Class XII

Physics (042)

Sample Question Paper 2018-19

Time allowed: 3 hours. **Max. Marks: 70**

General Instructions:

1. All questions are compulsory. There are 27 questions in all.
2. This question paper has four sections: Section A, Section B, Section C and Section D.
3. Section A contains five questions of one mark each, Section B contains seven questions of two marks each, Section C contains twelve questions of three marks each, and Section D contains three questions of five marks each.
4. There is no overall choice. However, internal choices have been provided in two questions of one mark, two questions of two marks, four questions of three marks and three questions of five marks weightage. You have to attempt only one of the choices in such questions.
5. You may use the following values of physical constants wherever necessary.

$c = 3 \times 10^8$ m/s

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

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

$\mu_o = 4\pi \times 10^{-7}$ T m A^{-1}

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

$\frac{1}{4\pi\varepsilon_0} = 9 \times 10^9$ N $m^2 C^{-2}$

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

mass of neutron = 1.675×10^{-27} kg

mass of proton = 1.673×10^{-27} kg

Avogadro's number = 6.023×10^{23} per gram mole

Boltzmann constant = 1.38×10^{-23} JK^{-1}

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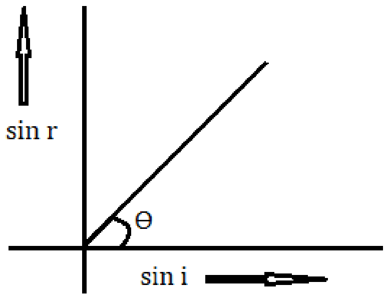
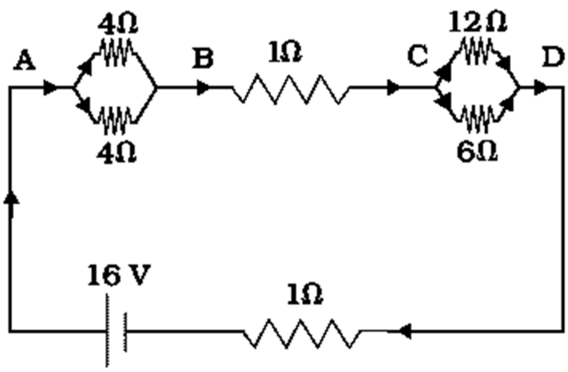
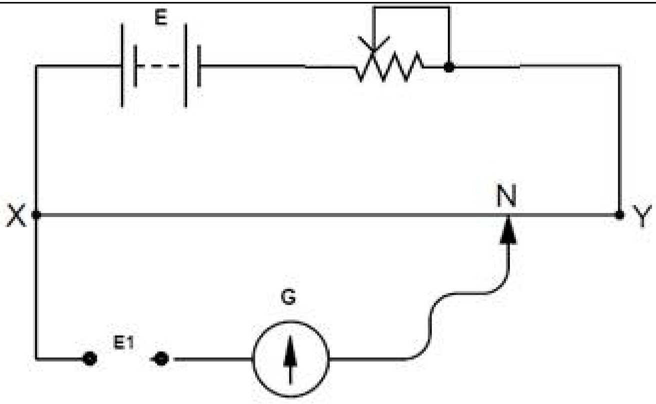
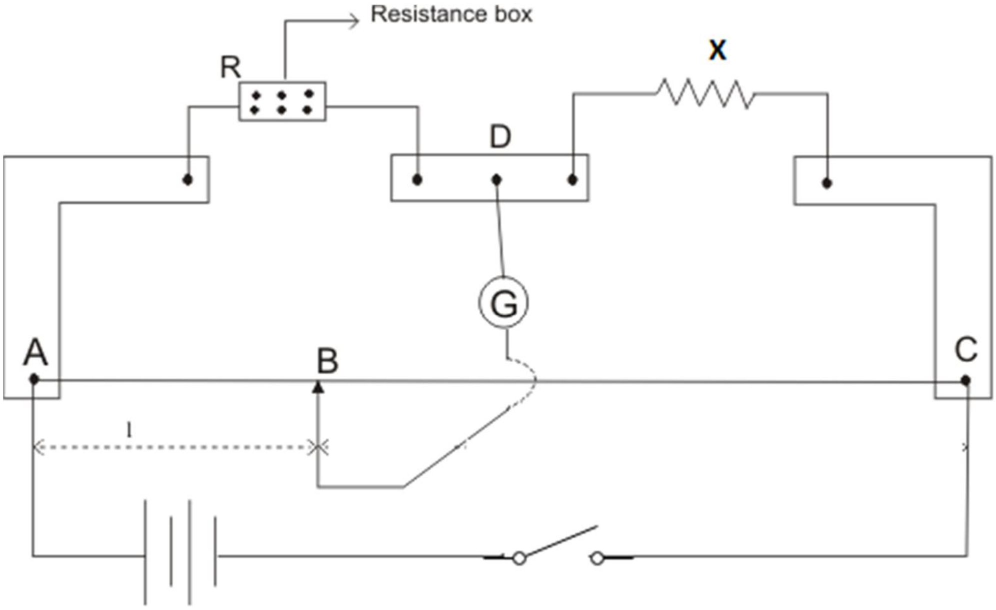
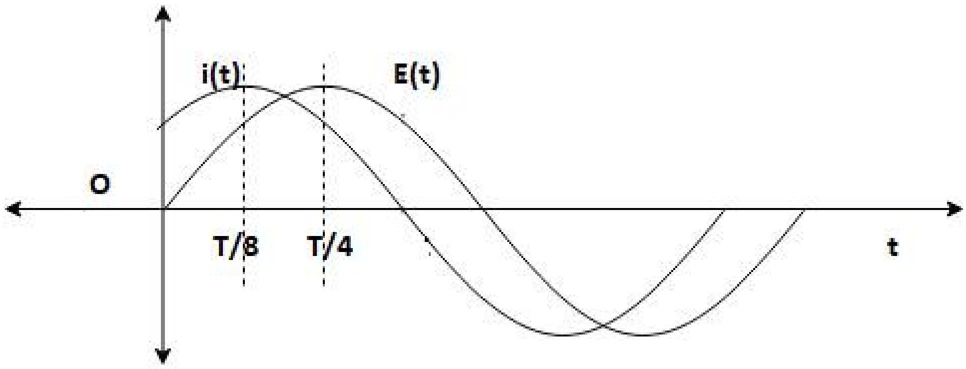
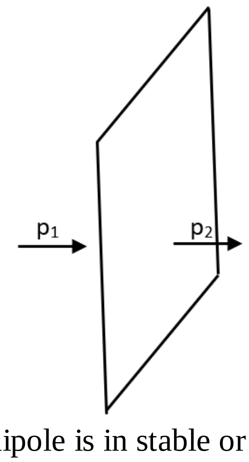
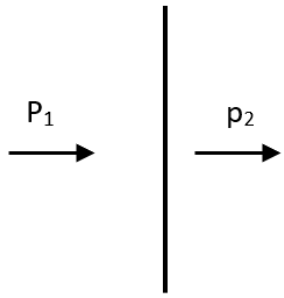
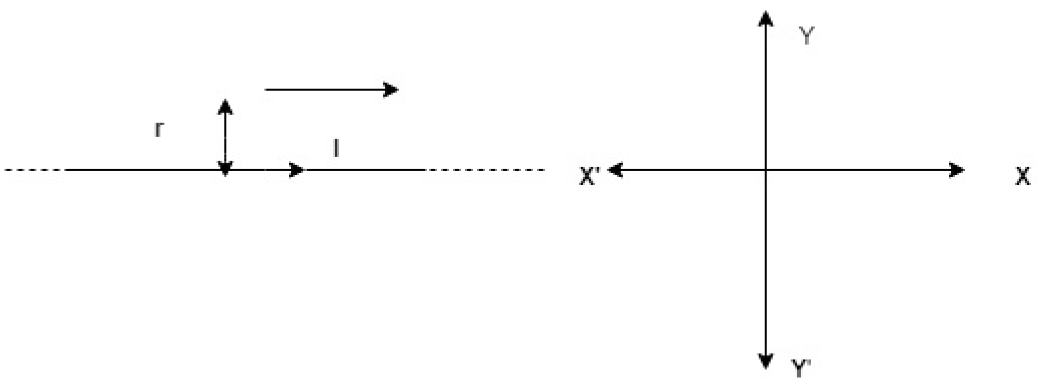
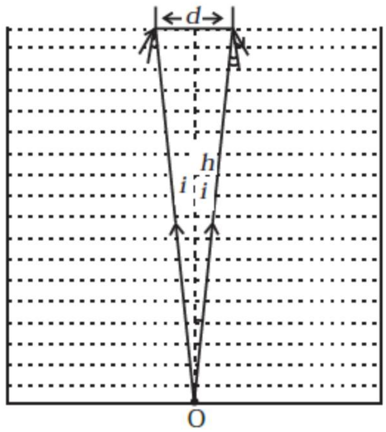
	Section-A	
1.	State the SI unit of the electric polarization vector **P**	**1**
2.	Define temperature coefficient of resistivity	**1**

