

**DIRECTORATE OF GOVERNMENT EXAMINATIONS, CHENNAI- 6**  
**HIGHER SECONDARY SECOND YEAR EXAMINATION - MAY - 2022**  
**PHYSICS KEY ANSWER**

**NOTE:**

1. Answers written with Blue or Black ink only to be evaluated.
2. Choose the most suitable answer in Part A from the given alternatives and write the option code and their corresponding answer.
3. For answers in Part – II , Part – III , Part – IV like reasoning , explanation, narration, description and listing of points, students may write in their own words but without changing the concepts and without skipping any point.
4. In numerical problems if formula is not written , marks should be given for the remaining correct steps.
5. In graphical representation, physical variables for X-axis and Y-axis should be marked.

**TOTAL MARKS : 70**

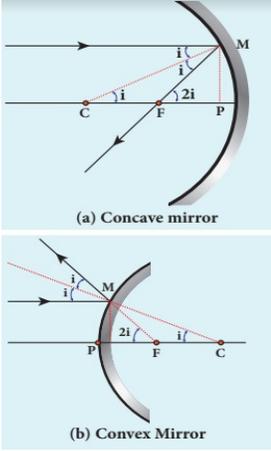
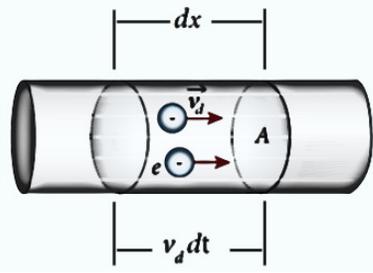
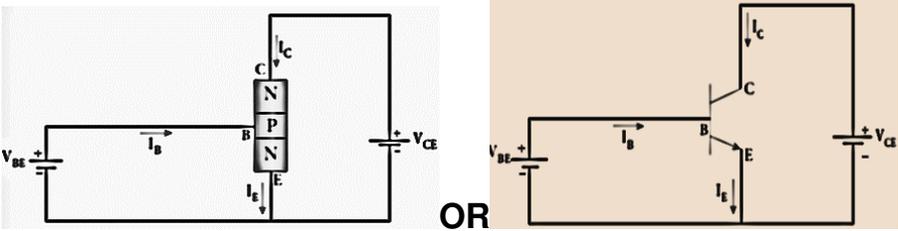
**PART - I**

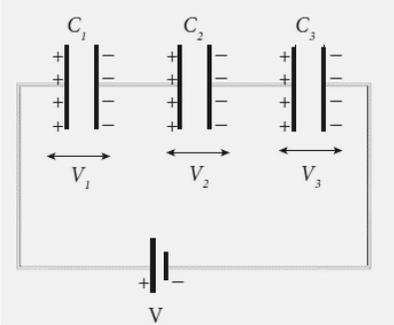
**Answer all the questions.**

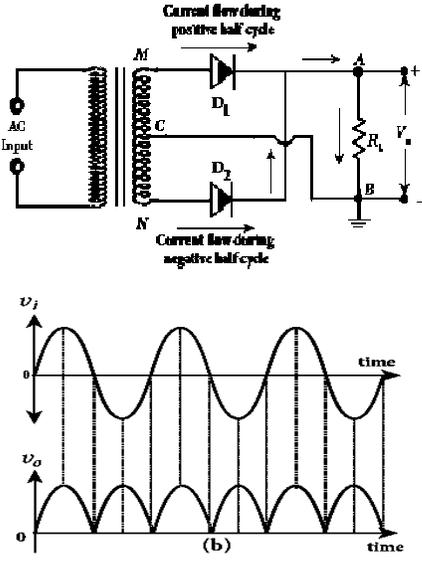
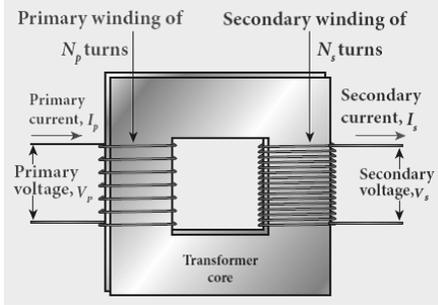
**15 X 1 = 15**

