JEE MAIN

COURSE
NUCLEUS

TEST CODE				
1	1	2	7	0

MOCK TEST-5

Class: **XII** ***Time:*** **3 Hours.** ***Max. Marks:*** **360**

IMPORTANT INSTRUCTIONS

1. The question paper consists of **'90'** objective type questions. There are **'30'** questions each in **Mathematics**, **Chemistry** and **Physics** respectively. **Please fill the OMR answer Sheet accordingly and carefully.**

2. Each question has four choices (1), (2), (3) and (4) out of which **ONLY ONE** is correct.

3. You will be **awarded 4 marks** for each question, if you have darkened only the bubble corresponding to the correct answer and zero mark if no bubble are darkened. In all other cases, **minus one (–1) mark** will be awarded.

4. There is only one correct response for each question. Filling up more than one response in each question will be treated as wrong response and marks for wrong response will be deducted accordingly as per instruction 3 above.

5. Use **Black or Blue Ball Point Pen** only for filling particulars.

6. Use of **Calculator, Log Table, Slide Rule and Mobile** is not allowed.

7. Rough work is to be done on the space provided at the bottom and in end of the booklet for this purpose in the Test Booklet only.

8. On completion of the test, the candidate must hand over the Answer Sheet to the Invigilator. However, the candidates are allowed to take away this Test Booklet with them.

9. Do not fold or make any stray marks on the Answer Sheet.

BANSAL CLASSES
PRIVATE LIMITED
Ideal for Scholars
Corporate Office : A-10, **"BANSAL TOWER"**, Road No.-1, I.P.I.A., Kota-324005 (Raj.) INDIA
Tel.: (0744) 2791000
Helpline: 09571042038 | Email: dlpd@bansal.ac.in, dlpd.care@bansal.ac.in | website : www.bansal.ac.in

USEFUL DATA

Atomic weights: Al = 27, Mg = 24, Cu = 63.5, Mn = 55, Cl = 35.5, O = 16, H = 1, P = 31, Ag = 108, N = 14, Li = 7, I = 127, Cr = 52, K=39, S = 32, Na = 23, C = 12, Br = 80, Fe = 56, Ca = 40, Zn = 65.5, Ti = 48, Ba = 137, U = 238, Co= 59, B =11, F = 19, He = 4, Ne = 20, Ar = 40 , Mo = 96

[Take : ln 2 = 0.693, ln 1.1 = 0.095, ln 3 = 1.09, $e = 1.6 \times 10^{-19}$, $m_e = 9.1 \times 10^{-31}$ kg]

Take: $\in_0 = 8.85 \times 10^{-12}\ C^2/Nm^2$, $g = 10\ m/s^2$, $S_{water} = 1$ cal/gm °C, $L_{ice} = 80$ cal/gm. , $g = 10\ m/s^2$ unless otherwise stated

MATHEMATICS

Q.1 The equation to the directrix of a parabola if the two extremities of its latus rectum are (2, 4) and (6, 4) and the parabola passes through the point (8, 1) is

(1) $y - 5 = 0$ (2) $y - 6 = 0$ (3) $y - 1 = 0$ (4) $y - 2 = 0$

Q.2 If $\Delta = \begin{vmatrix} 1 & 3\cos\theta & 1 \\ \sin\theta & 1 & 3\cos\theta \\ 1 & \sin\theta & 1 \end{vmatrix}$ then the maximum value of Δ, is

(1) 3 (2) 9 (3) 10 (4) 13

Q.3 The number of solution(s) of the equation $z^2 = 4z + |z|^2 + \dfrac{16}{|z|^3}$ is

(where $z = x + iy$, $x, y \in R$, $i^2 = -1$ and $x \neq 2$)

(1) 0 (2) 1 (3) 2 (4) 3

Q.4 Two circles of radii r_1 and r_2 are both touching the coordinate axes and intersecting each other orthogonally. The value of $\dfrac{r_1}{r_2}$ (where $r_1 > r_2$) equals

(1) $2 + \sqrt{3}$ (2) $\sqrt{3} + 1$ (3) $2 - \sqrt{3}$ (4) $2 + \sqrt{5}$

Q.5 Let X and Y be two matrices satisfying this relations

$2X + 3Y = \begin{pmatrix} 2 & 3 \\ 4 & 0 \end{pmatrix}$ and $3X + 2Y = \begin{pmatrix} 2 & -2 \\ -1 & 5 \end{pmatrix}$, then Tr.(X) – Tr.(Y) equals

(1) 5 (2) 4 (3) 3 (4) 2

[**Note :** Tr.(P) denotes trace of matrix P.]