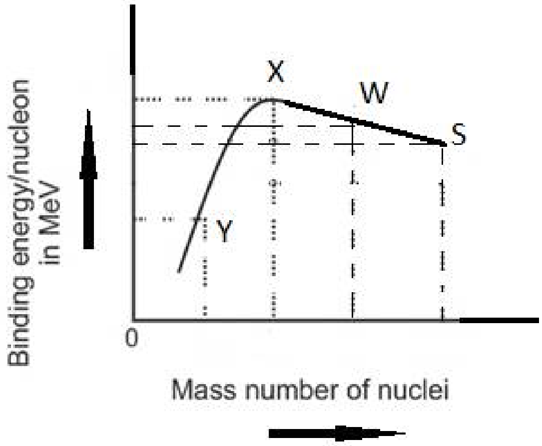
3.	Name the electromagnetic waves that are widely used as a diagnostic tool in medicine.	**1**
	OR	
	Name the current which can flow even in the absence of electric charge.	
4.	A ray of light is incident on a medium with angle of incidence ‘i’ and is refracted into a second medium with angle of refraction ‘r’. The graph of sin i versus sin r is as shown. Find the ratio of the velocity of light in the first medium to the velocity of light in the second medium.  	**1**
5.	Two particles have equal momenta. What is the ratio of their de-Broglie wavelengths?	**1**
	OR	
	Monochromatic light of frequency 6.0x 10^{14} Hz is produced by a laser. What is the energy of a photon in the light beam?	
	Section-B	
6.	A network of resistors is connected to a 16 V battery with internal resistance of 1 Ω., as shown in the following figure. Compute the equivalent resistance of the network.  	**2**
	OR	
	A 9 V battery is connected in series with a resistor .The terminal voltage is found to be 8 V. Current through the circuit is measured as 5 A. What is the internal resistance of the battery?	
7.	The diagram below shows a potentiometer set up. On touching the jockey near to the end X of the potentiometer wire, the galvanometer pointer deflects to left. On touching the jockey near to end Y of the potentiometer, the galvanometer pointer again deflects to left but now by a larger amount. Identify the fault in the circuit and explain, using appropriate equations or otherwise, how it leads to such a one-sided deflection.	**2**

