DIRECTORATE OF GOVERNMENT EXAMINATIONS, CHENNAI – 6
HIGHER SECONDARY SECOND YEAR PUBLIC EXAMINATION – MARCH 2018
KEY ANSWERS FOR PHYSICS

Important Note : -

1. For answers in Part II, III and 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 points.
2. Answers written only in BLACK or BLUE should be evaluated.
3. For graphical representation, X and Y variables must be mentioned. If not, reduce ½ mark.
4. Mark should be given to the unit, only if the answer is correct for problems.
5. Choose the correct answer and write the answer with option code.

Q N		TYPE A	Q N		TYPE B
1	b	uncontrolled fission reaction	1	d	intensity of incident radiation
2	a	in a direction bisecting angle ACB	2	a	10.7 MHz
3	d	scanning	3	a	immobile positive ions
4	d	α particles	4	a	capacitor
5	c	zero	5	a	0.66 milli coulomb
6	c	an ON switch	6	a	$\pi/3$
7	a	0.66 milli coulomb	7	b	contracts
8	d	intensity of incident radiation	8	c	conservation of energy
9	a	diffraction pattern becomes narrower and crowded together	9	a	in a direction bisecting angle ACB
10	a	the velocity of the particle	10	b	uncontrolled fission reaction
11	c	neither a net force nor a torque	11	a	$_{26}Fe^{59}$
12	b	0 , 0	12	c	10^{-27} kgms^{-1}
13	b	$\sqrt{\frac{\mu\varepsilon}{\mu_0 \epsilon_0}}$	13	a	$4h/2\pi$
14	a	10.7 MHz	14	b	$m^2 V^{-1} s^{-1}$ **(or)** c) Cs Kg^{-1}
15	d	1	15	c	neither a net force nor a torque
16	b	transverse	16	b	0 , 0
17	b	E	17	d	1
18	d	absorbs green light	18	c	an ON switch
19	b	$m^2 V^{-1} s^{-1}$**(or)**c) Cs Kg^{-1}	19	a	high specific resistance
20	c	conservation of energy	20	b	phenomenon of conversion of kinetic energy into radiation
21	a	capacitor	21	d	9 minutes
22	b	phenomenon of conversion of kinetic energy into radiation	22	a	diffraction pattern becomes narrower and crowded together
23	a	$\pi/3$	23	d	absorbs green light
24	c	10^{-27} kgms^{-1}	24	b	E
25	a	$4h/2\pi$	25	b	$\sqrt{\frac{\mu\varepsilon}{\mu_0 \epsilon_0}}$
26	a	immobile positive ions	26	c	zero
27	a	$_{26}Fe^{59}$	27	a	the velocity of the particle
28	a	high specific resistance	28	d	scanning
29	b	contracts	29	b	transverse
30	d	9 minutes	30	d	α particles

Part II

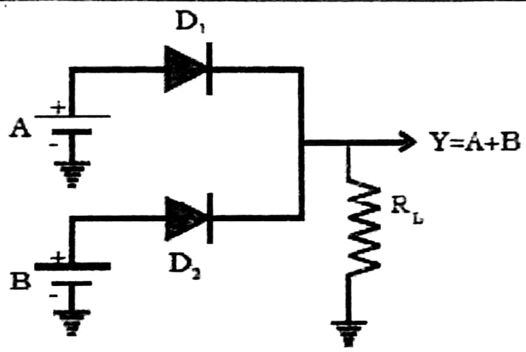
1. **For all problem type questions correct answer without unit reduce half mark**
2. **For wrong answers with correct unit do not award mark for unit**

31	The force of attraction or repulsion between two point charges is directly proportional to the product of the charges and inversely proportional to the square of the distance between them (OR) $F \alpha \frac{q_1 q_2}{r^2}$ **(give one mark)**	**3**	**3**
32	A polar molecule is one in which the centre of gravity of the positive charges is separated from the centre of gravity of the negative charges by a finite distance.	**2**	**3**
	Examples : N_2O, H_2O, HCl, NH_3. **(one only)**	**1**	
33	Correct definition The electrical resistivity of a material is defined as the resistance offered to current flow by a conductor of unit length having unit area of cross section	**2**	**3**
	The unit of ρ is ohm–m (Ω m)	**1**	