SPACE FOR ROUGH WORK

Q.6 The differential equation $\frac{dx}{dy} = \frac{3y}{2x}$ represents a family of hyperbolas (except when it represents a pair of lines) with eccentricity can be

(1) $\sqrt{2}$ (2) $\sqrt{\frac{5}{4}}$ (3) $\sqrt{\frac{5}{3}}$ (4) $\sqrt{3}$

Q.7 Line L, perpendicular to the line with equation $y = 3x - 5$, contains the point (1, 4). The x-intercept of L, is

(1) 12 (2) 13 (3) 14 (4) 15

Q.8 Let $A = [a_{ij}]$ $(1 \leq i, j \leq 3)$ be a 3×3 matrix and $B = [b_{ij}]$ $(1 \leq i, j \leq 3)$ be a 3×3 matrix such that $b_{ij} = \sum_{k=1}^{3} a_{ik} \cdot a_{jk}$. If det. A = 4, then the value of det. B is

(1) 0 (2) 4 (3) 8 (4) 16

Q.9 Number of words that can be formed using all the letters of the word GARGEE if no two alike letters are together, is

(1) 84 (2) 62 (3) 240 (4) None

Q.10 If acute angle between the line $\vec{r} = \hat{i} + 2\hat{j} + \lambda(4\hat{i} - 3\hat{k})$ and xy plane is α and acute angle between the planes $x + 2y = 0$ and $2x + y = 0$ is β then $(\cos^2\alpha + \sin^2\beta)$ equals

(1) 1 (2) $\frac{1}{4}$ (3) $\frac{2}{3}$ (4) $\frac{3}{4}$

Q.11 If area of pentagon PQRST be 7, where P(–1, –1), Q(2, 0), R(3, 1), S(2, 2) and T(–1, t), $t > 0$, then the value of t is

(1) 1 (2) $\frac{4}{3}$ (3) 2 (4) $\frac{5}{3}$

Q.12 The sum of all value of λ for which the lines $2x + y + 1 = 0$; $3x + 2\lambda y + 4 = 0$; $x + y - 3\lambda = 0$ are concurrent, is

(1) $\frac{1}{4}$ (2) $\frac{1}{2}$ (3) $\frac{7}{2}$ (4) $\frac{7}{12}$

SPACE FOR ROUGH WORK

Q.13 If A and B are two independent events such that $P(A' \cap B') = 2/15$, $P(A \cap B') = 1/6$ then P(B) =
(1) 5/9 (2) 4/9 (3) 3/10 (4) 7/10

Q.14 A hyperbola has centre at origin and one focus at (6, 8). If its two directrices are $3x + 4y + 10 = 0$ and $3x + 4y - 10 = 0$ and eccentricity is e, then the value of $\frac{4e^2}{5}$ is equal to
(1) 1 (2) 2 (3) 3 (4) 4

Q.15 Number of integral values of 'k' for which the chord of the circle $x^2 + y^2 = 125$ passing through P(8, k) gets bisected at P (8, k) and has integral slope is
(1) 8 (2) 6 (3) 4 (4) 2

Q.16 Locus of the feet of perpendiculars drawn from points (1, 2) and (3, 4) on a variable tangent to the conic $\left|\,|z-(1+2i)|-|z-(3+4i)|\,\right| = 2$ is
(1) $|z-(2+3i)|=1$ (2) $|z-(2+3i)|=4$
(3) $|z-(1+i)|=2$ (4) $|z-(1+i)|=1$

Q.17 Number of numbers greater than a million and divisible by 5 which can be formed by using only the digits 1, 2, 1, 2, 0, 5 and 2 is :
(1) 120 (2) 110 (3) 90 (4) none

Q.18 The dual of statement $(p \vee \sim q) \wedge (\sim p)$ is
(1) $(p \vee \sim q) \wedge (\sim p)$ (2) $(p \wedge \sim q) \wedge (\sim p)$ (3) $(p \vee \sim q) \vee (\sim p)$ (4) $(p \wedge \sim q) \vee (\sim p)$

Q.19 A normal is drawn to the parabola $y^2 = 9x$ at the point P(4, 6), S being the focus, a circle is described on the focal distance of the point P as diameter. The length of the intercept made by the circle on the normal at P is
(1) 4 (2) $\frac{15}{4}$ (3) 6 (4) $\frac{17}{4}$

SPACE FOR ROUGH WORK

Q.20 Consider ellipse $\frac{x^2}{9}+\frac{y^2}{4}=1$. Let C is centre of the ellipse and P is a variable point lying on the ellipse. If the angle between CP and tangent at P is minimum, then P may be

(1) $\left(\frac{3\sqrt{3}}{2}, 1\right)$ (2) $\left(\frac{3}{\sqrt{2}}, \sqrt{2}\right)$ (3) $\left(\frac{3}{2}, \sqrt{3}\right)$ (4) (0, 2)

