ANNEXURE-A

DAV PUBLIC SCHOOLS, ODISHA ZONE								
HALF YEARLY EXAMINATION(2023-24)								
SUBJECT: PHYSICS (SET-2) Time: 3 hours								CLASS : XII Max. Mark:70
BLUE PRINT OF QUESTION PAPER								
S.L NO.	**Name of the Chapters**	**Marks Allotted in syllabus**	**MCQ& AR 1mark**	**SA-I 2 marks**	**SA-II 3 marks**	**CB 4 marks**	**LA 5 marks**	**Total Marks**
1	Electric charges & Fields	31	2 [2MCQ]	1	1		1	12
2	Electrostatic potential & Capacitance		1 [1MCQ]	1	1	1		10
3	Current electricity		4 (3MCQ+ 1-AR)	1	1			9
4	Moving charges & Magnetism	34	2 (1MCQ+ 1-AR)	1	1		1	12
5	Magnetism & Matter		1 [1MCQ]		1			04
6	Electromagnetic induction		2 [2MCQ]	1		1		08
7	Alternating current		2 (1MCQ+ 1-AR)		1		1	10
8	Electromagnetic Waves	05	2 (1MCQ+ 1-AR)		1			05
Total		**70**	$\mathbf{1\times 16 = 16}$	$\mathbf{2\times 5 = 10}$	$\mathbf{3\times 7 = 21}$	$\mathbf{4\times 2 = 8}$	$\mathbf{5\times 3 = 15}$	**70**

ANNEXURE-B

DAV PUBLIC SCHOOLS, ODISHA ZONE

HALF YEARLY EXAMINATION(2023-24)

SUBJECT: PHYSICS (SET-2) **CLASS :XII**

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

QUESTION WISE ANALYSIS

Q.NO.	CHAPTERS	FORMS OF QUESTION	MARKS ALLOT TED	(R) ,(U) , (A) , (Analyzing, Evaluating , Creating)
1	Alternating Current	MCQ	1	A
2	Electric charges & Fields	MCQ	1	A
3	Electrostatic potential & Capacitance	MCQ	1	U
4	Current electricity	MCQ	1	A
5	Current electricity	MCQ	1	U
6	Current electricity	MCQ	1	R
7	Moving charges & Magnetism	MCQ	1	U
8	Magnetism & Matter	MCQ	1	R
9	Electromagnetic Induction	MCQ	1	A
10	Electromagnetic Induction	MCQ	1	A
11	Electric charges & Fields	MCQ	1	U
12	Electromagnetic Waves	MCQ	1	R
13	Electromagnetic Waves	MCQ (AR)	1	Analyse
14	Current electricity	MCQ(AR)	1	Analyse
15	Moving charges & Magnetism	MCQ (AR)	1	Analyse
16	Alternating Current	MCQ(AR)	1	Analyse
17	Electric charges & Fields	SA-I	2	R+ U
18	Electrostatic potential & Capacitance	SA-I	2	U
19	Current electricity	SA-I	2	A
20	Moving charges & Magnetism	SA-I	2	R + U
21	Electromagnetic Induction	SA-I	2	Analyse
22	Electric charges & Fields	SA-II	3	U
23	Electrostatic potential & Capacitance	SA-II	3	A
24	Current electricity	SA-II	3	U
25	Moving charges &Magnetism	SA-II	3	C
26	Magnetism & Matter	SA-II	3	U
27	Alternating current	SA-II	3	E
28	Electromagnetic waves	SA-II	3	A

29	Electrostatic potential & Capacitance	CB	4	A + E + C
30	Electromagnetic Induction	CB	4	A + E + C
31	Alternating current	LA	5	A+ U +C
32	Electric charges & Fields	LA	5	R+U+A
33	Moving charges &Magnetism	LA	5	A+E+C
TOTAL			70	

Remembering &Understanding:	**27Marks**	**38%**
Application:	**22Marks**	**32%**
Analyzing, Evaluating & Creating	**21Marks**	**30%**
TOTAL	**70Marks**	**100%**

