(21)	2(8)	3(15)	33(70)

SAMPLE QUESTION PAPER (GROUP-I)
CLASS: XII
SESSION: 2023-24
SUBJECT: PHYSICS (THEORY)

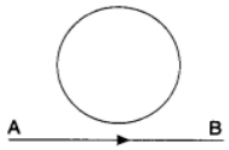
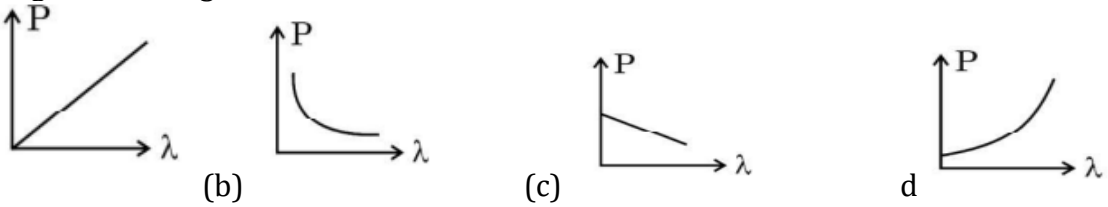
Maximum Marks: 70 Marks **Time Allowed: 3 hours.**

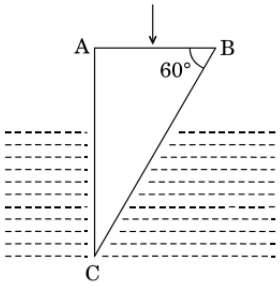
General Instructions:

(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.
(6) Use of calculators is not allowed.
(7) You may use the following values of physical constants where ever necessary

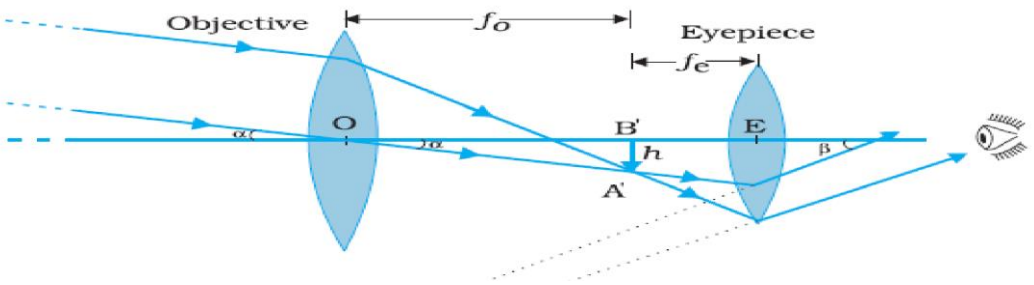
i. $c = 3 \times 10^8$ m/s
ii. $m_e = 9.1 \times 10^{-31}$ kg
iii. $e = 1.6 \times 10^{-19}$ C
iv. $\mu_0 = 4\pi \times 10^{-7}$ Tm$\boldsymbol{A^{-1}}$
v. $h = 6.63 \times 10^{-34}$ Js
vi. $\varepsilon_0 = 8.854 \times 10^{-12}$ $\boldsymbol{C^2N^{-1}m^{-2}}$
vii. Avogadro's number = 6.023 X $\mathbf{10^{23}}$ per gram mole

SECTION- A		
1.	The angle between area of equipotential surface and electric field is- (a) 0^0 (b) 90^0 (c) Between 0^0 and 90^0 (d) Between 90^0 and 180^0	1M
2.	When an electric dipole is placed in a uniform electric field, it experiences a) Force as well as torque b) Torque but no net force c) Force but no torque d) Neither any force nor any torque	1M
3.	Which of the following does not resemble the Gauss' law in magnetism? (a) Magnetic poles exist in pair of unlike poles. (b) Magnetic flux through a closed loop is zero. (c) The number of magnetic field lines entering a closed surface is equal to that leaving the surface. (d) Single pole exists in nature	1M

4.	In the given figure current from A to B in the straight wire is decreasing. The direction of induced current in the loop is A  (a) Clockwise (b) anticlockwise (c) changing (d) nothing can be said	1M
5.	EM waves can be produced by a charge: (a) An accelerated charged particles (b) A charged particles moving with constant speed (c) at rest. (d) either at rest or moving with constant velocity.	1M
6.	If λx, λ_m , λv represents wavelength of X-Rays, microwaves & visible rays then (a) $\lambda_m > \lambda x > \lambda v$ (b) $\lambda_m > \lambda v > \lambda x$ (c) $\lambda v > \lambda x > \lambda_m$ (d) $\lambda v > \lambda_m > \lambda_x$	1M
7.	A small object lies at the bottom of a vessel filled with water (refractive index 4/3) up to a height H. When viewed from a point above the surface of water, the object appears raised by n percent of H. The value of n is : (a) 15 (b) 20 (c) 25 (d) 33	1M
8.	Which of the following figures represents the variation of a particle's momentum with the de Broglie wavelength associated with it ?  (a) (b) (c) d	1M
9.	Two nuclei have their mass numbers in the ratio of 1 : 27. What is the ratio of their nuclear densities ? (a) 1 : 27 (b) 1 : 1 (c) 1 : 9 (d) 1 : 3	1M
10.	In the depletion region of unbiased p-n junction, (a) it is vacant of charge carriers (b) has only electrons (c) has only holes (d) p-n junction has a weak electric field.	1M
11.	In a Young's double-slit experiment, the slit separation is doubled. To maintain the same fringe spacing on the screen, the screen-to-slit distance D must be changed to (a) 2D (b) 4D (c) D/2 (d) D/4	1M
12.	Which of the following transitions in hydrogen emits the photon of the highest frequency? (a) n = 1 to n = 2 (b) n = 6 to n = 2 (c) n = 2 to n = 6 (d) n = 2 to n = 1	1M
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): 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.	1M