Q.21 If the algebraic sum of deviations of 20 observations from 30 is 20, then the mean of observations is
(1) 30 (2) 31 (3) 32 (4) 29

Q.22 If $\hat{a}$ and $\hat{b}$ are unit vectors such that $[\hat{a}\ \hat{b}\ \hat{a}\times\hat{b}] = \frac{1}{4}$, then the angle between $\hat{a}$ and $\hat{b}$, is equal to

(1) $\frac{\pi}{6}$ (2) $\frac{\pi}{4}$ (3) $\frac{\pi}{3}$ (4) $\frac{\pi}{2}$

Q.23 A fair cubic die has two faces marked with 1 & 2 and the other faces left blank. If the die is rolled 3 times, the probability of getting a total score of 4 is :
(1) 6/216 (2) 10/216 (3) 15/216 (4) 24/216

Q.24 The equation of the locus of the mid points of the chords of the circle $4x^2 + 4y^2 - 12x + 4y + 1 = 0$ that subtend an angle of $\frac{2\pi}{3}$ at its centre is
(1) $16(x^2 + y^2) - 48x + 16y + 31 = 0$ (2) $16(x^2 + y^2) - 48x - 16y + 31 = 0$
(3) $16(x^2 + y^2) + 48x + 16y + 31 = 0$ (4) $16(x^2 + y^2) + 48x - 16y + 31 = 0$

Q.25 Let $z = \frac{\left(2\sqrt{3}+2i\right)^8}{(1-i)^6} + \frac{(1+i)^6}{\left(2\sqrt{3}-2i\right)^8}$ where $i^2 = -1$, then
(1) $|z| = 2^{13} + \frac{1}{2^{13}}$ and amp $z = \frac{5\pi}{6}$ (2) $|z| = 2^{12} + \frac{1}{2^{12}}$ and amp $z = \frac{5\pi}{6}$
(3) $|z| = 2^{13} + \frac{1}{2^{13}}$ and amp $z = \frac{\pi}{6}$ (4) $|z| = 2^{12} + \frac{1}{2^{12}}$ and amp $z = \frac{7\pi}{6}$

SPACE FOR ROUGH WORK

Q.26 Let L_1 : $\vec{r} = \hat{i} - \hat{j} - 10\hat{k} + \lambda(2\hat{i} - 3\hat{j} + 8\hat{k})$ and L_2 : $\vec{r} = 4\hat{i} - 3\hat{j} - \hat{k} + \mu(\hat{i} - 4\hat{j} + 7\hat{k})$ represent two lines in R^3, then which one of the following is **incorrect**?

(1) L_1 is parallel to the vector $4\hat{i} - 6\hat{j} + 16\hat{k}$.

(2) L_2 is parallel to the vector $-\hat{i} + 4\hat{j} - 7\hat{k}$.

(3) L_1 and L_2 are coplanar.

(4) Angle between the lines L_1 and L_2 is $\cos^{-1}\left(\frac{70}{11\sqrt{7}}\right)$.

Q.27 If distance between two non-intersecting planes P_1 and P_2 is 3 units, where P_1 is $2x - 3y + 6z + 5 = 0$ and P_2 is $4x + by + cz + d = 0$ and point A (–3, 0, –1) is lying between the planes P_1 and P_2 then the value of $(b + c + d)$, is equal to

(1) 36 (2) 44 (3) 58 (4) 72

Q.28 A firing squad is composed of three policemen A, B and C who have probabilities 0.6, 0.7 and 0.8 respectively of hitting the victim. Only one of the three bullets is live and is allocated at random.
If the victim was found to be hit by live bullet, the probability that it was C who had the live round, is

(1) $\frac{1}{3}$ (2) $\frac{8}{21}$ (3) $\frac{6}{21}$ (4) $\frac{9}{21}$

Q.29 If R is a relation on the set of natural numbers such that $a \, R \, b \Leftrightarrow a = 3^K . \, b$ for some integer K, then R is

(1) Symmetric, transitive but not reflexive
(2) Reflexive, symmetric but not transitive
(3) Reflexive, transitive but not symmetric
(4) An equivalence relation

Q.30 The equation of the line passing through M(1, 1, 1) and intersects at right angle to the line of intersection of the planes $x + 2y - 4z = 0$ and $2x - y + 2z = 0$ is $\frac{x-1}{a} = \frac{y-1}{b} = \frac{z-1}{c}$, then a : b : c equals

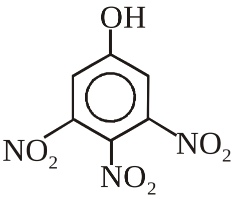
(1) 5 : – 1 : 2 (2) – 5 : 1 : 2 (3) 5 : – 1 : – 2 (4) 5 : 1 : 2

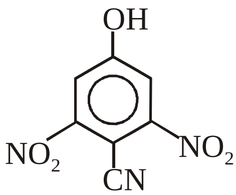
SPACE FOR ROUGH WORK

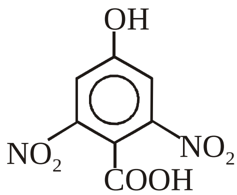
Q.31 A 0.1 M solution of which salt is most acidic?

