BLUE-PRINT II

XII Physics

S.No.	UNIT	VSA (1 Mark)	SA I (2 Marks)	SA II (3Marks)	LA (5 Marks)	Total
1.	Electrostatics	1(1)	4(2)	3(1)	-	8(4)
2.	Current Electricity	-	2(1)	-	5(1)	7(2)
3.	Magnetic Effect of current and magnetism	1(1)	2(1)	-	5(1)	8(3)
4.	Electromagnetic Induction & Alternative Currents	1(1)	4(2)	3(1)	-	8(4)
5.	Electromagnetic waves	1(1)	2(1)	-	-	3(2)
6.	Optics	1(1)	2(1)	6(2)	5(1)	14(5)
7.	Dual Nature of Matter	1(1)	-	3(1)	-	4(2)
8.	Atoms and Nuclei	1(1)	2(1)	3(1)	-	6(3)
9.	Electronic Devices	1(1)	-	6(2)	-	7(3)
10	Communication systems	-	2(1)	3(1)	-	5(2)
	Total	**8(8)**	**20(10)**	**27(9)**	**15(3)**	**70(30)**

SAMPLE QUESTION PAPER -II
XII - PHYSICS

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

General Instructions

(a) All questions are compulsory.

(b) There are 30 questions in total. Questions 1 to 8 carry one mark each, questions 9 to 18 carry two marks each, questions 19 to 27 carry three marks each and questions 28 to 30 carry five marks each.

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

(d) Use of calculators is not permitted.

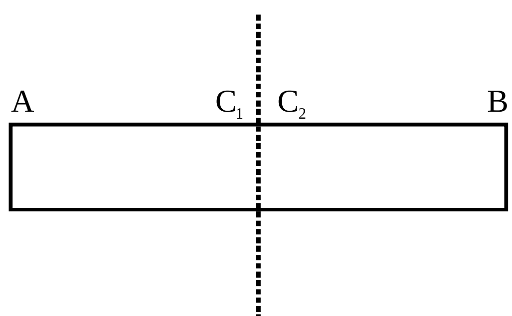
(e) You may use the following physical constants wherever necessary :

c	=	$3 \times 10^8 ms^{-1}$
h	=	$6.6 \times 10^{-34} Js$
e	=	1.6×10^{-19} C
	=	$4\pi \times 10^{-7}$ T m A^{-1}

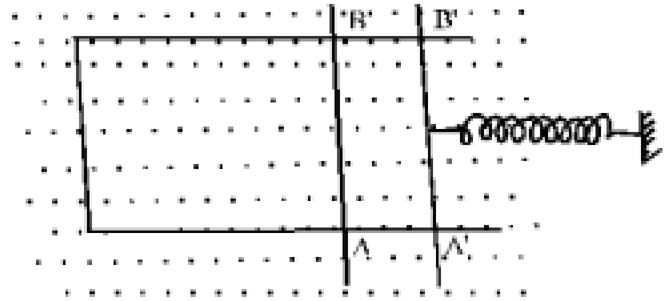
Boltzmann constant	$k = 1.38 \times 10^{23} JK^{-1}$
Avogadro's number	$N_A = 6.023 \times 10^{23}$/mole
Mass of neutron	$m_n = 1.6 \times 10^{-27}$ kg
Mass of electron	$m_e = 9 \times 10^{-31}$ kg μ_o

1. What is the angle between the directions of electric field at any (i) axial point and (ii) equitorial point due to an electric dipole? 1

2. A (hypothetical) bar magnet (AB) is cut into two equal parts. One part is now kept over the other, so that pole C_2 is above C_1. If M is the magnetic moment of the original magnet, what would be the magnetic moment of the combination so formed? 1



3. A rectangular wire frame, shown below, is placed in a uniform magnetic field directed upward and normal to the plane of the paper. The part AB is connected to a spring. The spring is stretched and released when the wire AB has come to the position A′ B′ (t=0). How would the induced emf vary with time? Neglect damping 1