14.	**Assertion (A)** : A planar loop of irregular shape carrying current is subjected to a magnetic field acting perpendicular to the plane of the loop. If the wire is flexible, the loop takes a circular shape. **Reason (R)** : The force acting on each point of a current carrying loop, in a magnetic field perpendicular to its plane, is radially outward.	1M
15.	**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.	1M
16.	**Assertion (A):** As the temperature of a conducting wire increases, the drift velocity of the electrons also increases. **Reason (R)**: With an increase in temperature, the average time of collision increases.	1M
	SECTION- B	
17.	Determine the distance of closest approach when an alpha particle of kinetic energy 4·5 MeV strikes a nucleus of Z = 80, stops and reverses its direction.	2M
18.	(a)A ray of light is incident normally on the face AB of a right-angled glass prism of refractive index $a\lceil g = 1{\cdot}5$. The prism is partly immersed in a liquid of unknown refractive index. Find the value of refractive index of the liquid so that the ray grazes along the face BC after refraction through the prism.  (b) Trace the path of the rays if it were incident normally on the face AC	2M
19.	When an alternating voltage of 220V is applied across an Inductor, a current of 0.25A flows which lags behind the applied voltage in phase by $\pi/2$ radian. If the same voltage is applied across resister, the same current flows but now it is in phase with the applied voltage Calculate the current flowing in the circuit when the same voltage is applied across the series combination of Inductor and Resistor	2M
20.	(a) Define current sensitivity of a galvanometer. Write its expression. (b) A galvanometer has resistance G and shows full scale deflection for current I_g. (i) How can it be converted into an ammeter to measure current up to I_0 ($I_0 > I_g$)? **OR** Explain, giving reasons, the basic difference in converting a galvanometer into (i) a voltmeter and (ii) an ammeter.	2M
21.	Derive the expression for the self-inductance of a long solenoid of cross-sectional area A and length l, having n turns per unit length.	2M
	SECTION- C	
22.	Two cells of emfs 1.5 V and 2.0 V having internal resistance 0.2 Ω and 0.3 Ω respectively are connected in parallel. Calculate the emf and internal resistance of the equivalent cell.	3M
23.	Two long straight parallel conductors carry steady currents I1 and I2 separated by a distance d. If the currents are flowing in the same direction, show how the magnetic field set-up in one produce an attractive force on other. Obtain the expression for this force. Hence define one ampere.	3M

24.	The total energy of an electron in the first excited state of the hydrogen atom is about –3.4 eV. (a)What is the kinetic energy of the electron in this state? (b) What is the potential energy of the electron in this state? (c)Which of the answers above would change if the choice of the zero of potential energy is changed? **OR** The ground state energy of hydrogen atom is -13.6 eV. (i) What is the kinetic energy of an electron in the 2nd excited state? (ii) What is the potential energy of an electron in 3 rd excited state? (iii) If an electron jumps to the ground state from 3 rd excited state, calculate the wavelength of photon emitted.	3M
25.	Define the term wave front. Using Huygens's wave theory, verify the law of reflection.	3M
26.	Draw a graph showing the variation of stopping potential with frequency of the incident radiations. What does the slope of the line with the frequency axis indicate? Hence define threshold frequency?	3M
27.	Explain briefly, with the help of a circuit diagram, how a *p*-*n* junction diode works as a full wave rectifier. Explain the working. Draw the input and output waveforms.	3M
28.	Draw the energy band diagrams (at T > 0 K) for n-type and p-type semiconductors. Using diagram, explain why in n-type semiconductor the conduction band has most electrons from the donor impurities.	3M
	SECTION- D	
29.	Dielectric with polar molecules also develops a net dipole moment in an external field, but for a different reason. In the absence of any external field, the different permanent dipoles are oriented randomly due to thermal agitation; so, the total dipole moment is zero. When an external field is applied, the individual dipole moments tend to align with the field. When summed overall the molecules, there is then a net dipole moment in the direction of the external field, i.e., the dielectric is polarized. The extent of polarization depends on the relative strength of two factors: the dipole potential energy in the external field tending to align the dipoles mutually opposite with the field and thermal energy tending to disrupt the alignment. There may be, in addition, the 'induced dipole moment' effect as for non-polar molecules, but generally the alignment effect is more important for polar molecules. Thus, in either case, whether polar or non-polar, a dielectric develops a net dipole moment in the presence of an external field. The dipole moment per unit volume is called polarization. (i) The best definition of polarization is (a) Orientation of dipoles in random direction (b) Electric dipole moment per unit volume (c) Orientation of dipole moments (d) Change in polarity of every dipole (ii) Calculate the polarization vector of the material which has 100 dipoles per unit volume in a volume of 2 units. (a) 200 (b) 50 (c) 0.02 (d) 100 (iii) The total polarization of a material is the	4M

	(a) Product of all types of polarization (b) Sum of all types of polarization (c)Orientation directions of the dipoles (d)Total dipole moments in the (iv) Dipoles are created when dielectric is placed in _____ (a) Magnetic Field (b) Electric field (c) Vacuum (d) Inert Environment **OR** Identify which type of polarization depends on temperature. (a)Electronic (b) Ionic (c) orientational (d) Interfacial	
30.	The telescope is used to provide angular magnification of distant objects. It also has an objective and an eyepiece. But here, the objective has a large focal length and a much larger aperture than the eyepiece. Light from a distant object enters the objective and a real image is formed in the tube at its second focal point. The eyepiece magnifies this image producing a final inverted image. The magnifying power *m* is the ratio of the angle β subtended at the eye by the final image to the angle α which the object subtends at the lens or the eye.  (i)An astronomical telescope uses two lenses of powers 10 D and 1 D. Its magnifying power in normal adjustment is (a) 20 (b)10 (c)0.05 (d)0.1 (ii)An astronomical telescope uses an objective lens of focal length of objective lens and eye piece are 150 m and 6 cm. In case when final image is formed at least distance of distinct vision, the magnifying power is (a)20 (b)30 (c)60 (d)15 (iii)You are given following three lenses. Two lenses which you will use as an eyepiece and as an objective to construct an astronomical telescope. (a)L_1,L_3 (b) L_2,L_3 (c)L_3,L_2 (d)L_3,L_1 (iv) Limitations of a refracting telescope are (a) Chromatic aberration (b) spherical aberration(c) Heavy (d) all of these **OR** In normal adjustment of an astronomical telescope, the final image is formed at (a) near point (b) infinity (c) at 25cm (d) less than 25cm	4M