Q.NO	OPTION	TYPE – A	Q.NO	OPTION	TYPE B
1	b	Peacock feather	1	d	Frequency modulation
2	a	decrease by 4 times	2	a	Thermionic
3	d	Frequency modulation	3	a	decrease by 4 times
4	d	All the above	4	b	$\gamma$ - rays
5	b	$3 \times 10^{-2}$ C	5	a	12 cm
6	b	$\gamma$ - rays	6	b	$3 \times 10^{-2}$ C
7	a	12 cm	7	b	Peacock feather
8	a	$\frac{R}{4}$	8	b	$\sqrt{\frac{2}{3}}\beta Il$
9	b	$\sqrt{\frac{2}{3}}\beta Il$	9	d	All the above
10	a	Thermionic	10	d	0.83
11	d	337.5 C	11	d	$r_n \propto n$
12	d	Negative	12	c	Polarisation
13	d	0.83	13	d	Negative
14	d	$r_n \propto n$	14	a	$\frac{R}{4}$
15	c	Polarisation	15	d	337.5 C

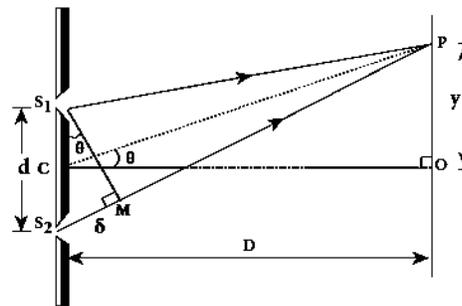
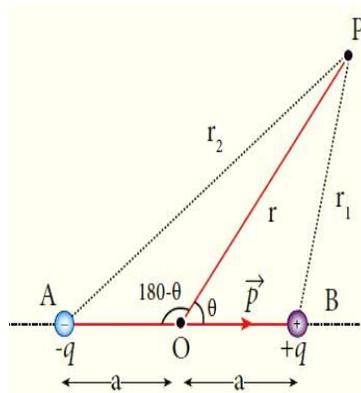
16	<p><b>Corona Discharge</b> : The total charge of the charged conductor near the sharp edge reduces</p> <p>(or)</p> <p>Leakage of charges from the sharp points of the charged conductor</p>		2
17	<p>The current sensitivity of a galvanometer can be increased by</p> <ol style="list-style-type: none"> <li>1. increasing the number of turns (N)</li> <li>2. increasing the magnetic induction (B)</li> <li>3. increasing the area of the coil (A)</li> <li>4. <b>by decreasing</b> the couple per unit twist of the suspension wire (K)</li> </ol> <p>(or)</p> <p><math>I_s = \frac{\theta}{I} = \frac{NAB}{K}</math> Only formula</p>	<p>1/2</p> <p>1/2</p> <p>1/2</p> <p>1/2</p> <p>1</p>	2
18	<p><b>Work function</b> : The minimum energy needed for an electron to escape from the metal surface</p> <p><b>Unit : electron volt (eV)</b> (or) J</p> <p>(or)</p> <p><math>h\nu_0 = \phi_0</math>, <math>\nu_0</math> – threshold frequency</p>	<p>1 1/2</p> <p>1/2</p> <p>1</p>	2
19	<p><b>R = R<sub>0</sub> A<sup>1/3</sup></b></p> <p><math>R = 1.2 \times 10^{-15} \times (197)^{1/3}</math></p> <p><math>R = 6.97 \times 10^{-15} \text{ m}</math> or <b>R = 6.97 F</b></p>	<p>1</p> <p>1/2</p> <p>1/2</p>	2
20	<b>Fleming's right hand rule:</b> Correct Statement		2
21	<b>Doping:</b> The process of adding impurities to the intrinsic semiconductor		2
22	<p><b>Displacement current:</b> The current which comes into play in the region in which the <b>electric field or the electric flux</b> is changing with time.</p> <p>(or)</p> <p><math>i_d = \epsilon_0 \frac{d\phi_E}{dt}</math> Only formula</p>	<p>2</p> <p>1</p>	2
23	<p><b>Electrical resistivity</b> : The resistance offered to current flow by a conductor of unit length having unit area of cross section.</p> <p>(or)</p> <p><math>\rho = \frac{RA}{l}</math> (or) <math>\rho = \frac{R(\pi r^2)}{l}</math> (or) <math>\rho = R</math> if <math>l = 1\text{m}, A = 1\text{m}^2</math></p>	<p>2</p> <p>1</p>	2
24	<p><math>n = \frac{\sin(\frac{A+D}{2})}{\sin(\frac{A}{2})}</math></p> <p>substitution</p> <p><math>n=1.532</math></p>	<p>1</p> <p>1/2</p> <p>1/2</p>	2