	ANNEXURE-C

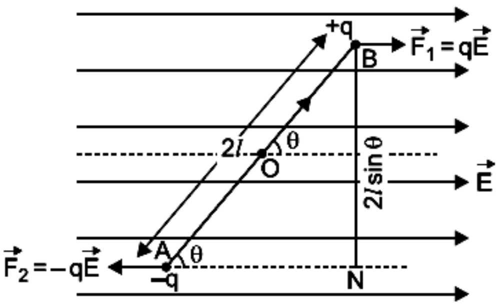
DAV PUBLIC SCHOOLS, ODISHA ZONE
HALF YEARLY EXAMINATION (2023-24)

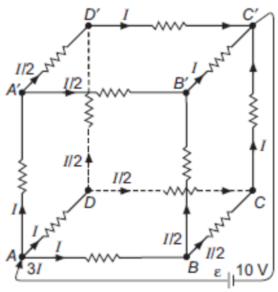
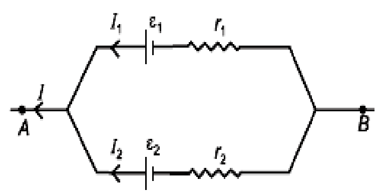
SUBJECT :PHYSICS (SET-2) **CLASS : XII**

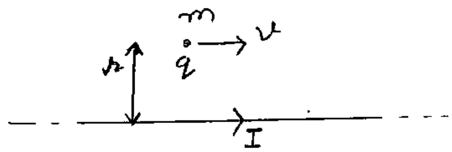
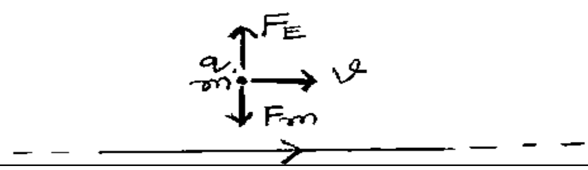
MARKING SCHEME

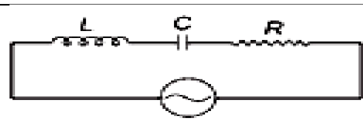
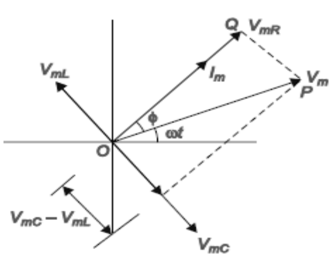
Q. NO.	VALUE POINTS	MARKS ALLOTTED	PAGE NO. OF NCERT TEXT BOOK (OLD BOOK)
	SECTION-A		
1	(c)	1	248
2	(d)	1	47
3	(c)	1	74
4	(b)	1	98
5	(a)	1	110
6	(b)	1	98
7	(d)	1	135
8	(a)	1	192
9	(b)	1	230
10	(d)	1	212
11	(c)	1	17
12	(d)	1	282
13	(a)	1	277
14	(c)	1	104
15	(b)	1	138
16	(a)	1	222
	SECTION-B		
17	The uniform charge −Q will be induced on inner surface of the shell and +Q will be induced on outer surface. This is follows from conservation of charge and no static charges reside in the interior of a metal in electrical equilibrium. Using Gauss's law the field at P_1: $E.4\pi r_1^2=Q/\epsilon_0$ Where Qen=+Q, charge inside Gaussian surface of radius r_1 . Thus, $E= Q/4\pi\epsilon_0 r_1^2$	1 1	39