		
	OR	
7	Following circuit was set up in a meter bridge experiment to determine the value X of an unknown resistance**.**  **(a)** Write the formula to be used for finding X from the observations. **(b)** If the resistance R is increased, what will happen to balancing length?	2
8.	The figure shows two sinusoidal curves representing oscillating supply voltage and current in an ac circuit.	2

	 Draw a phasor diagram to represent the current and supply voltage appropriately as phasors. State the phase difference between the two quantities.	
9.	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**
10.	A narrow slit is illuminated by a parallel beam of monochromatic light of wavelength λ equals to 6000 Å and the angular width of the central maxima 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**
11.	What are universal gates? How can AND gate be realized using an appropriate combination of NOR gates?	**2**
12.	A TV transmission tower antenna is at a height of 20 m. How much range can it cover if the receiving antenna is at a height of 25 m?	**2**
	Section-C	
13.	A particle, having a charge +5 μC, is initially at rest at the point x = 30 cm on the x axis. The particle begins to move due to the presence of a charge Q that is kept fixed at the origin. Find the kinetic energy of the particle at the instant it has moved 15 cm from its initial position if (a) Q =+15μC and (b) Q = -15μC	**3**
14.	(a) An electric dipole is kept first to the left and then to the right of a negatively charged infinite plane sheet having a uniform surface charge density. The arrows p_1 and p_2 show the directions of its electric dipole moment in the two cases.  Identify for each case, whether the dipole is in stable or unstable equilibrium. Justify each answer.	**3**

	(b) Next, the dipole is kept in a similar way (as shown), near an infinitely long straight wire having uniform negative linear charge density.  Will the dipole be in equilibrium at these two positions? Justify your answer**.**	
15.	Two material bars A and B of equal area of cross-section, are connected in series to a DC supply. A is made of usual resistance wire and B of an n-type semiconductor. (a) In which bar is drift speed of free electrons greater? (b) If the same constant current continues to flow for a long time, how will the voltage drop across A and B be affected? Justify each answer.	**3**
16.	Derive an expression for the velocity $\mathbf{v_C}$ of a positive ions passing undeflected through a region where crossed and uniform electric field E and magnetic field B are simultaneously present. Draw and justify the trajectory of identical positive ions whose velocity has a magnitude less than $\|\mathbf{v_C}\|$.	**3**
	OR	
	A particle of mass m and charge q is in motion at speed v parallel to a long straight conductor carrying current I as shown below.  Find magnitude and direction of electric field required so that the particle goes undeflected.	
17.	A sinusoidal voltage of peak value 10 V is applied to a series LCR circuit in which resistance, capacitance and inductance have values of 10 Ω, 1μF and 1H respectively. Find (i) the peak voltage across the inductor at resonance (ii) quality factor of the circuit.	**3**
18.	a) What is the principle of transformer?	**3**

	b) Explain how laminating the core of a transformer helps to reduce eddy current losses in it c) Why the primary and secondary coils of a transformer are preferably wound on the same core	
	OR	
	Show that in the free oscillations of an LC circuit, the sum of energies stored in the capacitor and the inductor is constant in time.	
19.	Draw a labelled ray diagram to show the image formation in a refracting type astronomical telescope in the normal adjustment position. Write two drawbacks of refracting type telescopes.	**3**
	OR	
	(a)Define resolving power of a telescope. Write the factors on which it depends. (b) A telescope resolves whereas a microscope magnifies. Justify the statement.	
20.	A jar of height h is filled with a transparent liquid of refractive index μ. At the centre of the jar on the bottom surface is a dot. Find the minimum diameter of a disc, such that when it is placed on the top surface symmetrically about the centre, the dot is invisible 	**3**
21.	(a) In photoelectric effect, do all the electrons that absorb a photon come out as photoelectrons irrespective of their location? Explain. (b) A source of light, of frequency greater than the threshold frequency, is placed at a distance 'd' from the cathode of a photocell. The stopping potential is found to be V. If the distance of the light source is reduced to d/n (where n>1), explain the changes that are likely to be observed in the (i) photoelectric current and (ii) stopping potential.	**3**
22.	A monochromatic radiation of wavelength 975 Å excites the hydrogen atom from its ground state to a higher state. How many different spectral lines are possible in the resulting spectrum? Which transition corresponds to the longest wavelength amongst them?	**3**
23.	Binding energy per nucleon versus mass number curve is as shown. ${}^{A}_{Z}S$, ${}^{A1}_{Z1}W$, ${}^{A2}_{Z2}X$ and ${}^{A3}_{Z3}Y$ are four nuclei indicated on the curve.	**3**



Based on the graph:

(a)Arrange X, W and S in the increasing order of stability.

(b) Write the relation between the relevant A and Z values for the following nuclear reaction.

$$S \longrightarrow X + W$$

(c)Explain why binding energy for heavy nuclei is low.

OR

How are protons, which are positively charged, held together inside a nucleus? Explain the variation of potential energy of a pair of nucleons as a function of their separation. State the significance of negative potential energy in this region?

24. A sinusoidal carrier wave of amplitude A_c and angular frequency ω_c is modulated in accordance with a sinusoidal information signal of amplitude A_m and angular frequency ω_m. Show that the amplitude modulated signal contains three frequencies centered around ω_c. Draw the frequency spectrum of the resulting modulated signal. **3**

Section-D

25. (a)Write the expression for the equivalent magnetic moment of a planer current loop of area A, having N turns and carrying a current i. Use the expression to find the magnetic dipole moment of a revolving electron. **5**

(b) A circular loop of radius r, having N turns and carrying current I, is kept in the XY plane. It is then subjected to a uniform magnetic field $\mathbf{B} = B_x\,\mathbf{i} + B_y\,\mathbf{j} + B_z\,\mathbf{k}$. Obtain expression for the magnetic potential energy of the coil-magnetic field system.