<p>25</p>	<p>Any one Diagram</p> $\tan i = \frac{PM}{PC}, \tan 2i = \frac{PM}{PF}$ $\tan i \approx i, \tan 2i \approx 2i$ $i = \frac{PM}{PC}, 2i = \frac{PM}{PF}$ $2PF = PC$ $2f = R \text{ or } f = \frac{R}{2}$	 <p>(a) Concave mirror</p> <p>(b) Convex Mirror</p>	<p>1</p> <p>1</p>	<p>3</p>
<p>26</p>	<p>Diagram (or) Explanation</p> $v_d = \frac{dx}{dt}$ $dQ = e(Av_d dt)n$ $I = \frac{dQ}{dt}$ $I = neAv_d$		<p>1</p> <p>1</p> <p>1</p>	<p>3</p>
<p>27</p>	<p><b>Laws of photoelectric effect:</b></p> <ol style="list-style-type: none"> <li>For a given metallic surface the emission of photoelectrons takes place only if the frequency of incident light is greater than a certain minimum frequency called the threshold frequency</li> <li>If (<math>\nu &gt; \nu_0</math>) number of photoelectrons emitted is proportional to frequency of incident radiation</li> <li>Maximum kinetic energy of photoelectron is independent of intensity of the incident radiation</li> <li>Maximum K.E of photoelectrons is proportional to frequency of incident radiation.</li> <li>There is no time lag between incidence of light and ejection of photoelectrons</li> </ol>	<p>1</p> <p>1/2</p> <p>1/2</p> <p>1/2</p> <p>1/2</p>	<p>3</p>	
<p>28</p>	<p><b>NPN transistor in CE Configuration.</b></p>  <p>OR</p>	<p>3</p>	<p>3</p>	

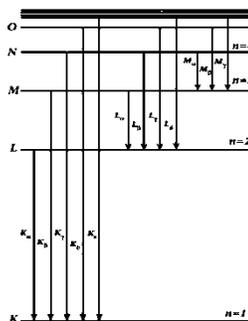
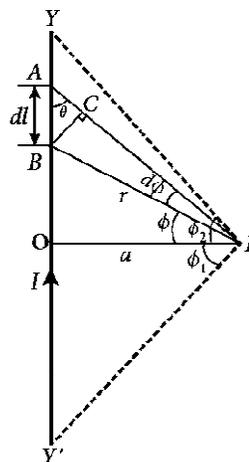
29	Any <b>three</b> uses of Polaroid's.	3×1	3
30	<p>Diagram &amp; Explanation</p> <p><math>V = V_1 + V_2 + V_3</math></p> <p>Upto <math>\frac{Q}{C_S} = Q \left( \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3} \right)</math></p> <p><math>\frac{1}{C_S} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3}</math> (or) Equivalent Statement</p>		<p>1</p> <p>1/2</p> <p>1/2</p> <p>1</p> <p>3</p>
31	<p>(i) Formula <math>l = \frac{nh}{2\pi}</math></p> <p>Substitution</p> <p><math>l = 5.25 \times 10^{-34} \text{ kg m}^2\text{s}^{-1}</math></p> <p>(ii) Formula <math>v = \frac{l}{mr}</math></p> <p>Substitution</p> <p><math>v = 4.4 \times 10^5 \text{ ms}^{-1}</math></p> <p style="text-align: center;">(or)</p> <p style="text-align: center;"><b>alternative method</b></p> <p>(ii) <math>v = \frac{1}{137} \frac{c}{n}</math></p> <p><math>v = \frac{1}{137} \frac{3 \times 10^8}{5}</math></p> <p><math>v = 4.4 \times 10^5 \text{ ms}^{-1}</math></p>	<p>1/2</p> <p>1/2</p> <p>1/2</p> <p>1/2</p> <p>1/2</p> <p>1/2</p> <p>1/2</p> <p>1/2</p>	<p>3</p>
32	<p>Any <b>three</b> characteristics of <b>Lorentz force</b></p> <p style="text-align: center;"><b>OR</b></p> <p style="text-align: center;"><math>F_m = qvB \sin \theta</math> (OR) <math>\vec{F}_m = q(\vec{v} \times \vec{B})</math></p>	<p>3×1</p> <p>1</p>	<p>3</p>
33	<p>(i) <b>Impedance</b> <math>Z = \sqrt{R^2 + (X_L - X_C)^2}</math></p> <p>Substitution <math>Z = \sqrt{30^2 + (184 - 144)^2}</math></p> <p><math>Z = 50 \Omega</math></p> <p>(ii) <b>Phase Angle</b> <math>\tan \phi = \frac{X_L - X_C}{R}</math></p> <p>Substitution <math>\tan \phi = \frac{184 - 144}{30} = 1.33</math></p> <p>Voltage leads current by <math>\phi = \tan^{-1} \left( \frac{4}{3} \right) = \tan^{-1}(1.33) = 53.1^\circ</math></p>	<p>1/2</p> <p>1/2</p> <p>1/2</p> <p>1/2</p> <p>1/2</p> <p>1/2</p>	<p>3</p>