Lenses	Power (P)	Aperture (A)
L_1	3 D	8 cm
L_2	6 D	1 cm
L_3	10 D	1 cm

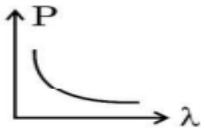
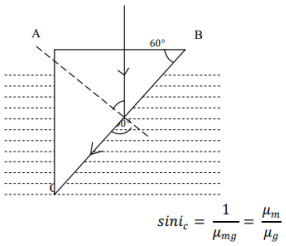
SECTION-E

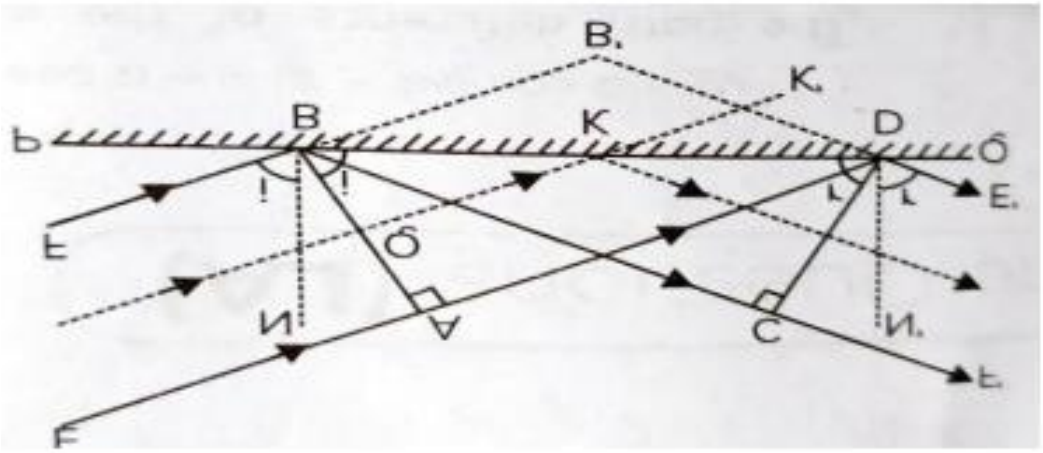
31.	Trace the rays of light showing the formation of an image due to a point object placed on the axis of a spherical surface separating the two media of refractive indices n_1 and n_2. Establish the relation between the distances of the object, the image and the radius of	5M

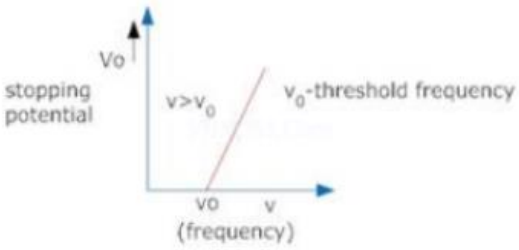
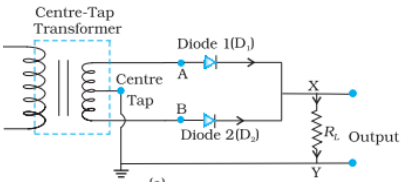
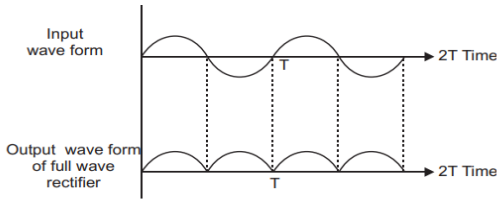
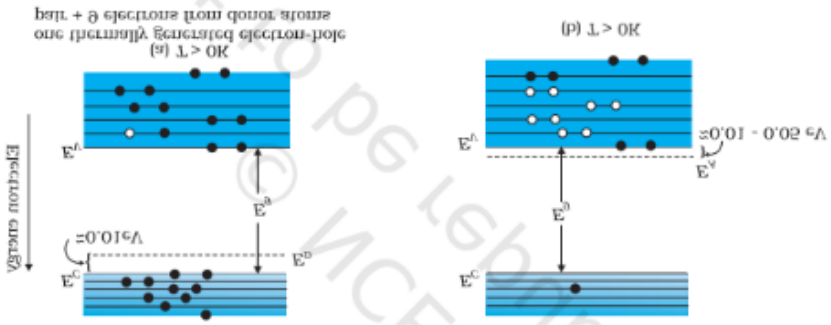
	curvature from the central point of the spherical surface. Hence, derive the expression of the lens maker's formula. **OR** Draw the labelled ray diagram for the formation of image by a compound microscope. Derive the expression for the total magnification of a compound microscope. Explain why both the objective and the eye piece of a compound microscope must have short focal lengths.	
32.	(a) Derive an expression for the impedance of an a.c. circuit consisting of an inductor and also draw its phasor diagram and graph of v and I versus wt. (b) A resistor of 200 Ω and a capacitor of 15.0 μF are connected in series to a 220 V, 50 Hz ac source. (a) Calculate the current in the circuit; (b) Calculate the voltage (rms) across the resistor and the capacitor. Is the algebraic sum of these voltages more than the source voltage? If yes, resolve the paradox **OR** (a) Write any three differences between paramagnetic materials, diamagnetic materials and ferromagnetic materials, by giving one examples each. (b) Find the relation between relative permeability and magnetic susceptibility.	5M
33.	(a) Sate Gauss Theorem and Using Gauss's law derive an expression for the electric field intensity at any point near a uniformly charged thin wire of charge/length λ C/m. An infinite line charge produces a field of 9×10^4 N/C at a distance of 2 cm. Calculate the linear charge density. **OR** (a) Find potential energy of an electric dipole place in uniform electric field. (c) Calculate the amount of work done in rotating a dipole, of dipole moment 3×10^{-8} C-m, from its position of stable equilibrium to the position of unstable equilibrium, in a uniform electric field of intensity 10^4 N/C.	5M