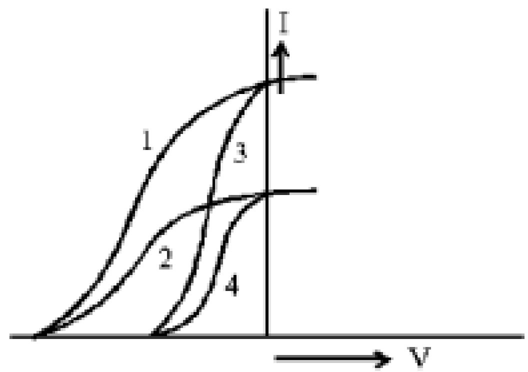
4. From the following, identify the electromagnetic waves having the (i) Maximum (ii) Minimum frequency. 1

(i) Radio waves (ii) Gamma-rays (iii) Visible light

(iv) Microwaves (v) Ultraviolet rays, and (vi) Infrared rays.

5. A partially plane polarised beam of light is passed through a polaroid. Show graphically the variation of the transmitted light intensity with angle of rotation of the polaroid.

6. The given graphs show the variation of photo electric current (I) with the applied voltage (V) for two different materials and for two different intensities of the incident radiations. Identify the pairs of curves that correspond to different materials but same intensity of incident radiations.

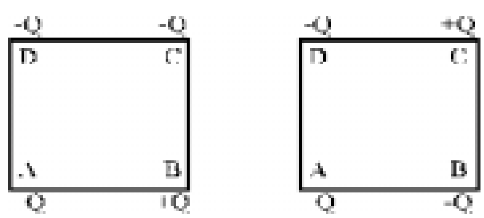


7. Four nuclei of an element fuse together to form a heavier nucleus. If the process is accompanied by release of energy, which of the two - the parent or the daughter nucleus would have a higher binding energy/nucleon?

8. Zener diodes have higher dopant densities as compared to ordinary p-n junction diodes. How does it affect the

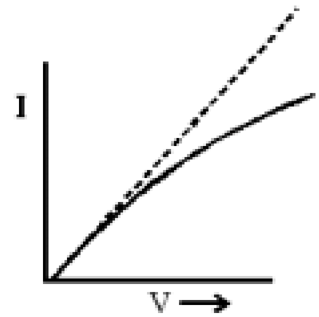
(i) Width of the depletion layer? (ii) Junction field?

9. Four point charges are placed at the four corners of a square in the two ways (i) and (ii) as shown below. Will the
(i) electric field
(ii) Electric potential, at the centre of the square, be the same or different in the two configrations and why?



(i) (ii)

10. The I-V characteristics of a resistor are observed to deviate from a straight line for higher values of current as shown below. Why?

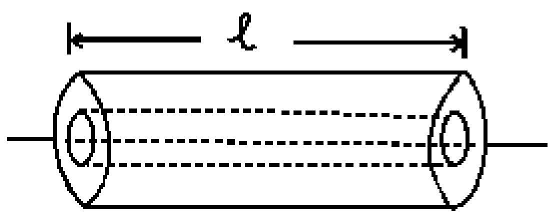


11. A charged particle moving with a uniform velocity $\vec{v}$ enters a region where uniform electric and magnetic fields $\vec{E}$ and $\vec{B}$ are present. It passes through the region without any change in its velocity. What can we conclude about the

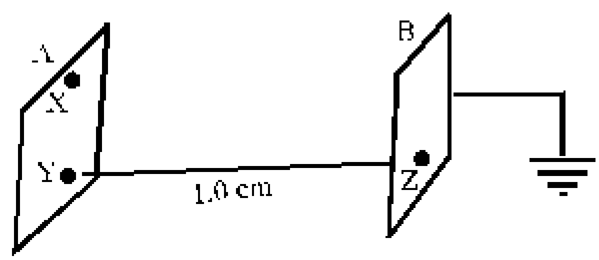
(i) Relative directions of $\vec{E}$, $\vec{v}$, and $\vec{B}$?

(ii) Magnitudes of $\vec{E}$ and $\vec{B}$?

12. Figure shows two long cooxial solenoids, each of length 'L'. The outer soleniod has an area of cross-section A and number of turns/ length n_1 . The corresponding values for the inner solenoid are A_2 and n_2. Write the expression for self inductance L_1, L_2 of the two coils and their mutual inductance M. Hence show that $M < \sqrt{L_1 L_2}$.

