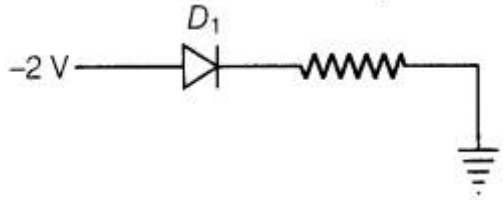
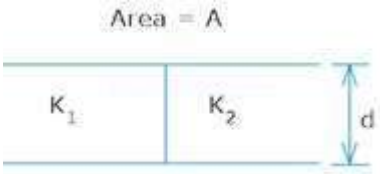
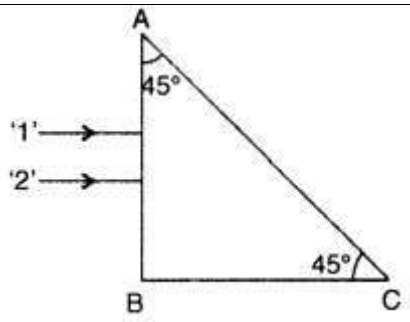
SAMPLE PAPER

CLASS-12 SU BJECT: PHYSICS

S.NO.	QUESTION	MARKS
1	What is the direction of Electric field on Axial line of electric Dipole.	1
2	What is the ratio of speed of Gamma rays and X-rays.	1
3	Magnetic field lines can be entirely confined within the core of a toroid, but not within a straight solenoid. Why?	1
4	A pair of adjacent coils has a mutual inductance of 1.5 H. If the current in one coil changes from 0 to 20 A in 0.5 s, what is the change of flux linkage with the other coil.	1
5.	What is the ratio of radii of the orbits corresponding to first excited state and ground state in a hydrogen atom?	1
6.	The maximum kinetic energy of a photoelectron is 3 eV. What is its stopping potential?	
7.	Two nuclei have mass number in the ratio 1 : 3. What is the ratio of their nuclear densities?	1
8.	State the reason, why GaAs is most commonly used in making of a solar cell.	1
9.	What happens to the width of depletion layer of a p-n junction when it is (i) forward biased, (ii) reverse biased?	1
10.	Show variation of resistivity of Si with temperature in a graph.	1
11.	In the questions (11-14), a statement of Assertion is given by the corresponding statement of Reason. Of the statements, mark the correct answer as (a) If both Assertion and Reason are true and Reason is the 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 Assertion is false, but Reason is true. Assertion: A current-carrying conductor experiences a force in a magnetic field. Reason: The force acting on a current-carrying conductor in a magnetic field is due to interaction between magnetic field produced by the current-carrying conductor and external magnetic field in which the conductor is placed.	1
12.	Assertion: Magnetic field lines do not intersect each other. Reason: There cannot be two direction of the magnetic field at a point.	1
13.	Assertion: No interference pattern is detected when two coherent sources are infinitely close to each other. Reason: Fringe width is inversely proportional to the distance between the two slits	1
14.	Assertion: Convex mirror is preferred for rearview mirror in vehicles. Reason: The field view of a convex mirror is lesser than that of concave mirror.	1
15.	Vivek was studying in his room. Suddenly he observed that the speed of his fan was going on decreasing from last two days. His father explained that there is a device in fan which maintain the speed.	4