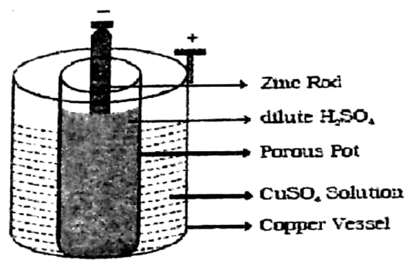
34	$R_t = R_0(1+\alpha t)$ formula $=10(1+0.004 \times 100)$ substitution $=14\Omega$ answer	1 1 ½ + ½	3
35	**Emf**: The difference of potentials between the two terminals of a cell in an open circuit is called the electromotive force (emf) of a cell. **potential difference**: The difference in potentials between any two points in a closed circuit is called potential difference. **Emf**: The emf is independent of external resistance of the circuit **potential difference**: Potential difference is proportional to the resistance between any two points	**2x1½**	3
36	The line integral $\oint \vec{B} \cdot \vec{dl}$ for a closed curve is equal to μ_o times the net current I_o through the area bounded by the curve (or) mere writing $\oint \vec{B} \circ \vec{dl} = \mu_o I_o$ give one mark	3	3
37	$e = -Blv$ formula $= -2 \times 10^{-5} \times 20.48 \times 40$ substitution = - 0.0164 V (or) 0.0164 V answer (any equivalent value)	1 1 1	3

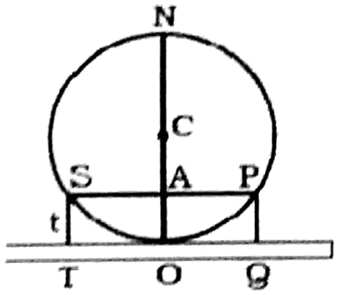
38	The Q factor of a series resonant circuit is defined as the ratio of the voltage across a coil or capacitor to the applied voltage. (OR) $Q = \frac{\text{voltage across L or C}}{\text{Applied voltage}}$	3	3
39	(i) every point on a given wave front may be considered as a source of secondary wavelets which spread out with the speed of light in that medium and (ii) the new wavefront is the forward envelope of the secondary wavelets at that instant	1 ½ 1 ½	3
40	$r_n^2 = nR\lambda (or) \lambda = \frac{r_8^2}{8R}$ Formula $\lambda = \frac{3.6 \times 10^{-3} \times 3.6 \times 10^{-3}}{8 \times 3}$ substitution = 5400A° (OR) 5.4×10^{-7}m (equivalent answer)	1 1 1	3
41	***Conditions to achieve laser action*** (i) There must be an inverted population i.e. more atoms in the excited state than in the ground state. (ii) The excited state must be a metastable state. (iii) The emitted photons must stimulate further emission	1 1 1	3

42	$2d\sin\theta = n\lambda$ formula For max wavelength $\sin\theta = 1$ $\lambda_{max} = \frac{2d}{n} = \frac{2 \times 2.82 \times 10^{-10}}{1}$ substitution $\lambda_{max} = 5.64 A^{\circ}$ (equivalent answer)	1 1 1	3
43	**Uses of Electron microscope** (i) It is used in the industry, to study the structure of textile fibres, surface of metals, composition of paints etc. (ii) In medicine and biology, it is used to study virus, and bacteria. (iii) In Physics, it has been used in the investigation of atomic structure and structure of crystals in detail.	**3x1=3**	**3**
44	**Properties of β Rays (Any Three)**	**3x1=3**	**3**
45	The conversion of a photon into an electron–positron pair on its interaction with the strong electric field surrounding a nucleus is called pair production The converse of pair production in which an electron and positron combine to produce a photon is known as annihilation of matter	**1 ½** **1 ½**	**3**
46	(A+B) (A+C) = AA + AC + BA + BC = A+ AC + AB + BC = A(1+C+B) + BC = A + BC	1 1 1	3
47	***Advantages of negative feedback*** (i) Highly stabilised gain. (ii) Reduction in the noise level. (iii) Increased bandwidth (iv) Increased input impedance and decreased output impedance. (v) Less distortion	**All Points**	**3**

48	***First theorem*** The complement of a sum is equal to the product of the complements. $\overline{A+B}=\overline{A}\bullet\overline{B}$ ***Second theorem*** "The complement of a product is equal to the sum of the complements $\overline{A\bullet B}=\overline{A}+\overline{B}$ Writing mere expression (1+1) marks	1 ½ 1 ½	3
49			3
50	**MERITS OF DIGITAL COMMUNICATIONS** (i) The transmission quality is high and almost independent of the distance between the terminals. (ii) The capacity of the transmission system can be increased. (iii) The newer types of transmission media such as light beams in optical fibers and wave guides operating in the microwave frequency extensively use digital communication.	**3x1=3**	**3**