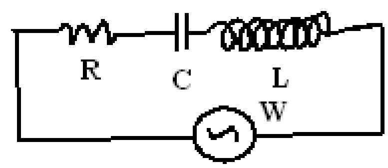


13. Two indentical plane metallic surfaces A and B are kept parallel to each other in air separated by a distance of 1.0 cm as shown in the figure.



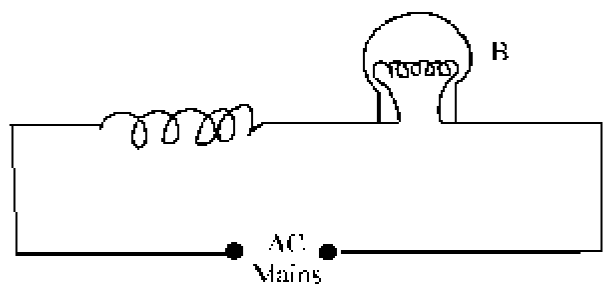
Surface A is given a positive potential of 10V and the outer surface of B is earthed. (i) What is the magnitude and direction of the uniform electric field between points Y and Z? (ii) What is the work done in moving a charge of 20 μC from point X and point Y?

14. In the circuit shown below, R represents an electric bulb. If the frequency ν of the supply is doubled, how should the values of C and L be changed so that the glow in the bulb remains unchanged?



OR

An air cored coil L and a bulb B are connected in series to the ac mains as shows in the given figure :



The bulb glows with some brightness. How would the glow of the bulb change if an iron rod were inserted in the coil? Give reasons in support of your answer. 2

15. Experimental observations have shown that X-rays
(i) travel in vaccum with a speed of 3×10^8 ms^{-1},
(ii) exhibit the phenomenon of diffraction and can the polarized.
What conclusion can be drawn about the nature of X-rays from each of these observations? 2

16. Write the relation between the angle of incidence (i), the angle of emergence (e), the angle of prism (A) and the angle of deviation (δ) for rays undergoing refraction through a prism. What is the relation between $\angle i$ and $\angle e$ for rays undergoing minimum deviation? Using this relation, write the expression for the refractive index (μ) of the material of a prism in terms of $\angle A$ and the angle of minimum deviation (δm) 2

17. A radioactive material is reduced to $\frac{1}{16}$ of its original amount in 4 days. How much material should one begin with so that 4×10^{-3} kg of the material is left after 6 days. 2

18. Distinguish between 'point to point' and 'broadcast' communication modes. Give one example of each. 2

19. In a double slit interference experiment, the two coherent beams have slightly different intensities I and $I + \delta I$ $(\delta I << I)$. Show that the resultant intensity at the maxima is nearly 4I while that at the minima is nearly $\frac{(\delta I)^2}{4I}$. 3

20. An electric dipole of dipole moment $\vec{p}$ is placed in a uniform electric field $\vec{E}$. Write the expression for the torque $\vec{\tau}$ experienced by the dipole. Identify two pairs of perpendicular vectors in the expression. Show diagramatically the orientation of the dipole in the field for which the torque is (i) Maximum (ii) Half the maximum value (iii) Zero.

OR

Two capacitors with capacity C_1 and C_2 are charged to potential V_1 and V_2 respectively and then connected in parallel. Calculate the common potential across the combination, the charge on each capacitor, the electrostatic energy stored in the system and the change in the electrostatic energy from its initial value. 3

21. Using a suitable combination from a NOR, an OR and a NOT gate, draw circuits to obtain the truth table given below: 3

A	B	Y
0	0	0
0	1	0
1	0	1
1	1	0

(i)

A	B	Y
0	0	1
0	1	1
1	0	0
1	1	1

(ii)

22. Which two main considerations are kept in mind while designing the 'objective' of an astronomical telescope? Obtain an expression for the angular magnifying power and the length of the tube of an astronomical telescope in its 'normal adjustment' position. 3

23. Calculate the de-Broglie wavelength of (i) an electron (in the hydrogen atom) moving with a speed of $1/100$ of the speed of light in vacuum and (ii) a ball of radius 5mm and mass 3×10^{-2} kg. moving with a speed of $100 ms^{-1}$. Hence show that the wave nature of matter is important at the atomic level but is not really relevant at the macroscopic level. 3