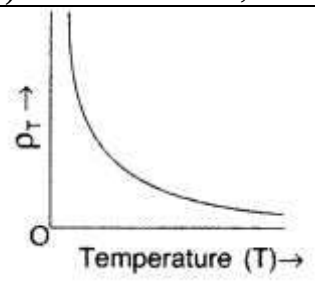
	His father also explained that how the device is connected in circuit. His father also told that AC circuit becomes inductive when this device is connected in circuit. A phase difference arises due to which leads to generate rotating magnetic fields and hence produce torque to rotor for rotating. Question No.1: Name the device used. Question No.2: Explain the principle of device. Question No.3: How capacitor is connected in circuit? Question No.4: What is the function of capacitor in ceiling fan? Question No.5: why capacitor start motors are not available in large size?	
16.	As we all know that Sun is the major source of light. Vihaan was walking on road after rain. He sees a pattern of colours in the sky consisting of different colors. He met his friend and talked about it. His friend, Also, tells him that the sky appears orange or red during sunset. For clarification they ask their physics Teacher next day. Then teacher answers. (1) Name the pattern of seven colours in sky (2) Why sky appears red during sunset? (3) What is dispersion of light. (4) Which color bends least? (5) What is ray leigh criteria?	4
17.	A magnetic needle free to rotate in a vertical plane parallel to the magnetic meridian has its North tip down at 60° with the horizontal. The horizontal component of the earth's magnetic field at the place is known to be 0.4 G. Determine the magnitude of the earth's magnetic field at the place.	2
18.	In a single-slit diffraction experiment, the width of the slit is made double the original width. How does this affect the size and intensity of the central diffraction band.	2
19.	A capacitor is connected to a battery. If we move its plates further apart, work will be done against the electrostatic attraction between the plates. What will be the effect on the energy of the capacitor?	2
20	Why cannot we take one slab of p-type semiconductor and physically join it to another slab of n-type semiconductor to get p-n junction? 	2
21	Using the concept of force between two infinitely long parallel current carrying conductors, define one ampere of current.	2
22	When a tiny circular obstacle is placed in the path of light from a distance source, a bright spot is seen at the centre of the shadow of the obstacle. Explain, why.	2
23	Why gallium arsenide solar cells are preferred over silicon solar cells?	2
24	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

25	Draw a ray diagram of a reflecting type telescope. State two advantages of this telescope over a refracting telescope.	2
26	How does the mutual inductance of a pair of coils change when (i) distance between the coils is decreased and (ii) number of turns in the coils is decreased?	3
27	(A)A cell of emf E and internal resistance r draws a current Write the relation between terminal voltage V in terms of E, I and r. (B)The emf of a cell is always greater than its terminal voltage. Why? Give reason.	3
28	A proton and a deuteron are accelerated through the same accelerating potential. Which one of the two has (a) greater value of de-Broglie wavelength associated with it, and (b) less momentum ? Give reasons to justify your Answer.	3
29	A 12.5 eV electron beam is used to bombard gaseous hydrogen at room temperature. Up to which energy level the hydrogen atoms would be excited ? Calculate the wavelength of the first member of Lyman and first member of Balmer series.	3
30	Answer the following questions, which help you understand the difference between Thomson's model and Rutherford's model better. (a) Is the average angle of deflection of α-particles by a thin gold foil predicted by Thomson's model much less, about the same, or much greater than that predicted by Rutherford's model? (b) Is the probability of backward scattering (i.e., scattering of α-particles at angles greater than 90°) predicted by Thomson's model much less, about the same, or much greater than that predicted by Rutherford's model? (c) Keeping other factors fixed, it is found experimentally that for small thickness t, number of α-particles scattered at moderate angles is proportional to t. What clue does this linear dependence on t provide?	3
31	Two charges ±10μC, ±10μC are placed 5.00 mm apart. Determine the electric field at (a) A point P on this axis of the dipole 15 cm away from its center O on the side of the positive charge (b) A point Q , 15 cm away from O on a line passing through O and normal to the axis of the dipole. OR Two dielectric slabs of dielectric constant $K_1 and\ K_2$ are filled in between the two plates, each of area A, of the parallel plate capacitor as shown in the figure. Find the net capacitance of the capacitor? Area of each plate = $\frac{A}{2}$ 	5
32	Two monochromatic rays of light are incident normally on the face AB of an isosceles right angled prism ABC. The refractive indices of the glass prism for the two rays ‘1’ and ‘2’ are respectively 1.35 and 1.45. Trace the path of these rays entering through the prism.	5

