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BHOPAL REGION
PREBOARD EXAMINATION, 2025-26
Class-XII SUBJECT-PHYSICS (042) SET- 2

Time 3 Hrs. **M.M. 70**

ROLL NO.						

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. $m_p = 1.7 \times 10^{-27}$ kg

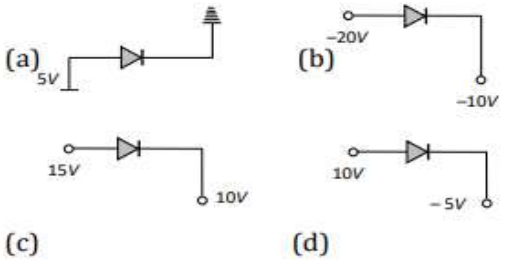
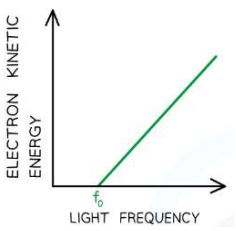
iv. $e = 1.6 \times 10^{-19}$ C

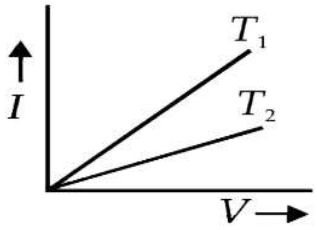
v. $\mu 0 = 4\pi \times 10^{-7}$ T m $\boldsymbol{A^{-1}}$

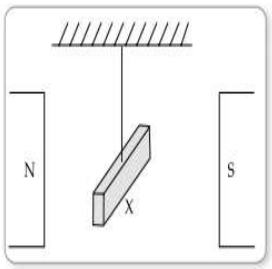
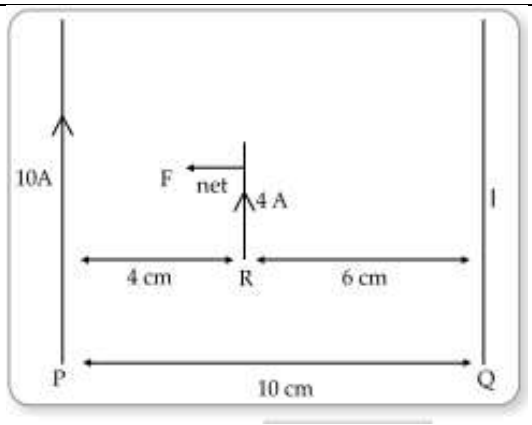
vi. $h = 6.63 \times 10^{-34}$ J s

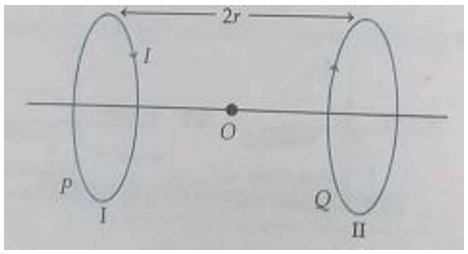
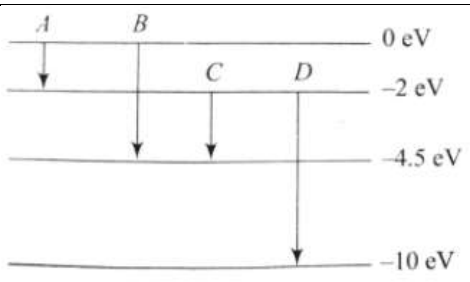
vii. $\varepsilon_0 = 8.854 \times 10^{-12} \boldsymbol{C^2 N^{-1} m^{-2}}$