24. Show that during the charging of a parallel plate capacitor, the rate of change of charge on each plate equals ϵ_0 times the rate of change of electric flux (ϕ_E) linked with it. What is the name given to the term $\varepsilon_0 \frac{d\phi_E}{dt}$? 3

25. The spectrum of a star in the visible and the ultraviolet region was observed and the wavelength of some of the lines that could be identified were found to be :

$$824\ \mathring{A}, 970\ A^\circ, 1120\ A^\circ, 2504\ A^\circ, 5173\ A^\circ, 6100\ A^\circ\cdot$$

Which of these lines cannot belong to hydrogen atom spectrum? (Given Rydberg constant R = 1.03 X $10^7 m^{-1}$ and $\frac{1}{R} = 970\,\mathring{A}$. Support your answer with suitable calculations. 3

26. What is space wave propagation? Which two communication methods make use of this mode of propagation? If the sum of the heights of transmitting and receiving antennae in line of sight of communication is fixed at h, show that the range is maximum when the two antennae have a height $\frac{h}{2}$ each.

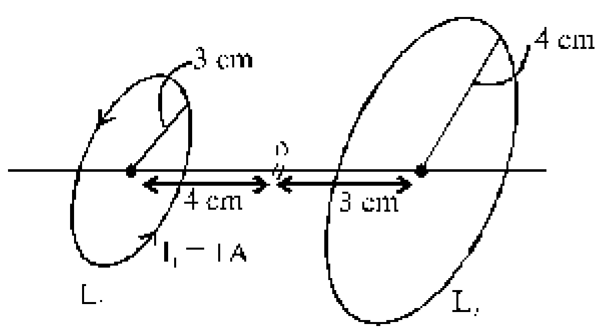
27. Draw the transfer characteristics of a base biased transistor in its common emitter configuration. Explain briefly the meaning of the term 'active region' in these characteristics. For what practical use, do we use the transistor in this 'active region'?

28. A cell of unkonown emf E and internal resistance r, two unknown resistances R_1 and R_2 (R_2>R_1) and a perfect ammeter are given. The current in the circuit is measured in five different situations : (i) Without any external resistance in the curcuit, (ii) With resistance R_1 only, (iii) With resistance R_2 only, (iv) With both R_1 and R_2 used in series combination and (v) With R_1 and R_2 used in parallel combination. The current obtained in the five cases are 0.42A, 0.6A, 1.05A, 1.4A, and 4.2A, but not necessarily in that order. Identify the currents in the five cases listed above and calculate E, r, R_1 and R_2.

OR

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? Two cells of EMF 1V, 2V and internal resistances 2 Ω and 1 Ω 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

29. (i) Describe an expression for the magnetic field at a point on the axis of a current carrying circular loop.
(ii) Two coaxial circular loops L_1 and L_2 of radii 3cm and 4cm are placed as shown. What should be the magnitude and direction of the current in the loop L_2 so that the net magnetic field at the point O be zero?

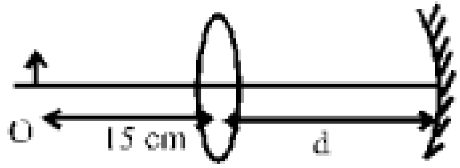


OR

(i) What is the relationship between the current and the magnetic moment of a current carrying circular loop? Use the expression to derive the relation between the magnetic moment of an electron moving in a circle and its related angular momentum?
(ii) A muon is a particle that has the same charge as an electron but is 200 times heavier than it. If we had an atom in which the muon revolves around a proton instead of an electron, what would be the magnetic moment of the

muon in the ground state of such an atom?

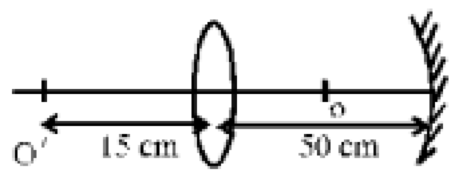
30. (i) Derive the mirror formula which gives the relation between f, v and u. What is the corresponding formula for a thin lens?
(ii) Calculate the distance d, so that a real image of an object at O, 15cm in front of a convex lens of focal length 10cm be formed at the same point O. The radius of curvature of the mirror is 20cm. Will the image be inverted or eract?