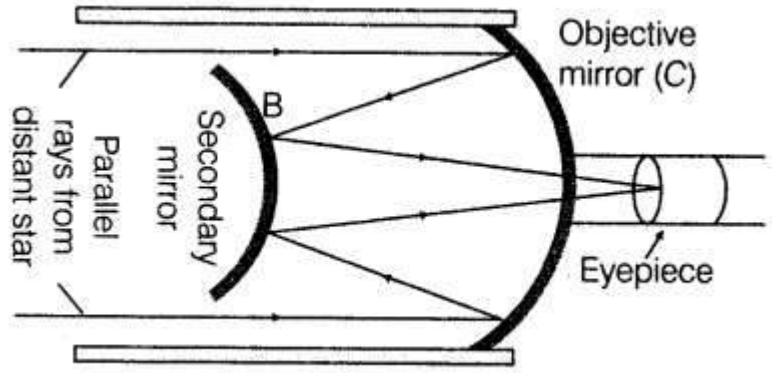
	 (iii) Derive expression for refractive index of Prism when a light ray is refracted through it. OR (i)State Huygens' Principle (ii)Use Huygens' principle to show how a plane wavefront propagates from a denser to rarer medium. Hence, verify Snell's law of refraction.	
33	In a step up transformer, transformation ratio is 100. The primary voltage is 200 V and input is 1000 watt. The number of turns in primary is 100. Calculate (1) Number of turns in the secondary (2) Current in the primary (3) The voltage across the secondary (4) Current in the secondary (5) Write the formula for transformation ratio? OR Explain Principle, Construction and working of AC generator. Write two advantages of AC over DC.	5

ANSWER KEY

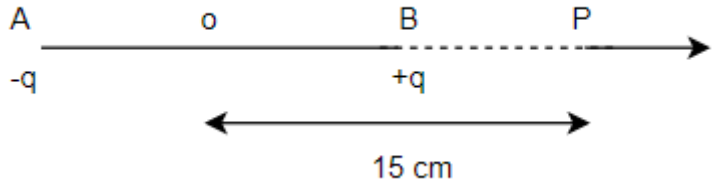
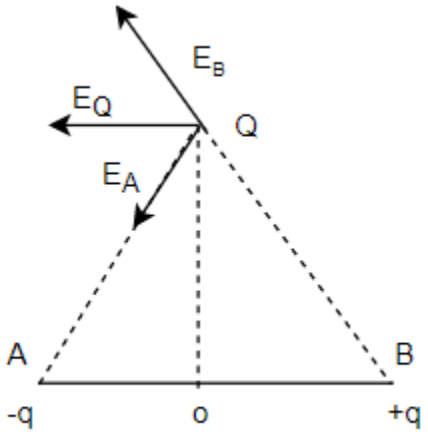
S.NO.	ANSWERS	MARKS
1.	In the direction of Electric Dipole i.e. Negative charge to Positive charge	1
2.	One	1
3.	At the edges of the solenoid, the field lines get diverged due to other fields and/or non-availability of dipole loops, while in toroids the dipoles (in loops) orient continuously.	
4.	Flux= MI Change in flux= MdI M= 1.5 H $I_2 = 20A$; $I_1 = 0A$ dI= 20-0= 20A Change in flux = 1.5*20 = 30Wb	1
5.	$R \alpha n^2$ For Ground state n=1 and for 1st Excited state n=2 Therefore, $R_{Excited}: R_{ground} = 2^2: 1^2$	1
6.	3V	1