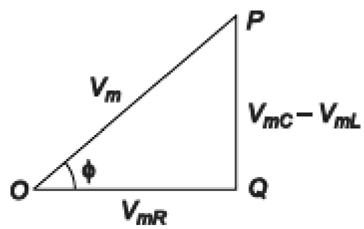
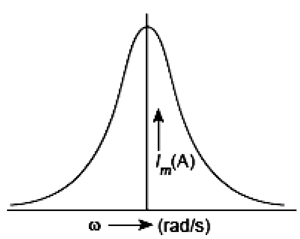
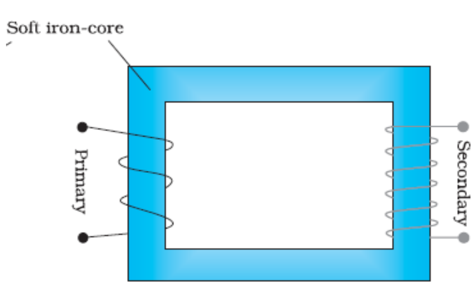
18.	$\frac{q_1}{4\pi \in_0 r} = -\frac{q_2}{4\pi \in_0 (d-r)}$ $\frac{q_1}{r} = \frac{-q_2}{d-r}$ $\frac{5\times10^{-8}}{r} = -\frac{(-3\times10^{-8})}{(0.16-r)}$ $\frac{0.16}{r} - 1 = \frac{3}{5}$ $\frac{0.16}{r} = \frac{8}{5}$ $\therefore r = 0.1\,\text{m} = 10\,\text{cm}$ **OR** (a) $V = \frac{1}{4\pi\varepsilon_0}\frac{Q}{r} = 9\times10^9\ \text{Nm}^2\ \text{C}^{-2} \times \frac{4\times10^{-7}\,\text{C}}{0.09\,\text{m}}$ $= 4 \times 10^4\ \text{V}$ (b) $W = qV = 2 \times 10^{-9}\text{C} \times 4 \times 10^4\text{V}$ $= 8 \times 10^{-5}\ \text{J}$ No, work done will be path independent. Any arbitrary infinitesimal path can be resolved into two perpendicular displacements: One along **r** and another perpendicular to **r**. The work done corresponding to the later will be zero.	0.5 1 0.5 1 0.5 0.5	87 55
19	The current in the circuit $I = \frac{E_1 - E_2}{R_{ext} + r} = \frac{120-8}{15.5+0.5}$ or $I = \frac{112}{16} = 7\ \text{A}$ Terminal voltage of the battery during charging : V = E + Ir = 8 + 7(0.5) = 11.5 V A series resistance is joined in the charging circuit to limit the excessive current so that charging is slow and permanent.	 0.5 0.5 0.5 0.5	128
20	$\frac{mV^2}{r} = qVB$ $\Rightarrow r = \frac{mV}{qB}$ $\nu = \frac{V}{2\pi r}$ $\nu = \frac{VqB}{2\pi mV}$ $\nu = \frac{qB}{2\pi m}$	0.5 0.5 0.5 0.5	138

21.	(a) The bulb B lights because an emf is induced in coil Q due to change in magnetic flux crossing through it. (b) Bulb gets dimmer if the coil Q is moved towards left because of mutual induction, and hence induced emf in coil Q decreases with separation between the coils.	1 1	206
	SECTION-C		
22	(a)  Net force on electric dipole in uniform electric field is F = $F_1 - F_2 = qE - qE = 0$. Thus there is no translational motion. (b) Torque on the dipole $\tau = F\,(2l \sin\theta) = qE\; 2l \sin\theta$ $\vec{\tau} = \vec{p} \times \vec{E}$ The direction of torque is perpendicularly into the plane of paper.	0.5 1 1 0.5	31
23	(a) Q = n q (b) $\frac{4}{3}\pi R^3 = n\frac{4}{3}\pi r^3 \quad \Rightarrow \quad R = n^{1/3} r$ If potential of a small drop, $V = \frac{Q}{C}$; then potential of a big drop, $V' = \frac{nQ}{n^{1/3}C} = n^{2/3}V$ (c) Capacity of each droplet, $C = 4\pi\varepsilon_0 r$ Capacity of a big drop, $C' = 4\pi\varepsilon_0 R = 4\pi\varepsilon_0\, n^{1/3} r = n^{1/3}\, C$ OR (a) $V = \frac{KQ}{r}$ $Q = \frac{V}{K\left(\frac{1}{r}\right)}$ $\frac{Q_1}{Q_2} = \frac{tan\theta_1}{tan\theta_2} = \frac{tan60^0}{tan30^0} = 3:1$	0.5 0.5 1 1 0.5 1 0.5	54