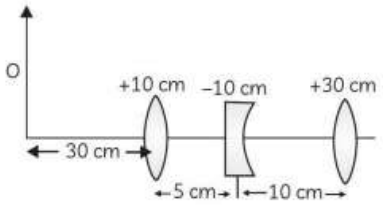
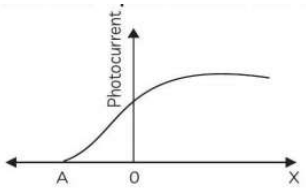
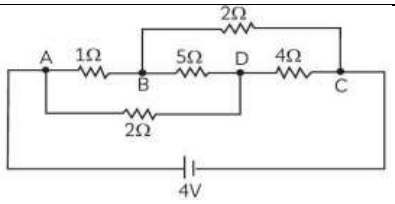
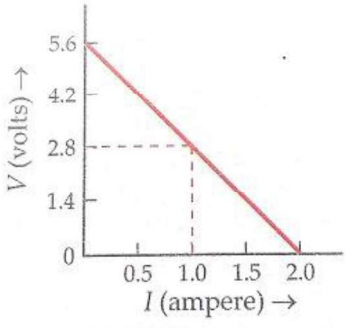
viii. Avogadro's number = 6.023 X $\boldsymbol{10^{23}}$ per gram mole

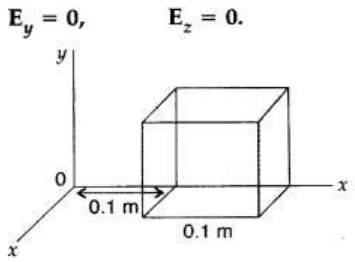
	SECTION A	
1.	When two point charges are placed at a certain distance r in air, they exerts a force F on each other. Find the distance at which these charges will experience the same force when kept in a medium of dielectric constant K. (a) $\frac{r}{K}$ (b) r (c) r x $\sqrt{K}$ (d) $\frac{r}{\sqrt{K}}$	1
2.	Which diagram below best illustrates a reverse biased diode? 	1
3.	The graph below shows the variation of the maximum kinetic energy of the emitted photoelectron with the frequency of the incident radiation for a given metal. Which of the following gives the work function of the metal? (a) x-intercept (b) y-intercept (c) the slope of the graph (d) the area under the graph 	1

4.	When an electron in an atom moves from the ground state to a higher energy level what happens to its kinetic and potential energies? Option / Kinetic energy / Potential energy a) Increases / Increases b) Increases / Decreases c) Decreases / Increases d) Decreases / Decreases	1
5.	The current-voltage (*I-V*) graph for a given metallic wire at two different temperatures *T*1 and *T*2 are shown in figure. It follows from the graph that: (a) *T*1>*T*2 (b) *T*1<*T*2 (c) *T*1 = *T*2 (d) *T*1 is greater or less than *T*2 depending on whether the resistance *R* of the wire is greateror less than the ratio *V*/*I*. 	1
6.	The property which is not of an electromagnetic wave travelling in free space – (a) They are transverse in nature (b) They originated from charge moving with uniform speed. (c) They travel with a speed equal to $\sqrt{\frac{1}{\mu_0 \epsilon_0}}$ (d) The energy density in electric field is equal to energy density in magnetic field.	1
7.	The impact parameter for an alpha particle approaching target nucleus is maximum when scattering angle(θ) is (a) 0° (b) 90° (c) 45° (d) 180°	1
8.	Two nuclei having mass no. in the ratio of 1:125, find the rartio of their nuclear density is (Given that $R_o = 1.2 \times 10^{-15}$ m) (a) 1:1 (b) 5:1 (c) 1:5 (d) 1: 125	1
9.	Nucleus X (having Z= 17 and equal number of protonand neutrons) has 1.2 Mev binding energy per nucleon. Another nucleus Y of Z= 12 has total 26 nucleons and 1.8 Mev binding energy per nucleon. The difference of binding energy between these two (a) 0.6 Mev (b) 1.6 Mev (c) 6 Mev (d) none	1
10.	Three students construct a solenoid of length 35 cm. They are each given insulated copper wire of the same length. The table below lists some details about the solenoids made by them. Magnetic field produced / Radius of solenoid / Core of solenoid Student - 1 / B_1 / 3 cm / air Student - 2 / B_2 / 3 cm / iron Student - 3 / B_3 / 6 cm / air Compare the magnetic field produced by the solenoids made by the three students. (a) B1 = B3 < B2 (b) B3 < B1 < B2 (c) B1 < B2 < B3 (d) B1 = B2 > B3	1