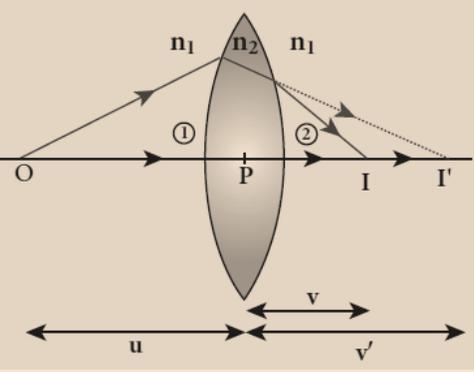
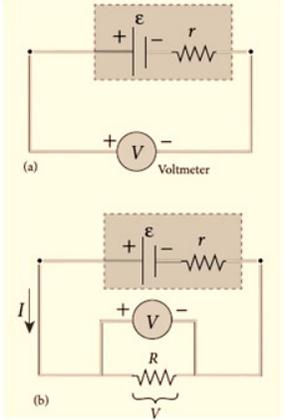
<p>34 (a)</p>	<p><b>Full wave rectifier :</b> <b>Circuit Diagram</b></p> <p><b>Construction</b></p> <p>Positive half cycle explanation</p> <p>Negative half cycle explanation</p> <p><b>Efficiency 81.2 %</b></p> <p>Input and output waveforms</p>		<p>1</p> <p>1/2</p> <p>1</p> <p>1</p> <p>1/2</p> <p>1</p>	<p>5</p>
<p>34 (b)</p>	<p><b>Transformer :</b> <b>Principle :</b> Mutual induction</p> <p>Diagram &amp; Explanation</p> $\left. \begin{aligned} \varepsilon_P &= -N_P \frac{d\phi_B}{dt} \text{ (or) } v_P = -N_P \frac{d\phi_B}{dt} \\ \varepsilon_S &= -N_S \frac{d\phi_B}{dt} \text{ (or) } v_S = -N_S \frac{d\phi_B}{dt} \end{aligned} \right\}$ <p>For an ideal transformer, input power = output power</p> $v_P i_P = v_S i_S$ $\frac{v_S}{v_P} = \frac{N_S}{N_P} = \frac{I_P}{I_S} = K$ <p>For step up transformer <math>K &gt; 1</math></p> <p>For step down transformer <math>K &lt; 1</math></p>		<p>1/2</p> <p>1</p> <p>1</p> <p>1/2</p> <p>1</p> <p>1</p>	<p>5</p>

35 a	<p><b>Electrostatic potential at a point due to an electric dipole:</b> Diagram &amp; Explanation</p> <p>upto <math>V = \frac{q}{4\pi\epsilon_0} \left( \frac{1}{r_1} - \frac{1}{r_2} \right)</math></p> <p>Upto <math>\frac{1}{r_1} = \frac{1}{r} \left( 1 + \frac{a \cos \theta}{r} \right)</math></p> <p><math>\frac{1}{r_2} = \frac{1}{r} \left( 1 - \frac{a \cos \theta}{r} \right)</math></p> <p>upto <math>V = \frac{1}{4\pi\epsilon_0} \frac{2aq \cos \theta}{r^2}</math></p> <p><math>p = 2aq</math></p> <p><math>V = \frac{1}{4\pi\epsilon_0} \frac{p \cos \theta}{r^2}</math> (or) <math>V = \frac{\vec{p} \cdot \hat{r}}{4\pi\epsilon_0 r^2}</math></p>	<p>1</p> <p>1</p> <p>1/2</p> <p>1/2</p> <p>1/2</p> <p>1</p>	5
35 (b)	<p><b>Young's double slit experiment:</b> Diagram &amp; Explanation</p> <p>up to <math>\delta = \frac{d y}{D}</math></p> <p>Condition for bright fringe or maxima <math>\delta = n\lambda</math>  <math>n = 0, 1, 2, 3, \dots</math>  <math>y = n \frac{\lambda D}{d}</math> (or) <math>y_n = n \frac{\lambda D}{d}</math></p> <p>Condition for dark fringe or minima <math>\delta = (2n - 1) \frac{\lambda}{2}</math>  <math>n = 1, 2, 3, \dots</math>  <math>y = \frac{(2n - 1) \lambda D}{2d}</math> (or) <math>y_n = \frac{(2n - 1) \lambda D}{2d}</math></p> <p>Definition of bandwidth</p> <p>Equation for bandwidth bright fringe or dark fringe</p> <p><math>\beta = \frac{\lambda D}{d}</math></p>	<p>1</p> <p>1</p> <p>1/2</p> <p>1/2</p> <p>1/2</p> <p>1</p>	5