OR

(a) A long solenoid with air core has n turns per unit length and carries a current I. Using Ampere's circuital law, derive an expression for the magnetic field B at an interior point on its axis. Write an expression for magnetic intensity **H** in the interior of the solenoid.

(b) A (small) bar of material, having magnetic susceptibility χ, is now put along the axis and near the centre, of the solenoid which is carrying a d.c. current through its coils. After some time, the bar is taken out and suspended freely with an unspun thread. Will the bar orient itself in magnetic meridian if (i) $\chi < 0$ (ii) $\chi > 1000$?

Justify your answer in each case.

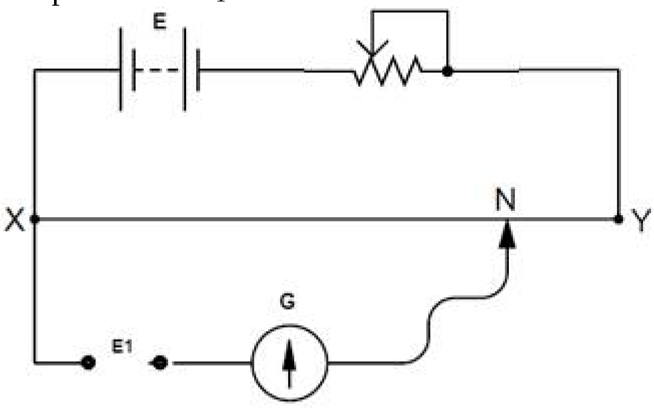
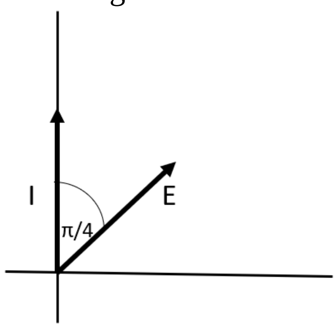
26. (a)There are two sets of apparatus of Young's double slit experiment. In set A, the phase difference between the two waves emanating from the slits does not change with time, **5**

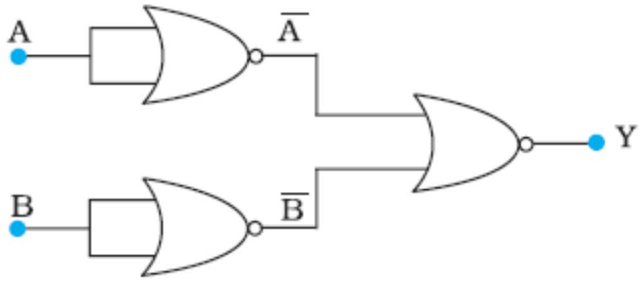
	whereas in set B, the phase difference between the two waves from the slits changes rapidly with time. What difference will be observed in the pattern obtained on the screen in the two set ups? (b) Deduce the expression for the resultant intensity in both the above mentioned set ups (A and B), assuming that the waves emanating from the two slits have the same amplitude A and same wavelength λ.	
	OR	
	(a) The two polaroids, in a given set up, are kept 'crossed' with respect to each other. A third polaroid, now put in between these two polaroids, can be rotated. Find an expression for the dependence of the intensity of light I, transmitted by the system, on the angle between the pass axis of first and the third polaroid. Draw a graph showing the dependence of I on Θ. (b) When an unpolarized light is incident on a plane glass surface, find the expression for the angle of incidence so that the reflected and refracted light rays are perpendicular to each other. What is the state of polarisation, of reflected and refracted light, under this condition?	
27.	(a) Draw the circuit diagram to determine the characteristics of a pnp transistor in common emitter configuration. Explain, using I-V characteristics, how the collector current changes with the base current. How can (i) output resistance and (ii) current amplification factor be determined from the I-V characteristics?	**5**
	OR	
	(a) Why are photodiodes preferably operated under reverse bias when the current in the forward bias is known to be more than that in reverse bias? The two optoelectronic devices: - Photodiode and solar cell, have the same working principle but differ in terms of their process of operation. Explain the difference between the two devices in terms of (i) biasing, (ii) junction area and (iii) I-V characteristics.	

Class: XII
Physics (042)
Marking Scheme 2018-19

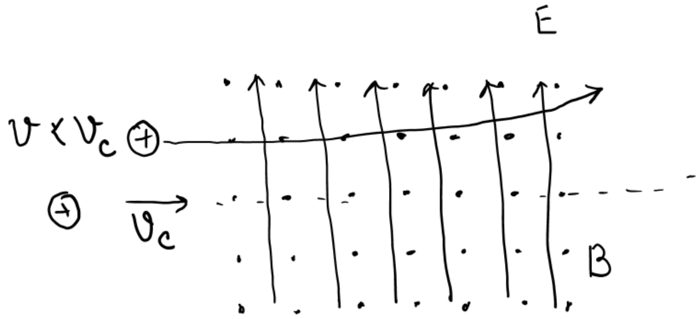
Time allowed: 3 hours | Maximum Marks: 70

Q No	SECTION A	Marks
1.	C/m^2	**1**
2.	Fractional change in resistivity per unit change in temperature.	**1**
3.	X-rays	**1**
	OR	
	Displacement current	**1**
4.	From the graph $\tan\Theta = \frac{\sin r}{\sin i}$ $\frac{\sin i}{\sin r} = \frac{v_1}{v_2}$ $\frac{v_1}{v_2} = \cot\theta$	**1/2** **1/2**
5.	$P_1 = P_2$ Ratio $\lambda 1/\lambda 2 = 1:1$	**1/2** **1/2**
	OR	
	Each photon has an energy, $E = h.\nu$ $= (6.63 \times 10^{-34}$ J s$)(6.0 \times 10^{14}$ Hz$)$ $= 3.98 \times 10^{-19}$ J	**1/2** **1/2**
	SECTION B	
6.	Equivalent Resistance = R1.R2/ (R1+R2) +R3+ R4.R5/(R4+R5) = [(4 × 4)/(4 + 4)] +1+ [(12 × 6)/(12 + 6)] Ω = 7 Ω. **OR** $r = \frac{\varepsilon - V}{I}$ $= \frac{9\,V - 8\,V}{5\,A}$ = 0.2 Ω	**1** **1/2** **1/2** **1** **1/2** **1/2**