OR

(i) Using the relation for refraction at a single spherical refracting surface, derive the lens maker's formula.

(ii) In the accompanying diagram, the direct image formed by the lens (f = 10cm) of an object placed of O and that formed after reflection from the spherical mirror are formed at the same point O'. What is the radius of curvature of the mirror?



MARKING SCHEME
SAMPLE PAPER - II
PHYSICS

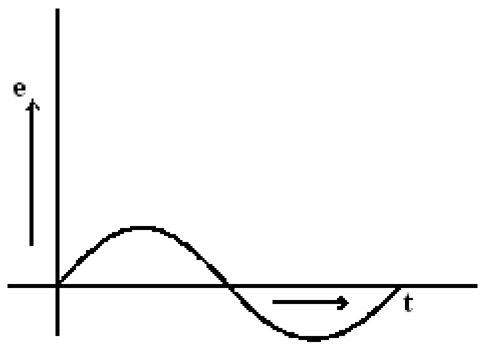
Q.No **Value Points** **Marks**

1. 180^0 or antiparallel — 1

2. Nearly Zero or Zero — 1

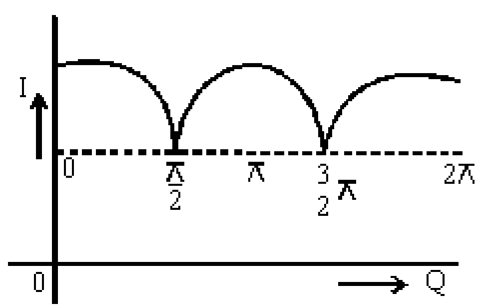
3. Sinusoidal Variation — 1

OR



4. (i) Maximum - γ -rays
(ii) Minimum - Radiowaves — ½

5.

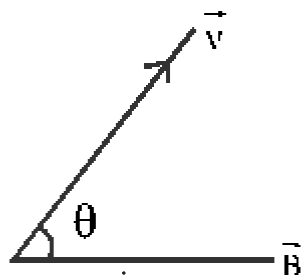


1

6. (1, 3)
(2, 4) — ½

7. The daughter element
(release of energy is accompanied by an increase of B.E) — 2

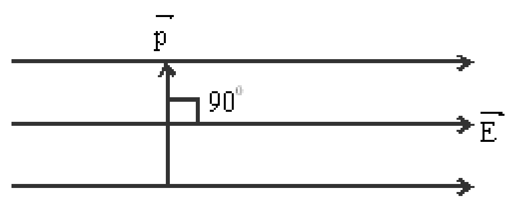
8. (i) 'Depletion layer' width decreases. — ½
(ii) Junction field becomes very high — ½

Q.No	Value Points	Marks
9.	(i) Potential is same (=zero) in both cases	½
	(ii) Electric field is different in the two cases.	½
	(iii) Correct explanation	½ + ½
10.	For higher values of current, we observe that the current value for a given voltage is less than given by Ohm's law. This means that R has increased for higher values of current.	1
	The increase of R is because of the increase in temperature of the resistor at higher values of the current.	1
11.	$\vec{E} \perp \vec{v}$	½
	$\vec{E} \perp \vec{B}$	½
	$\vec{v}$ is not parallel or antiparallel to $\vec{B}$	½
		
	∴	
	$1\vec{E}1 = vB \sin\theta$	½
12.	$L_1 = \mu_0 n_1^2 \frac{2}{\sqrt{1}} A_1 \ell$, $L_2 = \mu_0 n_2^2 A_2 \ell$	½
	$M = \mu_o n_1 n_2 \pi r_2^2 \ell$	½
	$\frac{M}{\sqrt{L_1 L_2}} = \sqrt{A_2 / A_1} = \frac{r_2}{r_1} < 1$	1
13.	(i) $E = -\frac{dV}{dr} = \frac{10V}{(10^{-2})m} = 1000 Vm^{-1}$	½
	$\therefore \lvert\vec{E}\rvert = 1000 Vm^{-1}$	
	Its direction is from higher potential to lower potential point, i.e. from Y to Z	½
	(ii) The surface of a charged metal plate is an equipotential. ∴ X and Y are at the same potential.	
	$\Delta V = V_Y - V_X = 0$	½