Group -I
Marking Scheme of Sample Question Paper Group-I

Answers

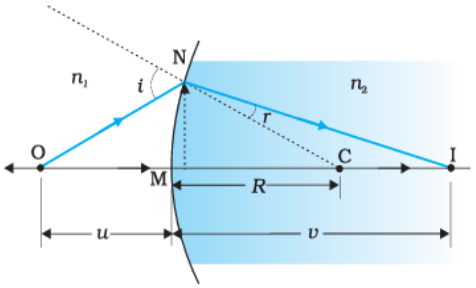
	SECTION (A)	
1.	(b) 90^0	1
2.	(b) Torque but no net force	1
3.	(d) Single pole exists in nature	1
4.	(b) Anticlockwise	1
5.	(a) An accelerated charged particle	1
6.	(b) $\lambda_m > \lambda v > \lambda x$	1
7.	(c) 25	1
8.	(b) 	1
9.	(b) 1 : 1	1
10.	(a) it is vacant of charge carriers	1
11.	(a) 2D	1
12.	(d) n = 2 to n = 1	1
13.	(a) both Assertion and Reason are true and Reason is correct explanation of Assertion	1
14.	(a) both Assertion and Reason are true and Reason is correct explanation of Assertion	1
15.	(c) Assertion is true but Reason is false	1
16.	(d) A is false and R is also false.	1
	SECTION (B)	
17.	Distance of the closest approach $r_o = \frac{1}{4\pi\epsilon 0}\frac{2ze^2}{E_\alpha} = 5.12 \times 10{-}14\ m$	½+1.5
18.	 $\mu_m = \mu_g sini = 1.299 \simeq 1.3$	½ ½ 1
19.	We are given that $0.25=220/X_L$, $X_L = 880\Omega$, Also $0.25=220/R$, $R = 880\Omega$ For the series combination of Inductor and Resistor, Equivalent impedance $Z = 880\sqrt{2}\ \Omega$, $I = 0.177$ A	1+1

20.	a) Deflection per unit current $I_s = \theta / I = BNA / K$ b) (i) By connecting a low resistance (Rs) in parallel to galvanometer such that $(I_0 - I_g)\, R_s = I_g G$ **OR** Conversion of Galvanometer into Ammeter A galvanometer may be converted into ammeter by using very small resistance in parallel with the galvanometer coil. The small resistance connected in parallel is called a shunt formula Conversion of Galvanometer into Voltmeter A galvanometer may be converted into voltmeter by connecting high resistance (R) in series with the coil of galvanometer. If V volt is the range of voltmeter formed, then series resistance formula	½ ½ ½ ½ ½ ½ ½ ½
21.	Diagram Magnetic field inside solenoid B =μ_0 nI And derivation of L = μ_0 n^2 Al	½ ½ 1
	SECTION (C)	
22.	$E = \frac{E_1 r1 + E_2\ r2}{r1 + r2}$ E=1.7v R =0.12 Ohm	1.5+1.5
23.	Diagram Derivation	1 2
24.	formula K=-E , U = -2K (a) K = 3.4 eV & (b) U= -6.8 eV (c) The kinetic energy of the electron will not change. The value of potential energy and consequently, the value of total energy of the electron will change. **OR** $E_3 = E_1/3^2$ =-13.6/9 =-1.51 eV $E_4 = E_1/4^2$ =-13.6/16 = -0.85 eV (i) KE of an electron in 2nd excited state = $-E_3$ = 1.51 eV (ii) PE of an electron in 3rd excited state = $2E_4$ = - 1.70 eV (iii) $E_4 - E_1 = hc/\lambda$ so $\lambda = hc/ E_4 - E_1$ =970 A	1 1 1 1 1 1
25.	A wave front is the continuous locus of vibrating particles which are in the same state of vibration or phase. Laws of Reflection from Huygens principle Derivation 	½ ½ 2

26.	Slope of graph=$\frac{\Delta\vartheta_0}{\Delta\vartheta}$ Einstein Photoelectric equation $eV_0=h\,\nu-\varphi_0$ differentiate$\Delta V_0/\Delta\,\nu = h/e$  Threshold frequency: - The minimum value of frequency of the incidence radiation below which photoelectric emission is not possible is called threshold frequency	1 1 1
27.	Circuit Diagram  Working of rectifier  	1 1 1
28.	 The **pentavalent** donor impurity has imparted extra electrons to the lattice structure. As a voltage is applied or the semiconductor is subject to external heat the electrons gain energy. The electrons break covalent bonds and more electrons are released into the conduction band	2 1
	SECTION (D)	
29.	(i) (b) (ii) (a) (iii) (b) (iv) (b) OR (b)	
30.	(i) (b)10 (ii) (b)30 (iii) (d)L_3, L_1 (iv) (d) all of these **OR** (b) infinity	

SECTION (E)