Part – III

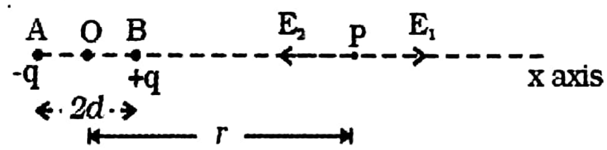
51	**Properties of electric lines of force** 5 properties	**5x1=5**	**5**
52.	Daniel cell Diagram  construction working the value of emf 1.08 V	1 1 2 1	5
53	**Applications of super conductors** (Any five applications)	**5x1=5**	**5**
54	$B = \dfrac{n\mu_o I a^2}{2(a^2 + x^2)^{3/2}}$ formula Substitution and simplification $B = 9.9 \times 10^{-5} T$ answer	**2** **2** **1**	**5**
55	Diagram  Explanation The Magnetic field produced at any point inside the solenoid S_1 due to the current I_1 is $B_1 = \dfrac{\mu_o N_1 I_1}{l}$ Flux linked with each turen of $S_2 = B_1 A$ Total Magnetic flux with linked with solenoid having N_2 turns	**1** **1**	**5**

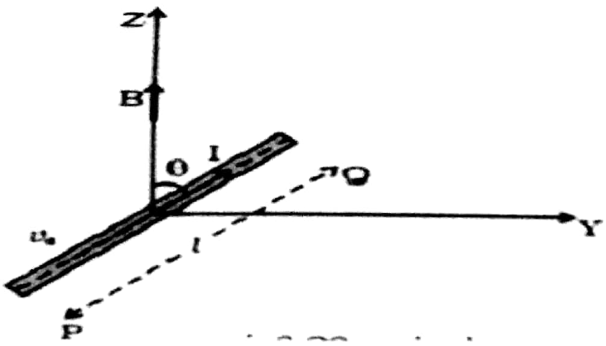
	is $\phi_2 = B_1 A N_2 = \left(\frac{\mu_o N_1 I_1}{l}\right) A N_2$ up to $\phi_2 = M I_1$ $M = \frac{\mu_o N_1 N_2 A}{l}$	2 1	
56	**Radius of nth dark ring** Diagram  Explanation Upto $2t = \frac{r_n^2}{R}$ Condition for dark ring 2t = nλ $r_n^2 = nR\lambda$ (or) $r_n = \sqrt{nR\lambda}$	1 1 1 1 1	5
57	**Spectral series of Hydrogen** Names and explanations with formula If Names alone written 2 marks	5x1=5	5
58	**Einstein photo electric equation** The emission of photo electron is the result of the interaction between a single photon of the incident radiation and an electron in the metal Explanation of usage of photon energy by two ways $h\nu = W + \frac{1}{2}mv^2$ If the electron does not lose energy by internal collisions, as it escapes from the metal, the entire energy will be exhibited as the kinetic energy of the electron. $h\nu = W + \frac{1}{2}mv_{max}^2$ $h\nu - h\nu_o = \frac{1}{2}m v_{max}^2 (or) h(\nu - \nu_o) = \frac{1}{2}m v_{max}^2$	1 1 1 1 1	5

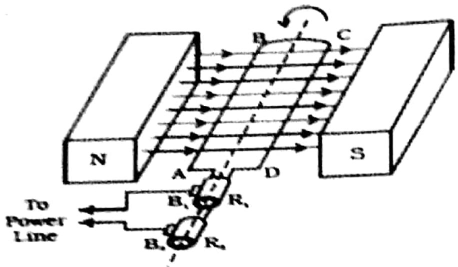
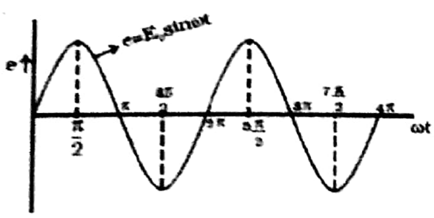
59	$l = l_0\sqrt{1-\frac{v^2}{C^2}}$ formula	2	5
	$\frac{99}{100} = \sqrt{1-\frac{v^2}{C^2}}$ Substitution and simplification	2	
	V = $4.23 \times 10^7\ ms^{-1}$ (any other equivalent answer)	1	
60	$\lambda = \frac{0.6931}{3.8}$ per day	1 1	5
	$N = N_0 e^{-\lambda t}$ $\frac{40}{100} N_0 = N_0 e^{-\lambda t}$ $e^{\lambda t} = \frac{10}{4}$ $t = \frac{3.8}{0.6931} \times \log_{10} 2.5 \times 2.3026$	2	
	= 5.022 days or any equivalent method (OR)	1	
	${}_1H^2 +{}_1 H^2 ---> {}_2He^4 + Q$ Total B.E of ${}_1H^2$ = 1.1 x 2= 2.2 MeV Total B.E of ${}_2He^4$ = 7.0 × 4 = 28.0 MeV	1 1	
	Total Binding energy of reactant = Total Binding energy of product – Energy released	1	
	∴Energy released = 28.0 -4.4 MeV	1	
	= 23.6 MeV	1	
	(or any equivalent method)		