Q.No	Value Points	Marks
	Work done in moving a charge in an elecrtic field $= q\Delta V$	
	$\therefore$ Work done in moving $20\mu c$ from X to Y = $(20\times10^{-6})\times0=0$	½
14.	For same current value, the total impedance must remain same	½
	$\therefore$ $wL-\frac{1}{wC}$ must remain same. Thus L and C must both be halved simultaneously.	½ + 1
	OR	
	The glow of the bulb will decrease	½
	As the iron rod is inserted in the coil, its inductance increases. As inductance incresases, its reactance also increases resulting in an increase in the impedance of the circuit.	½+½
	As a result, the current in the circuit and hence the glow of the bulb will decrease.	.½
15.	(i) X-rays are e.m. waves	1
	(ii) X-rays are transverse in nature	1
16.	$\angle i+\angle e-\angle\delta=\angle A$	½
	For minimum deviation $\left.\begin{array}{l}\angle i=\angle e\\ \angle i=\frac{\angle A+\angle\delta m}{2}\end{array}\right]$	½
	For minimum deviation, we also have $\angle r=\angle r'=\frac{\angle A}{2}$	½
	$\therefore \quad \mu=\frac{\sin i}{\sin r}=\frac{\sin\left(\frac{A+\delta m}{2}\right)}{\sin\left(\frac{A}{2}\right)}$	½
17.	Reduction factor = $\frac{1}{16}=\frac{1}{2^4}$ in 4 days. Hence Half life = 1 day	1
	$\therefore$ For 6 days reduction factor would be $\frac{1}{2^6}=\frac{1}{64}$	½
	$\therefore$ Original amount = $4\times10^{-3}\times 64kg=\underline{\underline{0.256}}\,kg$	½

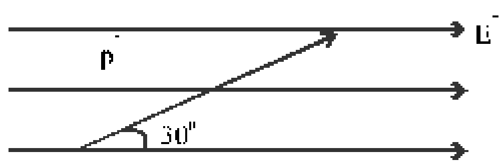
Q.No	Value Points	Marks
18.	Point to Point : Communication over a link between a single transmitter and receiver	½
	Example : Telephone	½
	Broad cast mode : Large number of receivers linked to a single transmitter	½
	Example : Radio	½
19.	The two amplitudes are $\sqrt{I}$ and $\sqrt{I+\delta I}$	1
	$\therefore$ Intensity at minima	
	$\left(\sqrt{I+\delta I}-\sqrt{I}\right)^2 = I+\delta I + I - 2\sqrt{I^2+\delta I.\ I}$	½
	$\cong (\delta I)^2 / 4I$	
	and intensity at maxima	
	$=\left(\sqrt{I+\delta I}+\sqrt{I}\right)^2 = I+\delta I+1+2\sqrt{I^2}+\delta I.I \approx 4I$	½
20.	$\vec{\tau} = \vec{p} \times \vec{E}$	½
	Two Pairs : $\vec{\tau}$ and $\vec{p}$, $\vec{\tau}$ and $\vec{E}$	½ + ½

(i)



½

(ii)



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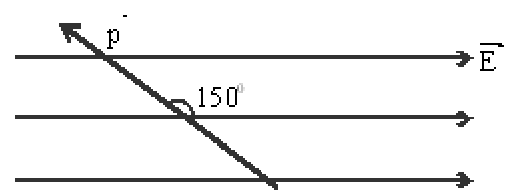
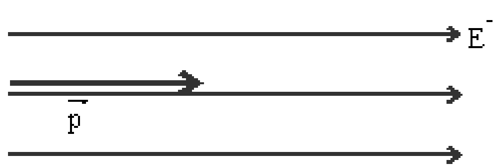


(iii)



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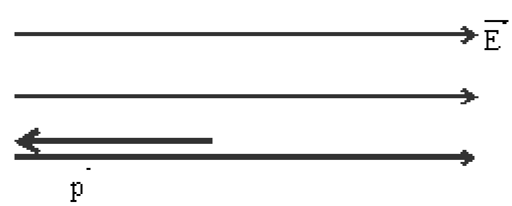