31. **Relation between *u, v, n*1 and *n*2 for a spherical surface:** 3



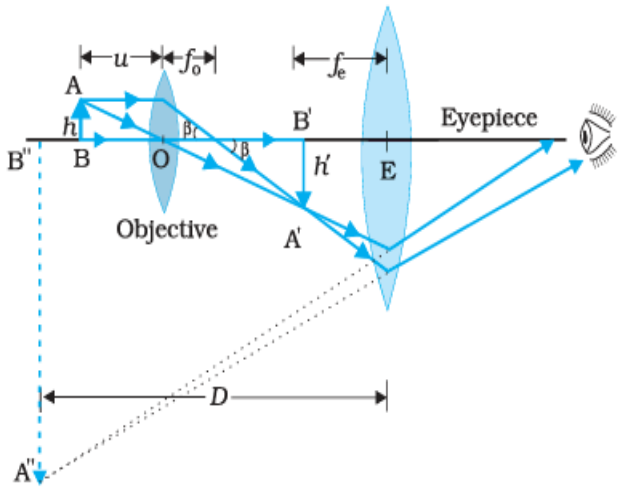
$$\frac{n_2}{v} - \frac{n_1}{u} = \frac{n_2 - n_1}{R}$$ 2

Lens Maker's Formula

$$\frac{1}{f} = (n-1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$$

OR

Compound Microscope:



2

Magnifying power of a microscope

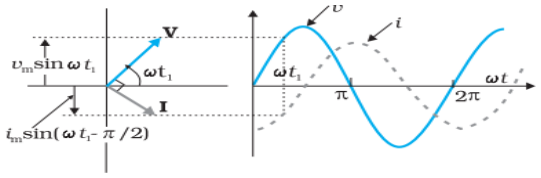
Magnification, *M*

$$\text{Magnification, } M = -\frac{v_0}{u_0}\left(1 + \frac{D}{f_e}\right)$$ 2

For greater magnification of a compound microscope, f_e should be small. As $f_0 < f_e$, so f_q is small. Hence, for greater magnification both f_0 and f_e should be small. 1

32. (a) Derivation — 1

And Phasor diagram — +2



(b)

$Z = \sqrt{R^2 + X_C^2}$ $Z = \sqrt{R^2 + (2\pi\vartheta C)^{-2}}$

=291.5Ω

Thus I=V/Z=220V/291.5Ω= 0.755A — 2

(b) Since the current is the same throughout the circuit, we have

V_R=IR =0.755/200 =151 V

V_C= IX_C= (0.755A)(212.3) =151 V

The algebraic sum of the two voltages, V_R and V_C is 311.3 V which is more than the source voltage of 220 V. How to resolve this paradox? As you have learnt in the text, the two voltages are not in the same phase. Therefore, they cannot be added like ordinary numbers. The two voltages are out of phase by ninety degrees. Therefore, the total of these voltages must be obtained using the Pythagorean theorem:

$V_{R+C}=\sqrt{V_R^2 + V_C^2}$ =220V

Thus, if the phase difference between two voltages is properly taken into account, the total voltage across the resistor and the capacitor is equal to the voltage of the source.

OR

(a) Any three differences

(b) Relation $\mu_r = 1 + \chi$ — 3

S. No.	Property	Paramagnetic materials	Diamagnetic materials	Ferromagnetic materials
1.	Effects of magnet	They are feebly attracted by magnets	They are feebly repelled by magnets	They are strongly attracted by magnets
2.	In external magnetic field	They acquire feeble magnetization in the direction of the magnetizing field.	They acquire feeble magnetization in the opposite direction of the magnetizing field.	They acquire strong magnetization in the direction of the magnetizing field.
3.	In uniform magnetic field	A freely suspended paramagnetic rod aligns itself parallel to the magnetic field.	A freely suspended diamagnetic rod aligns itself perpendicular to the magnetic field.	A freely suspended ferromagnetic rod aligns itself parallel to the magnetic field.
4.	In non - uniform magnetic field	They tend to move slowly from weaker parts to stronger parts of the field.	They tend to move slowly from stronger parts to weaker parts of the field	They tend to move quickly from weaker parts to stronger parts of the field
5.	Effect of temperature	Susceptibility varies inversely as temperature. $\chi_m \propto \frac{1}{T}$	Susceptibility is independent of temperature.	Susceptibility decreases with temperature in a complex manner. $\chi_m \propto \frac{1}{T-T_c}$. $where\ T > T_c$.

— 2

33.(a) Statement of Gauss Theorem — 1

Diagram — 1

Derivation — 1

(b) λ=10 μC/m\ — 2

OR

(a)Diagram — 3

Derivation

(b)

P = 3 X10-8 C-m; E =104 N/C At stable equilibrium (θ1)= 0° At unstable equilibrium (θ2) =180° — 2

Work done in rotating dipole is given by: W = PE (cos θ1 - cos θ2) =6X10-8J

KVS(RO) JAIPUR
CLASS-XII
SESSION-2023-2024
SAMPLE PAPER GROUP-J

UNITS	NAME OF CHAPTERS	MCQ 1 MARK	A &R 1 MARK	2-MARKS	3- MARKS	4- MARKS	5-MARKS	Weightage
I	Chapter–1: Electric Charges and Fields	1(1)		2(1)			5(1)	16(9)
	Chapter–2: Electrostatic Potential and Capacitance	1(1)	1(1)		3(1)			
II	Chapter–3: Current Electricity	1(1)	1(1)	2(1)				
III	Chapter–4: Moving Charges and Magnetism				3(1)		5(1)	17(6)
	Chapter–5: Magnetism and Matter				3(1)			
IV	Chapter–6: Electromagnetic Induction	1(1)						
	Chapter–7: Alternating Current	1(1)				4(1)		
V	Chapter–8: Electromagnetic Waves				3(1)		5(1)	18(9)
VI	Chapter–9: Ray Optics and Optical Instruments	1(1)	1(1)		3(1)			
	Chapter–10: Wave Optics	2(1)	1(1)	2(1)				
VII	Chapter–11: Dual Nature of Radiation and Matter	1(1)			3(1)			12(6)
VIII	Chapter–12: Atoms	1(1)			3(1)			
	Chapter–13: Nuclei	1(1)		2(1)				
IX	Chapter–14: Semiconductor Electronics: Materials, Devices and Simple Circuits	1(1)		2(1)		4(1)		7(3)
		1(12)=12	1(4)=4	2(5)=10	3X7=21	4(2)=8	5(3)=15	70(33)