11.	A rod when suspended in a uniform magnetic field aligns itself perpendicular to the magnetic field as shown . Which of the following statements is/are true for the rod? (P) Every atom in the rod, has a zero magnetic moment. Q) The rod is attracted when taken near the poles of a strong magnet. R) The relative permeability of the material of the rod is slightly less than 1. S) The susceptibility of the material of the rod is directly proportional to temperature. (a) only Q (b) only P and R (c) only Q and S (d) only R and S 	1
12.	Two long and straight current-carrying wires, P and Q are placed parallel to each other separated by a distance of 10 cm. A wire 'R' of length 8 cm and carrying a current of 4 A is placed between the two wires P and Q as shown below. If the wire R, experiences a net force towards wire P, then which of the following is definitely TRUE about the current 'I' in wire Q? (a) Current I cannot be in the upward direction. (b) Current I can have any magnitude greater than 0 A in the upward direction. (c) Current I cannot have a magnitude of more than 15 A in the upward direction. (d) Current I cannot have a magnitude of more than 10 A in the upward direction. 	1
	For Question number 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. (e) If Assertion is false but Reason is true.	1
13.	**Assertion (A):** The work function of a given material increases with an increase in the frequency of the incident radiation. **Reason (R):** As per Einstein's photoelectric equation $h\nu = \varphi + KE$, work function φ is directly proportional to the frequency ν of the incident radiation*	1
14.	**Assertion (A):** The electric potential is constant everywhere inside a charged conductor and is equal to its value at the surface. **Reason (R):** A constant work has to be done to move a test charge from the interior of a charged conductor to its surface.	1
15.	**Assertion (A):** An n- type semiconductor has large number of electrons but still it is electrically neutral. **Reason (R):** n- type semiconductor is obtained by doping of intrinsic semiconductor with pentavalent impurity.	1

16.	**Assertion (A):** It is not possible to have interference between the waves produced by two violins. **Reason (R):**For interference of two waves the phase difference between the waves must remain constant .	1
	SECTION B	
17.	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 net magnetic field at O. 	2
18.	In an electromagnetic wave propagating along x-axis the magnetic field oscillates at a frequency of $3x10^{10}$ Hz and has an amplitude of 10^{-7} Tesla acting along the y direction. i)What is the wavelength of the wave? ii) write the expression representing the corresponding oscillating electric field.	2
19.	The resistance of PN junction is low when forward wise and is high when reverse biased Explain. OR Wiith the help of a suitable diagrams explain the working of half wave rectifier.	2
20.	Depict the shape of a wavefront in each of the following cases: (I) Light diverging from point source. (II) Light emerging out of a convex lense when a point source is placed at its focus.	2
21.	A conductor of length' l' is connected to a d.c. sourceof potential 'V'. If the length of conductor tripled, by stretching it, keeping V coanstant, explain how do the following factors varyin the conductor. (a) Drift speed of the electron (b) Resistivity	2
	SECTION C	
22.	The energy level diagram of an element is given below. Which of them will result in the transition of a photon of wavelength 275 nm? Which transition corresponds to emission of radiationof i) maximum wavelength and iii) minimum wavelength? (give reason also) 	3

23.	Three lenses of focal length +10 cm, −10 cm and +30 cm are arranged coaxially as in the figure given below. Find the position of the final image formed by the combination. 	3
24.	A closely wound solenoid of 2000 turns and area of cross-section 1.6×10^{-4} m^2, carrying a current of 4.0 A, is suspended through its center allowing it to turn in a horizontal plane. i) What is the magnetic moment associated with the solenoid? ii) What are the force and torque on the solenoid if a uniform horizontal magnetic field of $7{\cdot}5\times10^{-2}$ T is set up at an angle of 30∘ with the axis of the solenoid?	3
25.	Draw V I - characteristics of a p n - junction diode in forward bias and reverse bias. Answer the following questions, giving reasons: (i) Why is the current under reverse bias almost independent of the applied potential upto a critical voltage? (ii) Why does the reverse current show a sudden increase at the critical voltage?	3
26.	The following graph shows the variation of photo current for a photo sensitive metal .  Identify the variables 'X' and 'A' on the horizontal . Draw this graph for three different values of frequencies of incident radiation $v1$, $v2$ and $v3$ ($v3 > v2 > v1$) for the same intensity. Draw this graph for three different values of intensities of incident radiation $I1$,2 and $I3$($I3 > I2 > I1$) having the same frequency.	3
27.	Calculate the current drawn from the battery by the network of resistors shown in the figure.  OR Four cells of identical emf ε, internal resistance r, are connected in series to a variable register. The following graph shows the variation of terminal voltage of the combination with the current outpu.t i) What is the emf of each cell used? ii) For what current from the cells, dead maximum power dessipation occur in the circuit? iii) Calculate the internal resistance of each cell . 	3