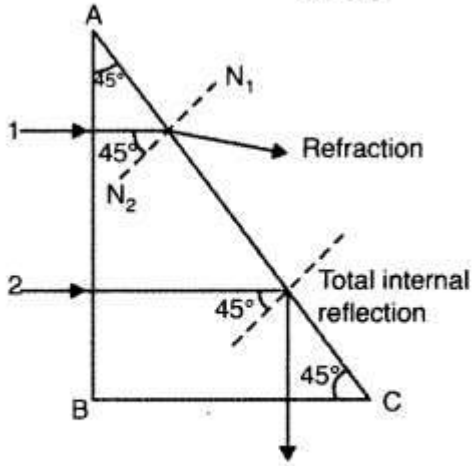
7.	Since nuclear density is independent of the mass number, the ratio of nuclear densities will be 1:1.	1
8.	GaAs is most commonly used in making of a solar cell because : (i) It has high optical absorption (~ 104 cm^{-1}) . (ii) It has high electrical conductivity.	1
9.	(i) In forward biased, the width of depletion layer of a p-n junction decreases. (ii) In reverse biased, the width of depletion layer of a p-n junction increases	1
10.		1
11.	(a) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.	1
12.	(A) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.	1
13.	(B) Both Assertion and Reason are true, but Reason is not the correct explanation of Assertion.	1
14.	(C) Assertion is true but Reason is false.	1
15.	Answer1: Capacitor Answer2: A capacitor works on the principle that the capacitance of a conductor increases appreciably when an earthed conductor is brought near it. Hence, a capacitor has two plates separated by a distance having equal and opposite charges. Answer3: Two phases are needed to produce the rotating magnetomotive force (MMF) but we have only one phase due to single phase AC supply in our homes. Therefore, we need an additional phase to start these kind of motors. We obtain the second phase by adding a capacitor in series with the starting wind of a ceiling fan motor. Answer4: We add a capacitor in series with the starting wind. Current lags 45° behind the current (or voltage leads by 45 degree from the current) in the running winding due to capacitance. The starting winding has high resistance and low inductive reactance and the resultant AC resistance equal to the capacitive reactance (X_C). This way, the resultant current flowing in the circuit is 90° out of phase. It means we got two different alternating phases which leads to generate a rotating magnetic fields and the produced torque start rotating the rotor. Answer5: Starting wind, small in size only helps to produce the phase shift (low torque) to start the motor, therefore capacitor start motors are not available in large sizes.	4
16.	(1) Rainbow	4

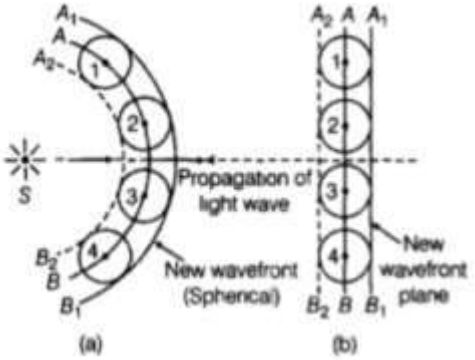
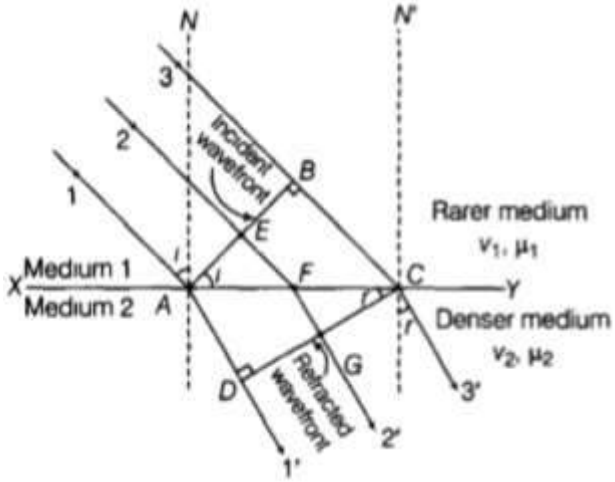
	(2) Because the sun is low on the horizon, sunlight passes through more air at sunset and sunrise than during the day, when the sun is higher in the sky. More atmosphere means more molecules to scatter the violet and blue light away from your eyes. This is why sunsets are often yellow, orange, and red. (3) Splitting of white light into seven colours (4) Red colour (5) *Rayleigh scattering* refers to the *scattering* of light off of the molecules of the air, and can be extended to *scattering* from particles up to about a fourth of the wavelength of the light	
17.	Angle of dip, $\delta = 60° = \frac{\pi}{3}$ Horizontal component of the earth's magnetic field, $H = 0.4$ G Earth magnetic field $(B_e) = ?$ $\because$ Horizontal component of the earth's magnetic field, $H = B_e \cos\delta$ **(1)** $\Rightarrow B_e = \frac{H}{\cos\delta} = \frac{0.4\text{ G}}{\cos 60°} = \frac{0.4\text{ G}}{\left(\frac{1}{2}\right)} = 0.8\text{ G}$ $\therefore \quad B_e = 0.8$ G **(1)**	2
18.	If the width of the diffraction slit is doubled, the size of the central diffraction band will become half and its intensity will become four times of its original value.	2
19	Since the battery remains connected, the potential difference V between the plates of the capacitor will remain constant. Now Since Capacitance depends on the distance between the plates, it will decrease with the movement. Now we know that Q=CV Now C is decreasing and V remains constant, the charge will decrease on the capacitor. Some charges from plates passing through the connecting wire will charge the battery. Thus some energy of the capacitor will be transferred to the battery. So energy of the capacitor will decrease. The work done done in moving apart the plates will be used up in this transference and dissipated in the form of heat in the connecting wires	2
20	In this way, continuous contact cannot be produced at atomic level and junction will behave as a discontinuity for the flowing charge carrier.	2
21	$F = \frac{\mu_0}{2\pi}\frac{I_1 I_2}{r}$ One ampere of current is the value of steady current, which when maintained in each of the two very long, straight, parallel conductors of negligible cross-section; and placed one metre apart in vacuum, would	2