61	Current gain in CB mode, $\alpha = \frac{I_c}{I_E}$	1	5
	Current gain in CE mode, $\beta = \frac{I_c}{I_B}$	1	
	$I_E = I_B + I_c$ (or) $\alpha = \frac{I_c}{I_B + I_c}$	1	
	$\frac{1}{\alpha} - 1 = \frac{1}{\beta}$ solving up to		
	$\beta = \frac{\alpha}{1-\alpha} (or) \alpha = \frac{\beta}{1+\beta}$	2	
62	Principle : Radio echo Applications	1 4x1=4	5

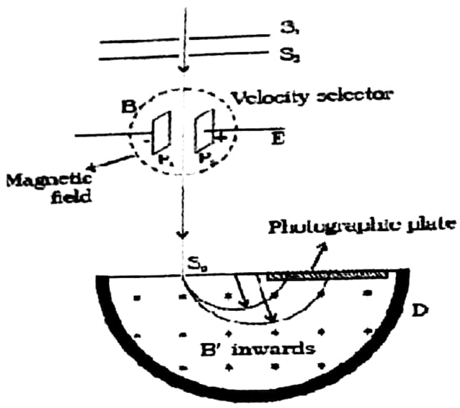
Part – IV

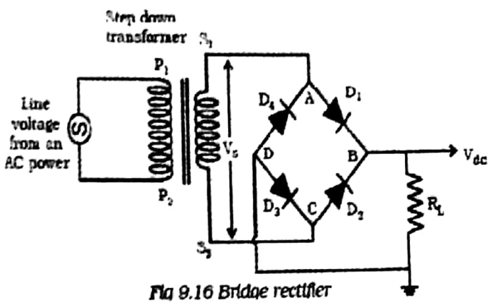
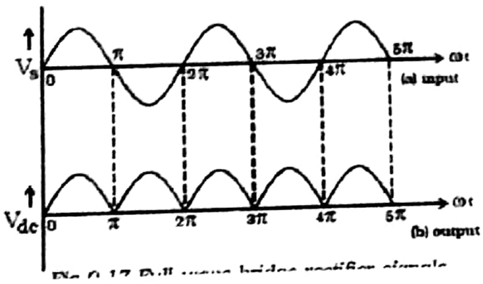
63	**Electric field due to dipole on axial line**		10
	Diagram	1	
			
	Explanation	1	
	Electric field due to +q charge $E_1 = \frac{1}{4\pi\varepsilon_o} \frac{q}{(r-d)^2}$ along BP	½+½	
	Electric field due to - q charge $E_2 = \frac{1}{4\pi\varepsilon_o} \frac{q}{(r+d)^2}$ along PA	½+½	
	$E = E_1 + (-E_2)$ or $E = E_1 - E_2$	1	
	$E = \frac{q}{4\pi\varepsilon_o}\left[\frac{1}{(r-d)^2} - \frac{1}{(r+d)^2}\right]$ $E = \frac{q}{4\pi\varepsilon_o}\left[\frac{4rd}{(r^2-d^2)^2}\right]$ along BP	2	
	$p = q2d$	1	
	$E = \frac{1}{4\pi\varepsilon_0} \frac{2p}{r^3}$	1	
	E acts in the direction of dipole moment.	1	