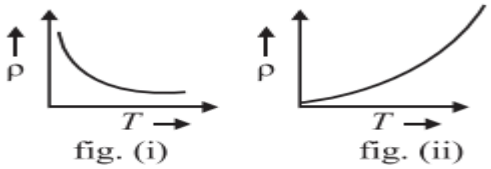
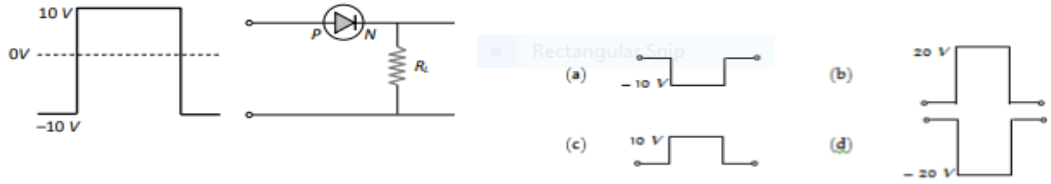
SAMPLE QUESTION PAPER (GROUP-J)
CLASS: XII
SESSION: 2023-24
SUBJECT: PHYSICS (THEORY)

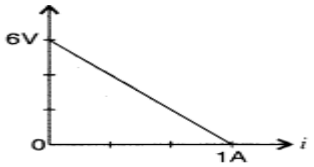
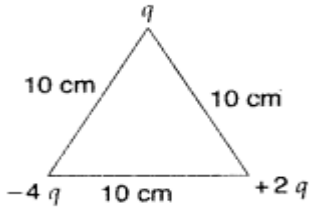
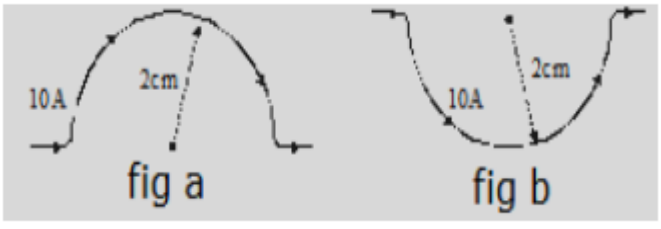
Maximum Marks: 70 Marks **Time Allowed: 3 hours.**

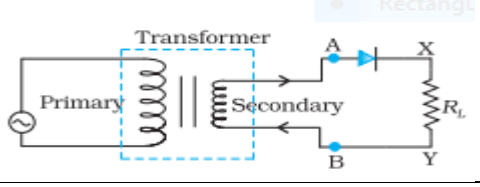
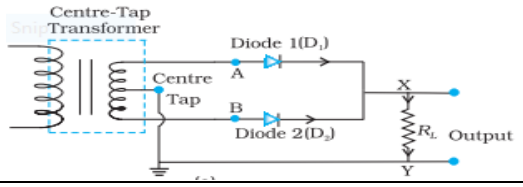
General Instructions:

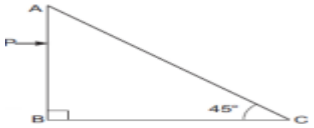
(1) There are 33 questions in all. All questions are compulsory.
(2) This question paper has five sections: Section A, Section B, Section C, Section D and Section E.
(3) All the sections are compulsory.
(4) **Section A** contains sixteen questions, twelve MCQ and four Assertion Reasoning based of 1 mark 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.
(6) Use of calculators is not allowed.
(7) You may use the following values of physical constants where ever 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. $\mu_0 = 4\pi \times 10^{-7}$ Tm$\boldsymbol{A}^{-1}$
v. $h = 6.63 \times 10^{-34}$ Js
vi. $\varepsilon_0 = 8.854 \times 10^{-12}$ $\boldsymbol{C^2N^{-1}m^{-2}}$
vii. Avogadro's number = 6.023 X $\mathbf{10^{23}}$ per gram mole

SECTION-A		
S.NO.	QUESTION	MARKS
Q1	According to Coulomb's law, which is the correct relation for the following figure?  (a) $q_1 q_2 > 0$ (b) $q_1 q_2 < 0$ (c) $q_1 q_2 = 0$ (d) $1 > q1/q2 > 0$	1
Q2	Which of the following is not the property of an equipotential surface? (a) They do not cross each other. (b) The work done in carrying a charge from one point to another on an equipotential surface is zero. (c) For a uniform electric field, they are concentric spheres. (d) They can be imaginary spheres.	1