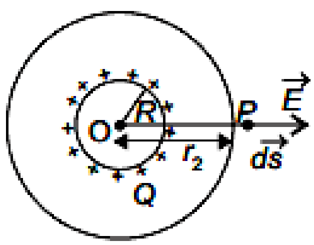
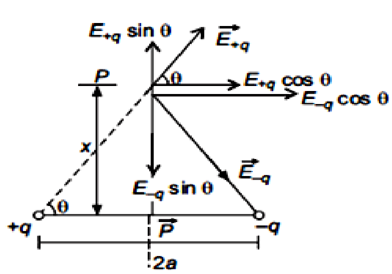
	(b) $\frac{Q_1}{4\pi\epsilon_0 R_1} = \frac{Q_2}{4\pi\epsilon_0 R_2}$ $\frac{Q_1}{Q_2} = \frac{R_1}{R_2}$ $\frac{\sigma_1}{\sigma_2} = \frac{Q_1}{Q_2}\left(\frac{R_1}{R_2}\right)^2 = \frac{R_2}{R_1}$ => $\frac{\sigma_2}{\sigma_1} = \frac{R_1}{R_2}$	1	
24	(a) Statement of the laws	1	116
	(b) 	0.5	
	For closed loop *ABCC′EA* applying Kirchhoff's second rule. $-IR - \frac{I}{2}R - IR + \varepsilon = 0 \Rightarrow \varepsilon = \frac{5}{2}IR$	0.5	
	The equivalent resistance of the network is R_{eq}, i.e. $R_{eq} = \frac{\varepsilon}{3I} = \frac{5}{6}R$	0.5	
	For $R = 1\ \Omega$, $R_{eq} = \frac{5}{6}\Omega$	0.5	
	OR **(a)**		
	We know $V = \varepsilon_1 - I_1 r_1$ So, $I_1 = \frac{\varepsilon_1 - V}{r_1}$ Similarly, $I_2 = \frac{\varepsilon_2 - V}{r_2}$ 	1	
	Now, $I = I_1 + I_2$ $\therefore$ $I = \left(\frac{\varepsilon_1 - V}{r_1}\right) + \left(\frac{\varepsilon_2 - V}{r_2}\right) \Rightarrow I = \left(\frac{\varepsilon_1}{r_1} + \frac{\varepsilon_2}{r_2}\right) - V\left(\frac{1}{r_1} + \frac{1}{r_2}\right)$ ...(a) $I = \left(\frac{\varepsilon_1 r_2 + \varepsilon_2 r_1}{r_1 . r_2}\right) - V\left(\frac{r_1 + r_2}{r_1 . r_2}\right) \Rightarrow V = \left(\frac{\varepsilon_1 r_2 + \varepsilon_2 r_1}{r_1 + r_2}\right) - I\left(\frac{r_1 r_2}{r_1 + r_2}\right)$...(b)	0.5	114
	$\therefore$ $V = \varepsilon_{eq} - I r_{eq}$ The expression for the equivalent emf of the combination	0.5	
	$\varepsilon_{eq} = \frac{\varepsilon_1 r_2 + \varepsilon_2 r_1}{r_1 + r_2}$ (b) Expression for the equivalent resistance of the combination	0.5	
	$r_{eq} = \frac{r_1 r_2}{r_1 + r_2}$	0.5	