7.	The positive of E_1 is not connected to terminal X.  In loop PGJX, $E_1 - V_G + E_{XN} = 0$ $V_G = E_1 + E_{XN}$ $V_G = E_1 + k\,\ell$ So, V_G (or deflection) will be maximum when ℓ is maximum i.e. when jockey is touched near end Y. Also, V_G (or deflection) will be minimum when ℓ is minimum i.e. when jockey is touched near end X.	**1/2** **1/2** **1/2** **1/2**
	OR	
(a)	$X = (100 - \ell)\,R/\ell$	**1**
(b)	Balancing length will increase on increase of resistance R.	**1**
8.	Phasor diagram  Equal length of phasors current leads voltage phase difference is $\pi/4$	**1/2** **1/2** **1**
9.	(i) Radiation re-radiated by earth has greater wavelength (ii)Tanning effect is significant for direct UV radiation; it is negligible for radiation coming through the glass.	**1** **1**
10.	Angular width $2\Theta = 2\lambda/d$ Given $\lambda = 6000$ Å In Case of new λ (assumed λ' here), angular width decreases by 30% $= \left(\frac{100-30}{100}\right) 2\,\Theta$ $= 0.70\,(2\,\Theta)$	**1/2** **1/2** **1/2**

	$2\lambda'/d = 0.70 \times (2\lambda/d)$ $\therefore \lambda' = 4200$ Å	**1/2**
11.	Universal gates (like the NAND and the NOR gates) are gates that can be appropriately combined to realize all the three basic gates. 	**1** **1**
12.	Range $d = \sqrt{2hR} + \sqrt{2h_R R}$ $d = 33.9$ km	**1** **1**
	SECTION: C	
13.	From energy conservation, $U_i + K_i = U_f + K_f$ $kQq/r_i + 0 = kQq/r_f + K_f$ $K_f = kQq\,(1/r_i - 1/r_f)$	 **1/2** **1/2**
	When Q is +15 μC, q will move 15 cm away from it. Hence r_f = 45 cm $K_f = 9\times 10^9 \times 15 \times 10^{-6} \times 5 \times 10^{-6}\,[\,1/(30 \times 10^{-2}) - 1/(45 \times 10^{-2})]$ $= 0.75$ J	 **1/2** **1/2**
	When Q is -15 μC, q will move 15 cm towards it. Hence r_f = 15 cm $K_f = 9\times 10^9 \times (-15 \times 10^{-6}) \times 5 \times 10^{-6}\,[\,1/(30 \times 10^{-2}) - 1/(15 \times 10^{-2})]$ $= 2.25$ J	 **1/2** **1/2**
14.	**(a)** p_1: stable equilibrium p_2: unstable equilibrium The electric field, on either side, is directed towards the negatively charged sheet and its magnitude is independent of the distance of the field point from the sheet. For position p_1, dipole moment and electric field are parallel. For position p_2, they are antiparallel.	**1/2** **1/2+1/2**
	(b) The dipole will not be in equilibrium in any of the two positions. The electric field due to an infinite straight charged wire is non- uniform ($E \propto 1/r$). Hence there will be a net non-zero force on the dipole in each case.	**1/2** **1/2** **1/2**
15.	**(a)** Drift speed in B (n-type semiconductor) is higher Reason: $I = neAv_d$ is same for both n is much lower in semiconductors.	**1/2** **1/2**
	(b) Voltage drop across A will increase as the resistance of A increases with increase in temperature. Voltage drop across B will decrease as resistance of B will decrease with increase in temperature.	**1/2+1/2** **1/2+1/2**
16.	$\mathbf{E} = E\,\mathbf{j}$ and $\mathbf{B} = B\,\mathbf{k}$ Force on positive ion due to electric field $\mathbf{F_E} = qE\mathbf{j}$ Force due to magnetic field $\mathbf{F_B} = q\,(\mathbf{v_c} \times \mathbf{B})$	 **1/2** **1/2**
	For passing undeflected, $\mathbf{F_E} = -\,\mathbf{F_B}$ $qE\mathbf{j} = -\,q\,(\mathbf{v_c} \times B\mathbf{k})$ This is possible only if $q\mathbf{v_c} \times B\mathbf{k} = qv_cB\mathbf{j}$ or $\mathbf{v_c} = (E/B)\mathbf{i}$	 **1/2**

The trajectory would be as shown. **1/2**



Justification: For positive ions with speed v <v_c

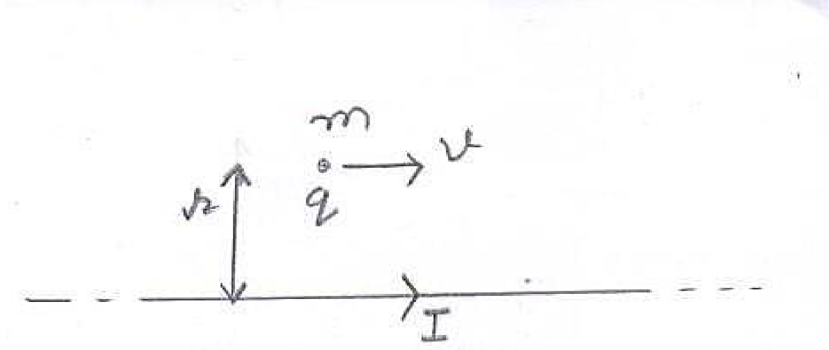
Force due to electric field = $F'_E = qE = F_E$

due to magnetic field $F'_B = qvB < F_B$ since $v < v_c$ **1/2**

Now forces are unbalanced, and hence, ion will experience an acceleration along **E**. **1/2**

Since initial velocity is perpendicular to E, the trajectory would be parabolic.