Q3	The temperature (T) dependence of resistivity of materials A and material B is represented by fig (i) and fig (ii) respectively. Identify material A and material B.  fig. (i) fig. (ii) (a) material A is copper and material B is germanium (b) material A is germanium and material B is copper (c) material A is nichrome and material B is germanium (d) material A is copper and material B is nichrome	1
Q4	Two coils are placed close to each other. The mutual inductance of the pair of coils depends upon the (a)rate at which current change in the two coils (b) relative position and orientation of the coils (c)rate at which voltage induced across two coils (d) currents in the two coils	1
Q5	A coil has L = 0.04 H and R = 12 Ω . When it is connected to 220V, 50Hz supply the current flowing through the coil, in amperes is (a) 10.7 (b) 11.7 (c) 14.7 (d) 12.7	1
Q6	A glass lens is immersed in water. What will be the effect on the power of lens? (a) Increase (b) decrease (c) constant (d) not depends	1
Q7	The wave-front due to source situated at the infinity is (a) Spherical (b) Plane (c) Cylindrical (d) Rectangular	1
Q8	The path difference between two waves at the place of destructive interference is given by: **(a) multiple of π (b) multiple of π /2 (c) even multiple of π /2 (d) odd multiple of π /2**	1
Q9	The photoelectric effect is based on the law of conservation of (a) momentum (b) energy (c) angular momentum (d) mass	1
Q10	A photon beam of energy 12.1eV is incident on a hydrogen atom. The orbit to which electron of H-atom be excited is (a) 2nd (b) 3rd (c) 4th (d) 5th	1
Q11	Nuclear binding energy is equivalent to (a)Mass of proton (b) Mass of neutron (c) Mass of nucleus (d) Mass defect of nucleus	1
Q12	If the following input signal is sent through a PN-junction diode, then the output signal across RL will be  	1
	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.**	

Q13	Assertion(A): Work done to move a charge on an equipotential surface is always zero. Reason(R) : Electric field is zero at each point on an equipotential surface.	1
Q14	Assertion: Bending a wire does not affect electrical resistance. Reason : Resistance of wire is proportional to resistivity of material.	
Q15	Assertion: If the angles of the base of the prism are equal, then in the position of minimum deviation, the refracted ray will pass parallel to the base of prism. Reason: In the case of minimum deviation, the angle of incidence is equal to the angle of emergence.	1
Q16	Assertion: No interference pattern is detected when two coherent sources are infinitely close to each other. Reason: The fringe width is inversely proportional to the distance between the two slits.	1
	SECTION-B	
Q17	An electric dipole when held at 30^0 with respect to a uniform electric field of 10^4 N/C experienced a Torque of $9X10^{-26}$ Nm. Calculate dipole moment of the dipole?	2
Q18	The plot of the variation of potential difference across a combination of three identical cells in series, versus current is as shown in the figure. What is the emf of each cell? 	2
Q19	In young's double slit experiment how is the fringe width change when (a) Light of smaller wavelength is used (b) Distance between the slits is decreased?	2
Q20	Two nuclei have mass numbers in the ratio 1: 8. What is the ratio of their nuclear radii?	2
Q21	What happens to the width of depletion layer of a p-n junction when it is (i) forward biased, (ii) reverse biased? **OR** For a extrinsic semiconductor, indicate on the energy band diagram the donor and acceptor levels?	2
	SECTION-C	
Q22	Calculate the work done to dissociate the system of three charges placed on the vertices of a triangle as shown. 	3
Q23	A current of 10A flows through a semi-circular wire of radius 2cm as shown in figure (a). What is direction and magnitude of the magnetic field at the centre of semicircle? Would your answer change if the wire were bent as shown in figure (b) 	3

Q24	Out of the two magnetic materials, 'A' has relative permeability slightly greater than unity while 'B' has less than unity. Identify the nature of the material's 'A' and 'B'. Will their susceptibilities be positive or negative?	3
Q25	(1) State the condition under which a microwave oven heats up food items containing water molecules most efficiently? (2) Name the radiations which are next to these radiations in e.m. wave spectrum having (a) Shorter wavelength (b) Longer wavelength	3
Q26	The radii of curvature of the faces of a double convex lens are 10 cm and 15 cm. If focal length of the lens is 12 cm, find the refractive index of the material of the lens.	3
Q27	An electron and alpha particle have the same de-Broglie wavelength associated with them. How are their kinetic energies related to each other?	3
Q28	Using Bohr model of the atom, derive expression for the total energy of the electron in hydrogen atom. What is the significance of total negative energy possessed by the electron?	3
	SECTION-D	
Q29	**Case Study Based Questions** **Read the following paragraph and answer the questions that follow.** A transformer is essentially an a.c. device. It cannot work on d.c. It changes alternating voltages or currents. It does not affect the frequency of a.c. It is based on the phenomenon of mutual induction. A transformer essentially consists of two coils of insulated copper wire having different number of turns and wound on the same soft iron core. The number of turns in the primary and secondary coils of an ideal transformer are 2000 and 50 respectively. The primary coil is connected to a main supply of 120 V and secondary coil is connected to a bulb of resistance 0.6Ω. 1. In an ordinary transformer which of the following does not change (a)Voltage (b)Current (c)Frequency (d)All of the above 2.Transformer works on the principle of (a) Convertor (b) mutual induction (c) self-induction (d) invertor 3. Which losses in a transformer is zero at full load? (a) core loss (b) eddy current loss (c) copper loss (d) Friction loss **OR** Transformer core lamination is made up of _____. (a) Silicon steel (b) Cast steel (c) Cast iron (d) Aluminium 4. A step-up transformer has _____ number of turns on primary winding and _____ number of turns on secondary winding. (a) More, More (b) More, Less (c) Less, More (d) Less, Less	1 1 1 1
Q30	**Case Study Based Questions** Read the following paragraph and answer the questions that follow. A rectifier is an **electronic device that converts an alternating current into a direct current by using one or more P-N junction diodes**. A diode behaves as a one-way valve that allows current to flow in a single direction. This process is known as rectification.   	