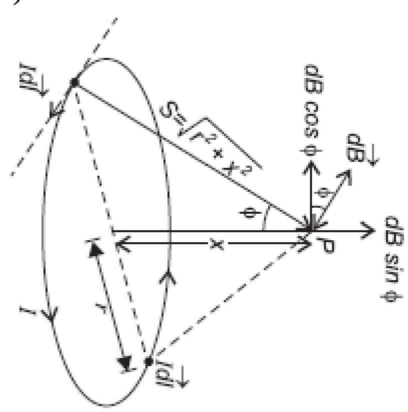
25	 For the charged particle to more undeflected Net force $\bar{F} = \overline{F_E} + \overline{F_m} \quad = 0$ $\vec{F_E} = -F_m$ (1) $\overline{F_E} \rightarrow$ electric force, $\overline{F_m} \rightarrow$magnetic force $\lvert\overline{F_E}\rvert = \lvert\overline{F_m}\rvert$ $qE = Bqv \sin 90° = Bqv$ $E = VB$ (3) $B = \frac{M_0 I}{2\pi r}$ (4) Using (4) and (3) $E = \frac{V M_0 I}{2\pi r}$ (5) Magnetic force F_m is towards wire. ∴ Electric force and electric field should be away from the line. 	0.5 0.5 1 1	140
26	(a) PQ_1 and PQ_2 (b) (i) PQ_3, PQ_6 (stable); (ii) PQ_5, PQ_4 (unstable) (c) PQ_6 Reason: $\mathbf{B}_P = -\frac{\mu_0}{4\pi}\frac{\mathbf{m}_P}{r^3}$ (on the normal bisector) $\mathbf{B}_P = \frac{\mu_0 2}{4\pi}\frac{\mathbf{m}_P}{r^3}$ (on the axis)	0.5 + 0.5 0.5 + 0.5 0.5 0.5	181
27	(a) Given: $V_{rms} = 50$ V, $\nu = \frac{50}{\pi}$ Hz, $R = 300\ \Omega$, $C = 20 \times 10^{-6}$ F, $L = 1.0$ H As we know $X_C = \frac{1}{2\pi\nu C} = \frac{1}{2\pi \times \frac{50}{\pi} \times 20 \times 10^{-6}} = 500\ \Omega$ As we know $X_L = 2\pi\nu L = 2\pi \times \frac{50}{\pi} \times 1 = 100\ \Omega$ ∴ $Z = \sqrt{R^2 + (X_C - X_L)^2} = \sqrt{90000 + (500-100)^2}$ $Z = \sqrt{90000 + 160000} = \sqrt{250000} = 500\ \Omega$	0.5 0.5 0.5	266

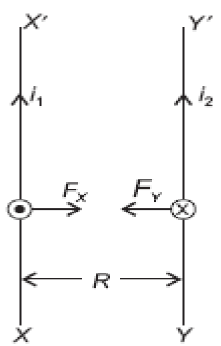
	(b) $I_{rms} = \frac{50}{5\times10^2} = 0.1\ A$ (c) Power factor $\cos\emptyset = \frac{R}{Z} = \frac{3}{5} = 0.6$	0.5 1	
28	$E_y = E_0\cos(\omega t - kx)$ N/C $\therefore E_0 = 4\times10^5$ N/C, $\omega = 3.14\times10^8$ rad s^{-1}, $k = 1.57$ rad.m^{-1} (a) $v = \frac{\omega}{k} = \frac{3.14\times10^8}{1.57}$ m/s $= 2\times10^8$ m/s (b) $\mu = \frac{c}{v} = \frac{3\times10^8}{2\times10^8} = 1.5$ (c) $\frac{E_0}{B_0} = c \Rightarrow B_0 = \frac{E_0}{c} = \frac{4\times10^5}{3\times10^8}$T $= 1.33\times10^{-3}$ T	 1 1 1	287
	SECTION-D		
29	(i) (c) (ii) (d) (iii) (b) (iv) (a) **OR** (iv) (b)	1 1 1 1 1	73,81
30	(i) (c) (ii) (b) (iii) (a) (iv) (b) **OR** (iv) (d)	1 1 1 1 1	222,224
	SECTION-E		
31	 (a) 	0.5 1	245