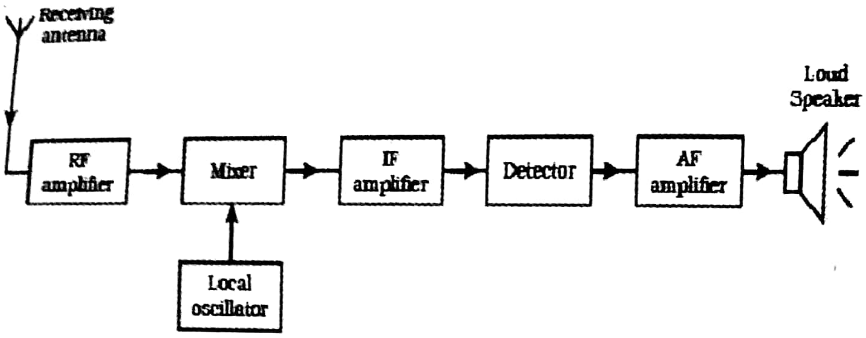
64	**Force acting on a current carrying conductor placed in a magnetic field**		10
	Diagram	1	
			
	Explanation	1	
	$I = nAev_d$ $\vec{Il} = -nAel\vec{v_d}$	2	
	$\vec{f} = -e(\vec{v_d} X \vec{B})$ $\vec{F} = N\vec{f}$	2	
	$\vec{F} = -nAle\vec{v_d} X \vec{B}$ $\vec{F} = \vec{Il} X \vec{B}$	2	
	Magnitude of Force $F = B\,I\,l\ \sin\theta$	1	
	(i) $\theta = 0;$ $F = 0$	½ +½	
	(ii) $\theta = 90^\circ$ **F=** $B\,I\,l$		

65	**AC generator**	2	10
	Diagram 		
	Principle : Electromagnetic induction	1	
	Explanation of four parts (Writing mere names alone – 1 mark)	4x ½ =2	
	Working		
	The direction of the induced current is given by **Fleming's right hand rule**	1	
	For First half rotation : AB moves downward, CD moves upward hence current flows along DCBA , in the outer circuit B_1 to B_2	1	
	For second half rotation : CD moves downward, AB moves upward hence current flows along ABCD , in the outer circuit B_2 to B_1	1	
	$e = E_o \sin\omega t$; $E_o = NBA\omega$	½ + ½	
	Wave form Diagram 	1	

66	Types of spectra Definition for emission and absorption spectrum Explanation for three types of emission spectra (appearance and example) (i) continuous emission (ii) line emission (iii) band emission Explanation for three types of absorption spectra (appearance and example) (i) continuous absorption (ii) line absorption (iii) band absorption (Mere heading alone written give 2 marks only)	2+2 3 3	10
67	**Bohr's postulates** two postulate **radius of electron in nth orbit** Explanation Electrostatic force $F = \frac{1}{4\pi\varepsilon_o}\frac{ze^2}{r_n^2}$ upto $\omega_n^2 = \frac{ze^2}{4\pi\varepsilon_o m r_n^3}$ $L = mv_n r_n = mr_n\omega^2{}_n$ (or) $L = \frac{nh}{2\pi}$ upto $\omega_n^2 = \frac{n^2h^2}{4\pi^2 m^2 r_n^4}$ Up to $r_n = \frac{n^2h^2\varepsilon_o}{\pi m z e^2}$	2x1=2 1 2 1 2 2	10

68	**Bain bridge mass spectrometer** Diagram  	2	
	Used for the accurate determination of isotopic / atomic masses	1	10
	construction	2	
	Working In the velocity selector $Bqv = qE \Rightarrow v = \frac{E}{B}$	1	
	in the evacuated chamber $B^{'}qv = \frac{mv^2}{R} \quad \Rightarrow \quad m = \frac{B^{'}qR}{v}$ Substituting $v = \frac{E}{B}$ $m = \frac{BB^{'}qR}{E}$	3	
	Ions with different masses trace semi- circular paths of different radii and produce dark lines on the plate. The distance between opening of the chamber and the position of the dark line gives the diameter 2R from which radius R can be calculated Knowin g q, B, B\` R isotopic masses determined	1	

69	**Bridge Rectifiers**		
	Definition - rectification	1	
	Diagram	2	
	 Fig 9.16 Bridge rectifier		
	construction	2	10
	Working Explanation for first half cycle	1	
	Explanation for second half cycle	1	
	input and output waveforms	2	
			
	Efficiency is about 81.2%	1	

70 s	**Super heterodyne AM receiver** Block diagram 	5	10
	Explanation Explanation of 5 parts	5x1=5	