	produce on each of these conductors a force of equal to 2×10^{-7} newtons per metre (Nm^{-1}) of length. ”	
22	Waves from the distant source are diffracted by the edge of the circular obstacle and these diffracted waves interfere constructively at the centre of the obstacle’s shadow producing a bright spot.	2
23	*Gallium arsenide solar cells are used because they can operate with visible energy whereas the silicon diodes works with infrared energies.*	2
24	(*i*) Shunt Resistance, $S = \frac{R_A i_g}{i - i_g} = \frac{0.6 \times 1}{4} = 0.15\ \Omega$ (*ii*) Total Resistance, $\frac{1}{R_{total}} = \frac{1}{0.6} + \frac{1}{0.15} = \frac{25}{3}$ $R_{total} = \frac{3}{25}\ \Omega = 0.12\ \Omega$	2
25	 Advantages (i) Reflecting telescopes have high resolving power due to a large aperture of mirrors. (ii) Due to availability of paraboloidal mirror, the image is free from chromatic and spherical aberration.	2
26	(i) increases. (ii) decreases, because M=m0n1n2Al where N_1 and N_2 are number of turns	3
27	(A)When a current Idraws from a cell of emf E and internal resistance r, then the terminal voltage is V = E – Ir. (B)The emf of a cell is greater than its terminal voltage because there is some potential drop across the cell due to its small internal resistance	3

28	a) de-Broglie wavelength, $\lambda \propto 1$ /mass (for same accelerating potential) Mass of a proton is less as compared to a deuteron. So, proton will have greater value of de-Broglie wavelength associated with it. (b) Momentum, p ∝ mass (for same accelerating potential) Mass of deuteron is more as compared to a proton. So, it will have a greater value of momentum.	3
29.	**Answer:** Energy of the electron in the n^{th} state of an atom $= \frac{-13.6}{n^2} \times Z^2 eV$ Here, Z is the atomic number of the atom. For hydrogen atom, Z is equal to 1. Energy required to excite an atom from the initial state (n_i) to the final state (n_f). $E_f = \frac{-13.6}{n_f^2} + \frac{13.6}{n_i^2} eV$ This energy must be equal to or less than the energy of the incident electron beam. $\Rightarrow \quad -\frac{-13.6}{n_f^2} + \frac{13.6}{n_i^2} = 12.5$ Energy of the electron in the ground state = 13.612 = −13.6 eV $\Rightarrow \quad \frac{-13.6}{n_f^2} + 13.6 = 12.5 \quad [\because n_i = 1]$ For the first member of the Lyman series : $n_f = 1$ and $n_i = 2$ $\frac{1}{\lambda} = 1.097 \times 10^7 \left(\frac{1}{1^2} - \frac{1}{2^2}\right)$ $\lambda = 1215$ (Å) For the first member of Balmer series : $n_f = 2$ and $n_i = 3$ $\frac{1}{\lambda} = 1.097 \times 10^7 \left(\frac{1}{2^2} - \frac{1}{3^2}\right)$ $\Rightarrow \quad \lambda = 6563$ Å	3
30	(a) about the same The average angle of deflection of α-particles by a thin gold foil predicted by Thomson's model is about the same size as predicted by Rutherford's model. This is because the average angle was taken in both models.	3