28.	The electric field components due to a charge inside the cube of side 0.1 m are as shown : Ex = ax, where a = 500 N/Cm Calculate (i) the flux through the cube, and (ii) the charge inside the cube.  	3
	SECTION D	
29.	**Case study based Questions:- (Answer any four of the following questions)** **Interference in light waves** The principal of superposition is used to understand the phenomena of interference of light waves. The principal state that at a particular point, the resultant displacement produced by a number of waves is the vector sum of the displacements produced by each wave. Light waves from two coherent sources produce interference pattern. Thomas Young devised a way to obtain two coherent sources using two identical pinholes (S_1 and S_2) illuminated by a single monochromatic pinhole source S. Using the sources in his experiment known as Young's double slit experiment , Young studied the interference pattern. The pattern consists of alternate bright and dark fringes. The distance between two successive bright and dark fringes depend on the distance between S_1 and S_2, the distance of the screen from the plane of S_1 & S_2 and the wavelength of light used. i) Consider the following waves. a) $y_1 = a \sin wt$ b) $y_2 = a \sin 2wt$ c) $y_3 = a \sin(2wt + \phi)$ d) $y_4 = a \sin(4wt + \pi/2)$ Which pair of the waves coming from two sources S1 and S2 will produce interference? ii) Two light waves of same intensity I not each having a path difference of $\lambda/4$ emanating from two coherent sources meet at a point. What will we the intensity at that point? iii) Vandana performs young double slit experiment by using orange, green and red light successively. If the fringe widths measured in the three cases are $\omega_1, \omega_2, \omega_3$ respectively, then arrange them in increasing order. iv) In a young double slit experiment the slit separation is 0.8 mm and the interference pattern is obtained on the screen kept 50 cm from the plane of the slits S1 and S2. If the first bright fringe is formed 0.4 mm from the central Maxima. Find the wavelength of light used for the experiment. v) What is the effect on the angular separation of the fringes if the screen is moved away from the plane of the slits?	4
30.	**Case study based Questions:- (Answer any four of the following questions)** **Using galvanometer as an ammeter and a voltmeter** A galvenometer is a device used to detect current in an electric circuit. It cannot as such be used as an ammeter to measure current in a given circuit. This is because very sensitive device. It gives a full scale deflection for a current of the order of μA. Moreover for measuring current, the galvanometer has to be connected in series and it has a large resistance this will change the value of current in the circuit. To overcome these difficulties we connect a small resistance R_s called shunt resistance, in parallel with the galvanometer coil ,so that most of the current passes through the shunt. Now to use galvanometer as avoltmeter, it has to be connected in parallel with the circuit element across which we need to measure potential difference. Moreover it must draw a very small current, otherwise it will be appreciably change the voltage which we are measuring. To ensure this a large resistance r is connected in series with the galvanometer.	4

i) A sensitive galvenometer like a moving coil gallometer can be converted into an ammeter or a voltmeter by connecting a proper resistance to it. Which of the following statement is true.

(a) A voltmeter is connected in parallel and current through it is negligible.
(b) An ammeter connected in parallel and potential difference across it is small.
(c) A voltmeter is connected in series and potential difference across it is small.
(d) An ammeter is connected in series in a circuit and the current through it is negligible

ii) By mistake a voltmeter is connected in series and and ammeter is connected in parallel with the resistance in an electric circuit what will happen to the instrument.