OR



1/2

For the charged particle to more undeflected

Net force $\overline{F} = \overline{F_E} + \overline{F_m} = 0$

$\grave{F}_E = - F_m$ (1)

$\overline{F_E}$ → electric force, $\overline{F_m}$ →magnetic force **1/2**

$|\overline{F_E}| = 1 - |\overline{F_m}|$ (2)

qE = Bqv sin90° = Bqv **1/2**

E = VB (3)

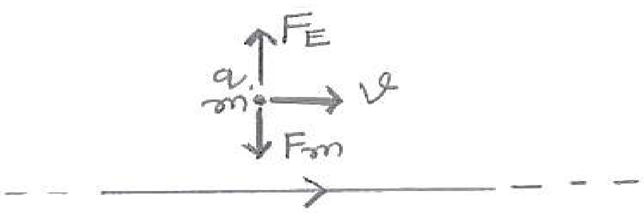
$B = \frac{MoI}{2\pi r}$ (4) **1**

Using (4) and (3)

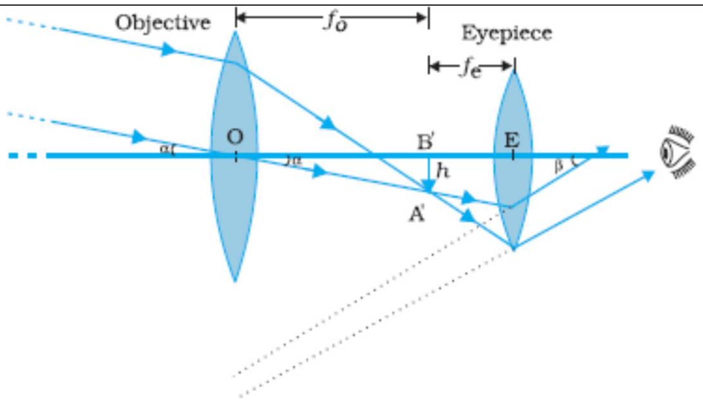
$E = \frac{VMoI}{2\pi r}$ (5) **1/2**

Magnetic force F_m is towards wire.

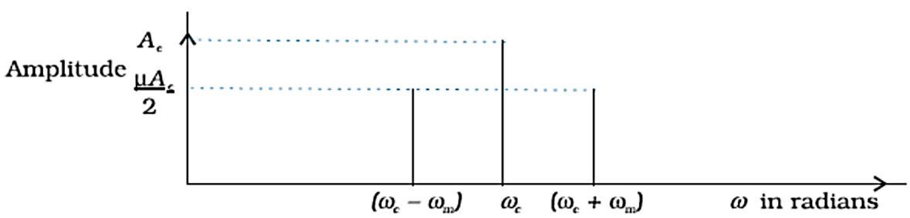
∴ Electric force and electric field should be away from the line.