	1. Which process straightens the direction of the current? (a) Amplification (b) Lithification (c) Rectification (d) None of these 2. Which of the following is used in a rectifier? (a)Inductor (b) Capacitor (c) Diode (d) Resistor 3. How many diodes are used in Half Wave Rectifiers? (a) 3 (b) 1 (c) 2 (d) 4 **OR** The equivalent DC voltage of a full wave rectifier is ------ the equivalent DC output voltage of a half wave rectifier (a) Equal (b) not related (c) half (d) double 4. Which rectifiers convert both cycles of AC to DC? (a) Half wave Rectifiers (b) Full wave Rectifiers (c) Positive cycle Rectifiers (d) Negative Cycle Rectifiers	1 1 1 1
	SECTION-E	
Q31	(a)An attractive force of 5N is acting between two charges of +2.0 μC & -2.0 μC placed at some distance. If the charges are mutually touched and placed again at the same distance, what will be the new force between them? (b)Draw the electric field lines for $q_1q_2<0$ (c) Calculate the surface charge density of a conductor whose charge is 5 C in an area of 10 m^2 **OR** (a)Derive the expression for the electric potential energy placed in uniform electric field. (b) Two-point charges 4 μC and +1 μC are separated by a distance of 2 m in air. Find the point on the line-joining charges at which the net electric field of the system is zero.	2 1 2 3 2
Q32	(a) Define critical angle and write condition for total internal reflection. (b)A right angle prism is placed as shown in the figure. Given that the prism is made of glass with R.I. as 1.5, trace the path of the ray P incident normal to the face AC.  **(a)** Draw the diagrams to show the behaviour of plane wave fronts as they (a) pass through a thin prism, and (b) reflect by a concave mirror**.** (b)State two differences between interference and diffraction patterns. (c) A slit of size 0.15 cm is placed at 2.1 m from a screen. On illuminated it by a light of wavelength 5×10^{-5} cm. The width of central maxima will be	3 2 2 1 2
Q33	(a)State the Lorenz's force and express it in vector form. Which pair of vectors are always perpendicular to each other? Derive the expression for the force acting on a current carrying conductor of length L in a uniform magnetic field 'B (b) Proton and an α-particle moving with the same velocity and enter into a uniform magnetic field which is acting normal to the plane of their motion. The ratio of the radii of the circular paths described by the proton and α-particle respectively. **OR** (a) State ampere's circuital law. Use this law to find magnetic field due to infinite current carrying wire. How are magnetic field lines different from electric field lines? (b) An electron after being accelerated through potential difference of 100 V enters a uniform magnetic field of 0.004 T perpendicular to its direction of motion. Calculate the radius of the path described by the electron.	½ +1/2 +2 2 3 2

Marking Scheme

S.NO.	Answer	MARKS
Q1	(b) q1q2<0	1
Q2	(c) For a uniform electric field, they are concentric spheres.	1
Q3	(b) material A is germanium and material B is copper	1
Q4	(b) relative position and orientation of the coils	1
Q5	(d) 12.7	1
Q6	(b) decrease	1
Q7	(b) Plane	1
Q8	(d) odd multiple of π /2	1
Q9	(b) energy	1
Q10	(b) third orbit	1
Q11	(d) Mass defect of nucleus	1
Q12	(c)	1
Q13	(c)	1
Q14	(a)	1
Q15	(a)	1
Q16	(b)	1
Q17	$\tau = 9x10^{-26}$ Nm $\theta = 30°$ Electric field, $E = 10^4$ N C^{-1} Torque acting on the dipole is given by the relation, $\tau = PE \sin\theta$ $P= \tau/E\sin\theta=18x10^{-30}$ Cm	1 1
Q18	Total emf of three cells in series = P.D corresponding to zero current = 6V ∴ The emf of each cell = 6/3 = 2V	1 1
Q19	$\beta= \lambda D/d$ (a)Decrease (b)Increase	 1 1
Q20	$R= R_0 A^{1/3}$ $R_1:R_2=1:2$	½ 1 +1/2
Q21	(i) In forward biased, the width of depletion layer of a p-n junction decreases. (ii) In reverse biased, the width of depletion layer of a p-n junction increases OR For Correct diagram	1 1 1+1
Q22	Initial P.E of the three charges $u_i = -2.304 \times 10^{-8}$ J final P.E.(u_f) =0 work required to dissociate the system of three charges $W= u_f-u_i =-2.304x10^{-8}$ J	1 1 1
Q23	Ans: (a) 5x10 $^{-5}$ T outward (b) 5x10 $^{-5}$T inward	3/2 +3/2

Q24	A' is paramagnetic 'B' is diamagnetic The susceptibility of material 'A' is positive while of 'B' is negative.	1 1 1
Q25	(1) Frequency of the microwaves must be equal to the resonant frequency of the water molecules present in the food item. 2 (a) Infrared (b) Radio wave	1 1 1
Q26	Given: R_1 = 10 cm, R_2 = -15 cm, f = 12 cm Using lens maker's formula Refractive index of the material of the lens :1.5	1/2 3/2 1
Q27	K.E= $P^2/2m$ λ=h/p $m_e/m_\alpha = E_{K\alpha} / E_{Ke}$ $m_\alpha > m_e$, so Kinetic energy of electron is greater than kinetic energy of alpha particle	½ ½ 1 1
Q28	For correct expression Significance	2 1
Q29	1-c 2-b 3-d or c 4-c	1x4=4
Q30	1-c 2-c 3-b or d 4-b	1x4=4
Q31	(a) For correct solution (b) For correct diagram (c) For correct solution OR (a) For correct derivation (b) For correct solution	2 1 2 3 2
Q32	(a) For correct answer (b)From $sin\ i_c = 1/n \Rightarrow sin\ i_c = 1/1.5 = 2/3$ So $i_c = 42^0$ Here angle of incidence at interface AC is 45^0 i.e i > ic So the ray undergoes TIR. OR (a)For correct answer and diagram (b)For correct answer (c) Width of central maxima $=2\lambda D/d$ $=2x2.1\times5\times10^{-7}/0.15x10^{-2}$ $=1.4\times10^{-3}$ m=1.4 mm	1+2 2 2 1 2
Q33	(a) For correct answer (b) For correct derivation **OR** (a) for correct expression (b) r=8.43mm	½+1/2+2 2 3 2