	(b) much less The probability of scattering of α-particles at angles greater than predicted by Thomson's model is much less than that predicted by Rutherford's model. (c) Scattering is mainly due to single collisions. The chances of a single collision increases linearly with the number of target atoms. Since the number of target atoms increase with an increase in thickness, the collision probability depends linearly on the thickness of the target.	
31	Here q=10μC=10−5q=10μC=10−5 C, 2a=5mm=5×10−32a=5mm=5×10−3m a. Field at a axial point P of the dipole is given by Ep=2p4πϵ0r3=2×q×2a4πϵ0r3Ep=2p4πϵ0r3=2×q×2a4πϵ0r3 Substituting the values,we get Ep=2.6×106Ep=2.6×106 N/C The direction of the electric field from -q to +q as shown below  b. Field at a equatorial point Q of the dipole is EQ=p4πϵ0r3=q×2a4πϵ0r3EQ=p4πϵ0r3=q×2a4πϵ0r3 Substituting the values,we get Ep=1.33×105Ep=1.33×105 N/C The direction of the electric field from +q to -q as shown below  OR Here the two capacitors are in parallel $\therefore$ Net capacitance $C = C_1 + C_2$	5

	$C_1 = \frac{K_1 \epsilon_o A/2}{d} = \frac{K_1 \epsilon_o A}{2d}$ $C_2 = \frac{K_1 \epsilon_o A/2}{2d} = \frac{K_2 \epsilon_o A}{2d}$ $\Rightarrow C = \frac{K_1 \epsilon_o A}{2d} + \frac{K_2 \epsilon_o A}{2d}$ $C = \frac{\epsilon_o A}{2d}(K_1 + K_2)$	
32	***(i) For the ray 1,*** $\mu_1 = \frac{1}{\sin C_1}$  $\sin C_1 = \frac{1}{\mu_1} = \frac{1}{1.35} = 0.74$ $\angle C_1 = 48°$ more than 45° Since the angle of incidence (45°) is less than the critical angle (48°), the ray will be refracted. (ii) For the ray 2, $\sin C_2 = \frac{1}{\sin \mu_2} = \frac{1}{1.45} = 0.68$ $\angle C_2 = 43°$ less than 45° Since the angle of incidence (45°) is more than the critical angle (43°), the ray will be total internally reflected. (iii) As per NCERT text Book OR (i)As per NCERT text Book. (ii) According to Huygens' principle, Every point on a wave-front may be considered a source of secondary spherical wavelets which spread out in the	5

	forward direction at the speed of light. The new wave-front is the tangential surface to all of these secondary wavelets. A surface touching these secondary wavelets, tangentially in the forward direction at any instant gives the new wavefront at that instant. This is called secondary wavefront.   Derivation as per NCERT	
33	(1) k = 100, Ep = 200V Ep Ip = 1000 W, Np = 100 K= Ns/Np Ns= 100*Np =100*100 Ns=10000 (2) Ep Ip = 1000W Ip= 1000/Ep Ip=1000/200 Ip= 5A (3) Es/Ep=Ns/Np Es= 20,000 V (4) Es/Ep= Ip/Is Is= 0.05A (5) For step up transformer K>1 OR As Per NCERT text book.	5