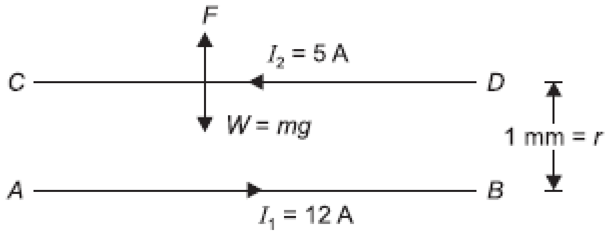
	On applying Pythagoras theorem, we get $$V_m^2 = V_{Rm}^2 + (V_{Cm} - V_{Lm})^2$$ Here $V_{Rm} = I_m R$, $V_{Cm} = I_m X_C$, $V_{Lm} = I_m X_L$ $$V_m = I_m \sqrt{R^2 + (X_C - X_L)^2}$$ $$V_m = I_m Z$$ where, $Z = \sqrt{R^2 + (X_C - X_L)^2}$ Z is called the impedance of the circuit.	1	
	(b) 	0.5	
	$\phi = \tan^{-1}\left(\frac{V_{Cm} - V_{Lm}}{V_{Rm}}\right)$	0.5	
	$I = I_m \sin(\omega t + \phi)$	0.5	
	(c) 	1	
	N. B.- Award marks for $X_L > X_c$ **OR**		
	(a) 	0.5	259

	Principle – Based on the principle of mutual induction	0.5	
	(b) Assumptions- (i) the primary resistance and current are small; (ii) the same flux links both the primary and the secondary as very little flux escapes from the core, and (iii) the secondary current is small.	1	
	Theory- $\varepsilon_p = -N_p \frac{d\phi}{dt}$ $\varepsilon_s = -N_s \frac{d\phi}{dt}$ But $\varepsilon_p = V_p$. If this were not so, the primary current would be infinite since the primary has zero resistance(as assumed). If the secondary is an open circuit or the current taken from it is small, then to a good approximation $\varepsilon_s = V_s$ where V_s is the voltage across the secondary. $\upsilon_s = -N_s \frac{d\phi}{dt}$ $\upsilon_p = -N_p \frac{d\phi}{dt}$	0.5	
	$\frac{\upsilon_s}{\upsilon_p} = \frac{N_s}{N_p}$ If the transformer is assumed to be 100% efficient (no energy losses), the power input is equal to the power output, and since $p = i\,v$,	0.5	
	$i_p \upsilon_p = i_s \upsilon_s$ $\frac{i_p}{i_s} = \frac{\upsilon_s}{\upsilon_p} = \frac{N_s}{N_p}$	0.5	
		0.5	
	(c) The large scale transmission and distribution of electrical energy over long distances is done with the use of transformers. The voltage output of the generator is stepped-up (so that current is reduced and consequently, the I^2R loss is cut down).	1	

32.	(a) Gauss's Law states that the net outward flux through any closed surface is equal to $\frac{1}{\epsilon_0}$ times the charge enclosed by the closed surface.	0.5	39,35
	(i) When the point P is inside the shell. In this case, the Gaussian surface lies inside the spherical shell and hence no charge is enclosed by it.	0.5	
	$\oint \vec{E}.\vec{ds} = \frac{1}{\varepsilon_0}\times 0 = 0$ or $E = 0$, i.e. there is no electric field inside a charged spherical shell. (ii) When the point P lies outside the shell At every point of this shell, the $\vec{E}$ and $\vec{ds}$ are directed outwards in the same direction, i.e. $\theta = 0$.	0.5	
	 $\therefore \quad \oint \vec{E}\vec{ds} = \oint E.ds = E\oint ds = E \times 4\pi r_2^2 \quad \ldots(i)$ Also, by Gauss's law $\oint \vec{E}\vec{ds} = \frac{1}{\varepsilon_0}.Q \quad \ldots(ii)$ From (i) and (ii), we get $E \times 4\pi r^2 = \frac{1}{\varepsilon_0}.Q \Rightarrow E = \frac{1}{4\pi\varepsilon_0}.\frac{Q}{r^2} \quad [\because r = r_2]$	1.5	
	(b) $q = \epsilon_0\phi = \epsilon_0(\phi_R + \phi_L)$ $= \epsilon_0(4a^3 - 2a^3) = 2\epsilon_0 a^3$	1+1	28,16
	OR		
	(a) 	1	