<p>36 (a)</p>	<p><b>Magnetic field due to long straight conductor carrying current :</b> Diagram &amp; Explanation</p> $d\vec{B} = \frac{\mu_0 I dl \sin \theta}{4\pi r^2} \hat{n}$ <p>upto <math>d\vec{B} = \frac{\mu_0 I d\phi}{4\pi r} \hat{n}</math></p> $d\vec{B} = \frac{\mu_0 I}{4\pi a} \cos \phi d\phi \hat{n}$ <p>upto <math>\vec{B} = \frac{\mu_0 I}{4\pi a} (\sin \phi_1 + \sin \phi_2) \hat{n}</math></p> $\phi_1 = \phi_2 = 90^\circ \text{ or } \frac{\pi}{2}$ $\vec{B} = \frac{\mu_0 I}{2\pi a} \hat{n}$	<p>1 1/2 1 1/2 1/2 1</p>	<p>5</p>
<p>36 b</p>	<p><b>Spectral series of Hydrogen atom:</b> Names of spectral series with explanations and formula (or) Names of spectral series alone</p>	<p>5×1 2</p>	<p>5</p>
<p>37 a(i)</p> <p>37 a(ii)</p>	<p><b>Characteristic x-ray spectra:</b> x – ray spectra show some narrow peaks at some well – defined wavelengths when the target is hit by fast electrons. The line spectrum showing these peaks is called <b>characteristic x – ray spectrum</b>.</p> <p>Explanation with Diagram</p> $\lambda_o = \frac{12400}{V} \text{A}^\circ$ $\lambda_o = 0.62 \text{A}^\circ$ $\nu_o = \frac{c}{\lambda_o}$ $\nu_o = 4.84 \times 10^{18} \text{Hz}$	<p>1 2 1 1</p>	<p>5</p>
<p>37 (b)</p>	<p><b>Spectrum :</b> The definite pattern of colours obtained on the screen after dispersion is called as spectrum. <b>Emission Spectrum :</b> (i) Continuous Emission Spectra (ii) Line Emission Spectra (iii) Band Emission Spectra Explanation and examples (or) Naming the types of Emission spectrum alone</p>	<p>1/2 1 1/2 1 1/2 1 1/2</p>	<p>5</p>



<p>38 a</p>	<p><b>Len's makers formula:</b></p> <p>Diagram &amp; Explanation</p> $\frac{n_2}{v} - \frac{n_1}{u} = \frac{(n_2 - n_1)}{R}$ $\frac{n_2}{v'} - \frac{n_1}{u} = \frac{(n_2 - n_1)}{R_1}$ $\frac{n_1}{v} - \frac{n_2}{v'} = \frac{(n_1 - n_2)}{R_2}$ $\left. \frac{1}{v} - \frac{1}{u} = \left(\frac{n_2}{n_1} - 1\right) \left(\frac{1}{R_1} - \frac{1}{R_2}\right) \right\}$ <p>If the object is at infinity, the image is formed at the focus of the lens. <math>u = \infty</math>, <math>v = f</math></p> $\frac{1}{f} = \left(\frac{n_2}{n_1} - 1\right) \left(\frac{1}{R_1} - \frac{1}{R_2}\right)$ <p>If the lens is kept in air, <math>n_1 = 1</math> and <math>n_2 = n</math>.</p> $\frac{1}{f} = (n - 1) \left(\frac{1}{R_1} - \frac{1}{R_2}\right)$		<p>1</p> <p>1/2</p> <p>1/2</p> <p>1/2</p> <p>1 1/2</p> <p>1</p>	<p>5</p>
<p>38 (b)</p>	<p><b>Internal resistance of a cell using voltmeter:</b></p> <p><b>Both the diagrams</b></p> <p>Explanation</p> <p><math>V = IR</math></p> <p><math>V = \varepsilon - Ir</math> (or) <math>Ir = \varepsilon - V</math></p> $\frac{Ir}{IR} = \frac{\varepsilon - V}{V}$ <p>Internal resistance <math>r = \left[\frac{\varepsilon - V}{V}\right] R</math></p>		<p>1</p> <p>1/2</p> <p>1</p> <p>1</p> <p>1/2</p> <p>1</p>	<p>5</p>