½ + ½

OR

$$V = \frac{Q}{C_1 + C_2} = \frac{C_1V_1 + C_2V_2}{C_1 + C_2}$$ **1**

Charges : $Q_1 = C_1V, Q_2 = C_2V$ ½

Energy stored $= \frac{1}{2}(C_1 + C_2)V^2 = \frac{1}{2}\frac{(C_1V_1 + C_2V_2)^2}{C_1 + C_2}$ ½

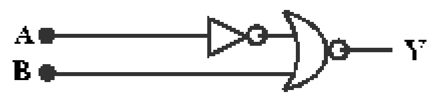
Q.No **Value Points** **Marks**

Change in energy stored $= \Delta U = \frac{1}{2}\left[\frac{(C_1V_1 + C_2V_2)^2}{C_1 + C_2} - (C_1V_1^2 + C_2V_2^2)\right]$

$= -\frac{1}{2}\frac{C_1 C_2}{C_1 + C_2}(V_1 - V_2)^2$ 1

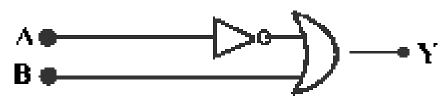
21. Output not symmetric for A, B = (0, 1) and
(1,0) NOT gate in one input. 1
(i) has three zeros NOR gate

Thus 1



(ii) has three one's $\Rightarrow$ OR gate

Thus 1



22. The two main considerations
(i) Large light gathering power ½
(ii) Higher resolution (resolving power) ½

[Both these requirements are met better when an objective of large focal length as well as large aperture is used]
Ray diagram for normal adjustment. ½
Derivation of the expression for angular magnifying power 1
Derivation of the expression for the length of the telescope tube ½

23. $\lambda = \frac{h}{p} = \frac{h}{mv}$

$\therefore \quad \lambda_e = \frac{6.6 \times 10^{-34}}{9 \times 10^{-31} \times 3 \times 10^6} = 2.44 \times 10^{-10}\, m$

$\lambda_{ball} = \frac{6.6 \times 10^{-34}}{3 \times 10^{-2} \times 100} = 2.2 \times 10^{-34}\, m$ ½

$\lambda_e \simeq$ size of atom, λ_{ball} <<size of ball 1

24. $q = CV = CEd$ ½

$= \frac{\epsilon_0 A}{d} Ed = \epsilon_0 AE$ ½

$= \epsilon_0 \phi_E \, (\because \phi_E = EA)$ ½

$\therefore \frac{dq}{dt} = \epsilon_0 \frac{d\phi_E}{dt}$ ½

Q.No	Value Points	Marks
	The term $\epsilon_0 \frac{d\phi_E}{df}$ is known as displacement current	½
	This term has been used to modify and generalize Ampere's Circuital law.	½
25.	$\bar{v} = \frac{1}{\lambda} = R\left(\frac{1}{n_2^2} - \frac{1}{n_1^2}\right)$	
	$\therefore \lambda = \frac{\frac{1}{R}}{(1/n_2^2 - 1/n_1^2)} = \frac{970A^o}{\left(\frac{1}{n_2^2} - \frac{1}{n_1^2}\right)}$	½
	Let us take $n_2 = 1$ (Lyman series of hydrogen spectrum)	
	Here can take values $\frac{970A^o}{(3/4)}, \frac{970A^o}{(8/9)}, \frac{970A^o}{(15/16)} - - - - -, \frac{970A^o}{1}$	
	(Corresponding to n_1 = 2, 3, 4, -------------- ∞)	½
	$\therefore$ Permitted values of λ are 1293.3A°, 1091A°, 1034.6 A°, ----------------------970A°	½
	Let us next take $n_2 = 2$ (Balmer series of hydrogen spectrum)	
	Here λ can take values $\frac{970A^o}{5/36}, \frac{970A^o}{3/16}, \frac{970A^o}{21/100}, - - - - - - \frac{970A^o}{1/4}$	½
	(Coresponding to n_1 = 3, 4, 5--------------- ∞)	½
	Possible values of λ are 6984A°, 5173. 3A°, 4619A°, -------3880A°	½
	Hence $\lambda = 824A^o, 1120A^o, 2504A^o, 6100A^o$, of the given lines, cannot belong to the hydrogen atom spectrum.	½
26.	Space wave : A space wave travels in a straight line from the transmitting antenna to the receiving antenna :	1
	Two ways : Line of sight communication and satellite communication]	½
	We have $\left[\begin{array}{l} D = \sqrt{2Rh_1} + \sqrt{2Rh_2} \\ \text{Let } h_1 = x \text{ so that } h_2 = (h - x) \end{array}\right]$	½
	$\therefore D = \sqrt{2Rx} + \sqrt{2R(h-x)}$	
	$\therefore \frac{dD}{dx} = \sqrt{\frac{R}{2x}} - \sqrt{\frac{R}{2(h-x)}} = 0 \Rightarrow x = h/2$	1
27.	Transfer characteristics	1
	Brief discussion of 'active region'	1½