	$\vec{E} = -(E_{+q} + E_{-q})\cos\theta\,\hat{p}$ $\vec{E} = -\frac{2qa}{4\pi\varepsilon_0(x^2+a^2)^{3/2}}\hat{p}$ $\vec{E} = -\frac{\vec{p}}{4\pi\varepsilon_0(x^2+a^2)^{3/2}}$ For x >>a $\vec{E} = -\frac{1}{4\pi\epsilon_0}\frac{\vec{P}}{x^3}$ (b) $\vec{F} = k\frac{q_1q_2}{r^2}\hat{r}$ $r = \sqrt{2}a$ $\hat{r} = \frac{\hat{\imath}+\hat{\jmath}}{\sqrt{2}}$ $\vec{F} = k\,q.\frac{2q}{(\sqrt{2}a)^2}\left(\frac{\hat{\imath}+\hat{\jmath}}{\sqrt{2}}\right) = \frac{kq^2}{\sqrt{2}a^2}(\hat{\imath}+\hat{\jmath})N$	1.5 0.5 2	
33	(a)  $\lvert\vec{dB}\rvert = \frac{\mu_0}{4\pi}\frac{Idl\sin 90^\circ}{S^2}$ $dB = \frac{\mu_0}{4\pi}\frac{Idl}{S^2} = \frac{\mu_0}{4\pi}\frac{Idl}{(r^2+x^2)}\left(\because S = \sqrt{r^2+x^2}\right)$ The direction of $\vec{dB}$ is perpendicular to the plane containing $\vec{S}$ and $\vec{dl}$. We resolve $\vec{dB}$ into rectangular components $dB\cos\phi$ and $dB\sin\phi$.	1	145

	Thus, total magnetic field is given by $$B = \int dB \sin\phi = \int \frac{\mu_0 I dl \sin\phi}{4\pi(r^2 + x^2)}$$ $$B = \frac{\mu_0 I}{4\pi(r^2+x^2)} \frac{r}{(x^2+r^2)^{1/2}} . 2\pi r$$ $$= \frac{\mu_0 I r^2}{2(r^2+x^2)^{3/2}}$$	2	
	(b)Since the total length of the wire used remains the same, N×πd=N′×π(2d)	1	
	N′=N / 2 Hence the ratio of the magnetic moments=M/M′ =INA/IN′A′ $=NA/N'A'=Nd^2/N'd'^2 = 2$ M′ /M = 1/2	1	
	OR (a)  	0.5	154
	The magnitude of magnetic field at each point on Y' due to current i_1 in XX' is given by $$B_1 = \frac{\mu_0}{2\pi} \cdot \frac{i_1}{R}$$		
	$$F_Y = i_2 B_1 l = i_2 \frac{\mu_0}{2\pi} \cdot \frac{i_1}{R} \cdot l$$	0.5	
	Force per unit length of YY' is given by $$\frac{F_Y}{l} = \frac{\mu_0}{2\pi} \cdot \frac{i_1 i_2}{R}$$	0.5	
	Similarly $$\frac{F_X}{l} = \frac{\mu_0}{2\pi} \cdot \frac{i_1 i_2}{R}$$ The force is attractive in nature.	0.5	

	The *ampere* is the value of that 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 produce on each of these conductors a force equal to 2×10^{-7}newtons per metre of length. (b)  $F = \frac{\mu_0}{4\pi} \cdot \frac{2I_1I_2}{r} = mg$ $m = \frac{\mu_0}{4\pi} \cdot \frac{2I_1I_2}{rg}$ $m = \frac{10^{-7} \times 12 \times 5 \times 2}{1 \times 10^{-3} \times 10}$ $m = 12 \times 10^{-4}$ kg-m^{-1} The direction of current in wire *CD* will be opposite to the direction of current in wire *AB*.	1 0.5 0.5 0.5 0.5	