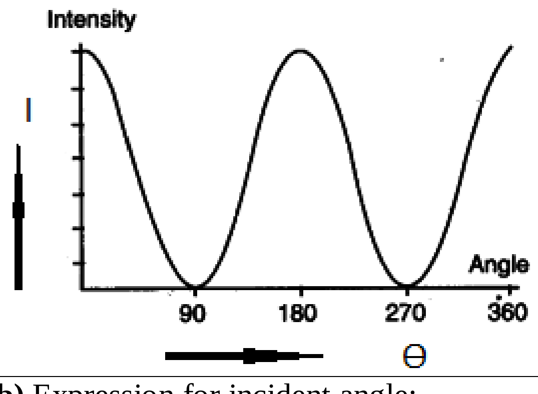


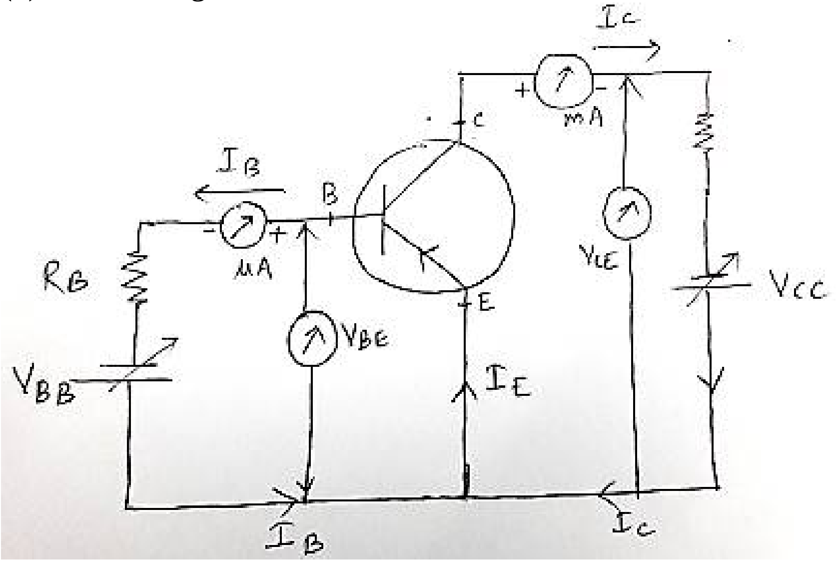
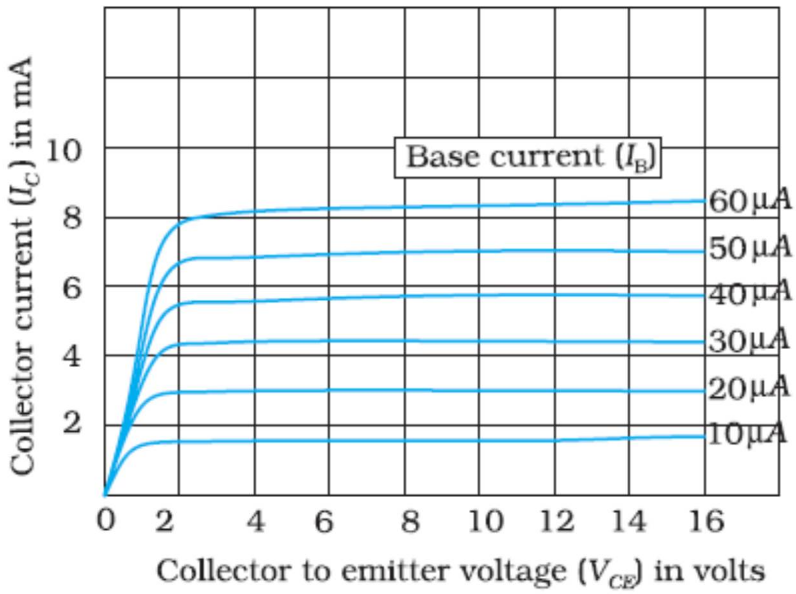
17.	$I_0 = V_0/R = 10/10 = 1$ A $\omega_r = 1/\sqrt{LC} = 1/\sqrt{(1 \times 1 \times 10^{-6})} = 10^3$ rad/s $V_0 = I_0 X_L = I_0 \omega_r L$ $= 1 \times 10^3 \times 1 = 10^3$ V $Q = \omega_r L/R$ $= (10^3 \times 1)/10 = 100$	**1/2** **1/2** **1/2** **1/2** **1/2** **1/2**
18.	**a)** Principle of transformer b) Laminations are thin, making the resistance higher. Eddy currents are confined within each thin lamination. This reduces the net eddy current. c) For maximum sharing of magnetic flux and magnetic flux per turn to be the same in both primary and secondary.	**1** **1** **1**
	OR	
	At an instant t, charge q on the capacitor and the current i are given by: $q(t) = q_0 \cos \omega t$ $i(t) = -q_0 \omega \sin \omega t$ Energy stored in the capacitor at time t is $U_E = \frac{1}{2} C V^2 = \frac{1}{2}\frac{q^2}{C} = \frac{q_0^2}{2C} \cos^2(\omega t)$ Energy stored in the inductor at time t is $U_M = \frac{1}{2} L i^2$ $= \frac{1}{2} L q_0^2 \omega^2 \sin^2(\omega t)$ $= \frac{q_0^2}{2C} \sin^2(\omega t) \quad (\because \omega = 1/\sqrt{LC})$ Sum of energies $U_E + U_M = \frac{q_0^2}{2C}(\cos^2 \omega t + \sin^2 \omega t)$ $= \frac{q_0^2}{2C}$ This sum is constant in time as q_0 and C, both are time-independent.	**1** **1** **1**
19.	Ray diagram: (2)	



	Drawbacks: (i)Large sized lenses are heavy and difficult to support (ii) large sized lenses suffer from chromatic and spherical aberration.	**1/2** **1/2**
	OR	**1**
	(a) Resolving power of a telescope is the reciprocal of the smallest angular separation between the two objects which can be just distinctly seen. Factors: diameter of the objective, wavelength of the incident light	**1/2+1/2**
	(b) a telescope produces image of far objects nearer to our eye. Objects which are not resolved at far distance, can be resolved by telescope. A microscope, on the other hand magnifies objects nearer to us and produces their large image.	**1**
20.	Let d be the diameter of the disc. The spot shall be invisible if the incident rays from the dot at O, at the center of the disc, are incident at the critical angle of incidence Let i be the critical angle of incidence. Then Sin i = $\frac{1}{\mu}$ Now, $\frac{d/2}{h} = \tan i$ $\Rightarrow \frac{d}{2} = h \tan i = h\left[\sqrt{\mu^2 - 1}\right]^{-1}$ $\therefore d = \frac{2h}{\sqrt{\mu^2-1}}$	**1** **1/2** **1/2** **1/2** **1/2**
21.	**(a)** No, it is not necessary that if the energy supplied to an electron is more than the work function, it will come out. The electron after receiving energy, may lose energy to the metal due to collisions with the atoms of the metal. Therefore, most electrons get scattered into the metal. Only a few electrons near the surface may come out of the surface of the metal for whom the incident energy is greater than the work function of the metal.	**1** **1**
	(b) on reducing the distance, intensity increases. Photoelectric current increases with the increase in intensity. Stopping potential is independent of intensity, and therefore remains unchanged.	**1/2** **1/2**
22.	Energy corresponding to the given wavelength: E (in eV) = $\frac{12400}{\lambda\ (\text{in Å})}$ = 12. 71 eV The excited state: $E_n - E_1 = 12.71$ $\frac{-13.6}{n^2} + 13.6 = 12.71$ $\therefore\ n = 3.9 \approx 4$ Total no. of spectral lines emitted: $\frac{n\,(n-1)}{2} = 6$ Longest wavelength will correspond to the transition	**1** **1/2** **1/2** **1/2**