(a) Voltmeter is damaged.
(b) Ammeter is damaged.
(c) Bboth are damaged.
(d) Nnone is damaged.

iii) A galvanometer coil has a resistance of 15Ω and gives full scale deflection for a current of 4mA. To convert it to anammeter of range 0 to 6 A:
(a) 10 mΩ resistance is to be connected in parallel to the galvanometer.
(b) 10 mΩ resistance is to be connected in series with the galvanometer .
(c) 0.1 mΩ resistance is to be connected in parallel to the galvanometer.
(d) 0.1 mΩ resistance is to be connected in series with the galvanometer.

iv) A galvanometer has a resistance of 'G'Ω and range of 'V' volt. The value of resistance used in series to converted into a voltmeter of range 5V is
(a) 5G b) 4G c) G/5 d) G/4

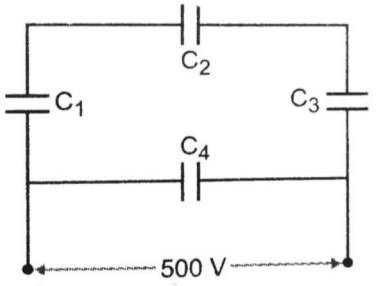
v) Two identical galvanometers are converted into an ammeter and a millimetre. Resistance of the shunt of milli-ammeter through which the current passes through will be -
a) more b) equal c) less d) zero

SECTION E

31. a) Find the potential energy of an electric dipole placed in a uniform electric field. 5
b) In which orientation a dipole placed in a uniform electric field is in i) stable ii) unstable equilibrium
c) An electric dipole with dipole moment 4 x10^{-9} Cm is aligned at 30°with direction of a uniform electric field of magnitude 5 x10^{4} N/C. Calculate the magnitude of torque acting on the dipole.

OR

a) A parallel plate capacitor of capacitors 'C' is charged to a potential 'V' by a battery. Without disconnecting the battery, the distance between the plates is tripled and a dielectric medium of 'K' is introduced between the plates of capacitor. Explain giving reason, how will the following be affected i) capacitance of capacitor
ii) Charge of capacitor
iii) Energy of capacitor
b) Network of 4 capacitors each of 12 μF capacitance is connected to 500V supply as shown in the figure determine
i) equivalent capacitance of the network
ii) charge on each capacitor



32.	(a) You are given two convex lenses of short aparature having focal length 4 cm and 10 cm respectively. Which one of these will you use as an objective and which one as an eyepiece for constructing a compound microscope. (b)Draw a ray diagram to show the formation of the image of a small object due to a compound microscope for maximum magnification. (c) If an object is placed at 6 cm from the objective lens. Calculate magnifying power of the it if final image is formed at the least distance of distinct vision. **OR** **(a)** A point object is placed on the principle axis of a convex spherical surface of radius of curvature R which separate the two media of refractive indices n_1 and n_2 ($n_2 > n_1$). Draw the ray diagram and deduce the relation between the object distance 'u', image distance 'v' and the radius of curvature 'R' for refraction to take place at convex spherical surface light going from rarer to denser medium. (b) A converging lens has a focal length of 20 cm in air. It is made of a material of refractive index 1.6, it is immersed in a liquid of refractive index 1.3. Find its new focal length.	5
33.	A) When a circuit element X is connected across an a.c. source, a current of $\sqrt{2}$A flows through it and this current is in phase with the applied voltage. When another element Y is connected across the same a.c. source, the same current flows in the circuit but it leads the voltage by $\frac{\pi}{2}$ radians. i) Name the circuit element X and Y. ii) Find the current that flows in the circuit when series combination of X and Y is connected across the same ac voltage. B) Using Phasor Diagram find expression for impedance of LCR series circuit. **OR** I**.** State the principle of working of a transformer . Can a transformer be used to step up our step down a DC voltage (give reason) 2.Specify the two characteristic properties of material suitable for making core of a transformer 3. Mention the two reasons for energy losses in an actual transformer 4. The power transmission lines need input power at 2300 volt to step down transformer with its primary winding having 4000 turns what should be the number of turns in the secondary bindings in order to get output power at 230 volt.	5