Q.No	Value Points	Marks
	we operate the transistor in the active region for using it as an 'amplifier'	½
28.	Total resistance in the five cases are : $r, r+R_1; r+R_2; r+R_1+R_2; r+\frac{R_1 R_2}{R_1+R_2}$	1
	or $r, r+\frac{R_1 R_2}{R_1+R_2}, r+R_1, r+R_2, r+R_1+R_2$ in increasing order	½
	∴ The correct order of values of I are : 4.2A, 1.4A, 1.05 A, 0.6 A and 0.42 A	½
	Also	
	$\frac{E}{r}=4.2, \frac{E}{r+R_1}=1.05, \frac{E}{r+R_2}=0.6, \frac{E}{r+R_1+R_2}=0.42, \text{and } \frac{E}{r+\frac{R_1 R_2}{R_1+R_2}}=1.4$	1
	Solve first four to obtain, E = 4.2V, r = 1 Ω , R_1 = 3 Ω , R_2 = 6 Ω	4 x
	OR	
	(i) Derivation for parallel combination : $E=\frac{E_1 r_2+E_2 r_1}{(r_1+r_2)}$	2
	$\frac{1}{2} = 2$	
	$r=\frac{r_1 r_2}{r_1+r_2}$	½
	(ii) Series combination formula : $(E=E_1+E_2), (r=r_1+r_2)$	½
	(iii) Numerical	
	$\left[\frac{2+1}{1+2+R}=\frac{(1x1+2x2)/(1+2)}{\frac{1x2}{1+2}} \Rightarrow R=\frac{9}{4}\Omega; \text{More in series}\right]$	½
29.	(i) Derivation	3
	(ii) Numerical	2
	$\left[\text{We have : } B=\frac{\mu_o 1(3x10^{-2})}{\left[(3x10^{-2})^2+(4 \times 10^{-2})^2\right]^{\frac{3}{2}}}=\frac{\mu_o I_2(4x10^{-2})^2}{\left[(4x10^{-2})^2+(3x10^{-2})^2\right]^{3/2}}\right]$	

Thus $I_2 = -\frac{9}{6} A$ 1 ½

Current in opposite sense to that in L_1 ½

OR

(i) Relationship ½

(ii) Derivation 2 ½

$$\left[\vec{\mu} = -\frac{e}{2m_\mu} \vec{\ell} \Rightarrow \mu = \frac{e}{2m_\mu} \frac{h}{2\pi} = \frac{eh}{4m_\mu} \right.$$ 1

$$\left. = 4.63 \times 10^{-26} A.m^2 \right]$$ 1

30. (i) Derivation of formula $\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$ 2½

Then lens formula $\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$ ½

(ii) Numerical

$\frac{1}{v} - \frac{1}{u} = \frac{1}{f} \Rightarrow v = +30cm$ ½

Distance of this image from the mirror must be 20 cm ½

[∴ For image to from at O,

mirror must reverse the light ∴ d = (30 + 20) cm = 50 cm) ½

The final image is inverted. ½

OR

Statement of formula for single surface ½

(i) Derivation : 2 ½

(ii) Numerical 1

[$v = 15cm, f = 10cm \Rightarrow u = -30cm$

Distance of O from mirror : 20cm

But O must be at radius of curvature for rays to reverse $\Rightarrow R = 20cm$] 1