	n = 4 to n = 3	**1/2**
23.	**(a)** S,W,X	**1**
	(b) Z = Z1 + Z2 A = A1 + A2	**1/2** **1/2**
	(c) Reason for low binding energy:- In heavier nuclei, the Coulombian repulsive effects can increase considerably and can match/ offset the attractive effects of the nuclear forces. This can result in such nuclei being unstable.	**1**
	OR	
	Nuclear force binds the protons inside the nucleus. For Graph and explanation, refer to NCERT page no 445 Significance of negative potential energy: Force is attractive in nature	**1/2** **2** **1/2**
24.	The modulated signal: $C_m(t) = (A_c + A_m \sin\omega_m t)\sin\omega_c t$ $= A_c\left(1 + \frac{A_m}{A_c}\sin\omega_m t\right)\sin\omega_c t$ $C_m(t) = A_c \sin\omega_c t + \mu A_c \sin\omega_m t \sin\omega_c t$ $C_m(t) = A_c \sin\omega_c t + \frac{\mu A_c}{2}\cos(\omega_c - \omega_m)\, t - \frac{\mu A_c}{2}\cos(\omega_c + \omega_m)\, t$ Frequency Spectrum :- 	**1/2** **1/2** **1/2** **1/2** **1**
	SECTION: D	
25.	**(a)** The equivalent magnetic moment is given by μ = NiA The direction of **μ** is perpendicular to the plane of current carrying loop. It is directed along the direction of advance of a right-handed screw rotated along the direction of flow of current derivation of expression for **μ** of electron revolving around a nucleus	**1/2** **1/2** **2**
	(b) for the loop, **μ** = N (πr^2) i (±**k**) Magnetic potential energy = **μ.B** = N (πr^2) i (±**k**).(B_x **i** + B_y **j** + B_z **k**) = $\pm\pi r^2$ N I B_z	**1/2** **1/2** **1/2** **1/2**
	OR	
	(a) Derivation H = nI The direction of **H** is along the axis of the solenoid, directed along the direction of advance of a right-handed screw rotated along the direction of flow of current	**2.5** **1/2**
	(b) (i) Not necessarily. Reason: material is diamagnetic. After removal of magnetising field, no magnetisation will remain in the material and hence earth's magnetic field	**1/2** **1/2**

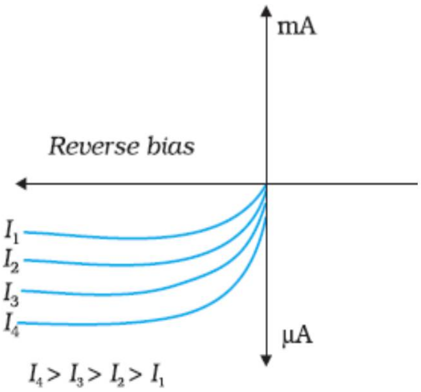
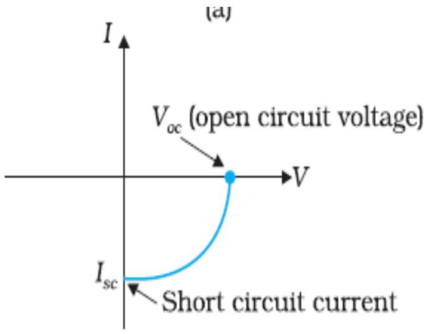
	will not affect it. (ii) Yes Reason: The material is ferromagnetic. It will remain magnetised even after removal from the solenoid and hence align with magnetic meridian.	 **1/2** **1/2**
26.	**(a)** Set A: stable interference pattern, the positions of maxima and minima does not change with time. Set B : positions of maxima and minima will change rapidly with time and an average uniform intensity distribution will be observed on the screen.	**1** **1**
	(b) Expression for intensity of stable interference pattern in set –A If the displacement produced by slit S1 is $y_1 = a\cos\omega t$ then, the displacement produced by S_2 would be $y_2 = a\cos(\omega t + \phi)$ and the resultant displacement will be given by $y = y_1 + y_2$ $= a[\cos\omega t + \cos(\omega t + \phi)]$ $= 2a\cos(\phi/2)\cos(\omega t + \phi/2)$ The amplitude of the resultant displacement is $2a\cos(\phi/2)$ and therefore the intensity at that point will be $I = 4I_0\cos^2(\phi/2)$ $\Phi = 0$ $\therefore I = 4 I0$ In set B, the intensity will be given by the average intensity $<I> = 4I_0 <\cos^2(\phi/2)>$ $I = 2I_0$	**2** **1**
	OR	
	(a) Refer to NCERT example 10.8 on page no. 378 	**2** **1**
	(b) Expression for incident angle: $\mu = \frac{\sin i_B}{\sin r} = \frac{\sin i_B}{\sin(\pi/2 - i_B)}$ $= \frac{\sin i_B}{\cos i_B} = \tan i_B$ Nature of polarisation: Reflected light: Linearly polarised	**1** **1/2**

<table>
<tr><td></td><td>Refracted light: Partially polarised</td><td>1/2</td></tr>
<tr><td>27.</td><td>(a) Circuit diagram

</td><td>2</td></tr>
<tr><td></td><td>(b) output characteristics is the variation of collector current with collector -emitter voltage for different fixed value of I_B.
If VBE is increased by a small amount, both the hole current and electron current in the base region increases. As a result, both I_B and I_C increases proportionately.


Output resistance is the ratio of change in collector-emitter voltage to the change in collector current.
Current amplification factor is ratio of change in collector current to the change in base current at constant collector- emitter voltage.</td><td>1

1/2

1/2</td></tr>
<tr><td></td><td>OR</td><td></td></tr>
<tr><td></td><td>(a) The fractional change in majority charge carriers is very less compared to the fractional change in minority charge carriers on illumination.</td><td>1</td></tr>
<tr><td></td><td>(b) The difference in the working of two devices:</td><td></td></tr>
</table>

	Photodiode	**Solar cell**
Biasing	Used in Reverse biasing (½)	No external biasing is given (½)
Junction Area	Small (½)	Large for solar radiation to be incident on it. (½)
I-V characteristics	 (1)	 (1)

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