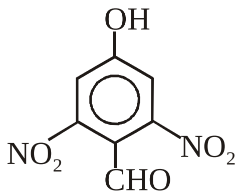
(1) $NH_4C_2H_3O_2$ (2) NaCN (3) KNO_3 (4) $AlCl_3$

Q.32 Which is the strongest acid amongst the following compounds ?

(1) 

(2) 

(3) 

(4) 

Q.33 Select the **correct** order of metallic character :

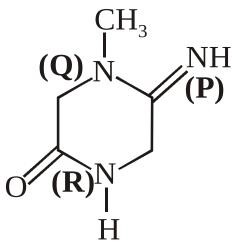
(1) P < Si < Be < Mg < Na (2) Be < P < Si < Mg < Na

(3) P < Be < Si < Na < Mg (4) Si < P < Be < Mg < Na

Q.34 In hydrogen atom which transition produces a photon with highest energy?

(1) $n = 3 \rightarrow n = 1$ (2) $n = 5 \rightarrow n = 3$ (3) $n = 12 \rightarrow n = 10$ (4) $n = 22 \rightarrow n = 20$

Q.35 The **correct** basicity order of indicated atoms P, Q and R is -



(1) R > Q > P (2) Q > P > R (3) P > R > Q (4) P > Q > R

Q.36 Select the **incorrect** statement regarding N^{3-}, O^{2-}, F^{-}, Na^{+} and Mg^{2+}.

(1) All have same number of electron in valence shell.

(2) Maximum energy required in their formation from their atomic state is for F^{-}.

(3) N^{3-} have largest size among them.

(4) Ionisation energy is maximum for Mg^{2+}

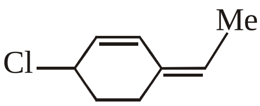
SPACE FOR ROUGH WORK

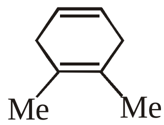
Q.37 Dioxygen difluoride (O_2F_2) is a highly oxidising and unstable liquid. At 300 K it decomposes back to oxygen and fluorine, which are both gases at this temperature. The equation for the reaction is given below. 0.1 g of O_2F_2 was left for 24 hours and the 24.9 ml of gas mixture evolved was collected at 300 K and 100 kPa. What % by mass of dioxygen difluride has decomposed by this time?

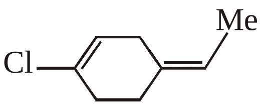
$$O_2F_2(l) \rightarrow O_2(g) + F_2(g)$$

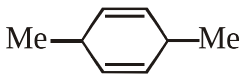
(1) 70 % (2) 35 % (3) 25 % (4) 15 %

Q.38 Which of the following cyclic dienes does not show geometrical isomerism?

(1) 

(2) 

(3) 

(4) 

Q.39 Which of the following property is different for two different isoelectronic homonuclear diatomic species?

(1) Bond order (2) Magnetic behaviour
(3) Bond length (4) Lone pairs

Q.40 In an analysis of solutions containing Barium ions (Ba^{2+}), 50 ml of solution gave 0.233 g of $BaSO_4$ upon addition of sufficient sulphuric acid to precipitate all the Ba^{2+} ions present. What is concentration (in M) of Ba^{2+} ions in the solution.

(1) $\frac{1000}{50}\times\frac{0.233}{233}$ (2) $\frac{50}{1000}\times\frac{0.233}{233}$ (3) $\frac{1000}{50}\times\frac{233}{0.233}$ (4) $\frac{50}{1000}\times\frac{233}{0.233}$

Q.41 Ethers are more volatile than same no. of carbon containing alcohol due to -

(1) Ethers are more polar. (2) Absence of H-bonding in ethers.
(3) Insolubility of ethers in H_2O. (4) Solubility of ethers in H_2O

Q.42 Select the species which becomes Bent due to lone pair – bond pair repulsion.

(1) NO_2 (2) I_3^- (3) XeF_4 (4) SO_2

SPACE FOR ROUGH WORK

Q.43 Quinaldine red is a useful acid-base indicator which is red in solution of pH greater than 3.5 but colorless below pH = 1.5. Which of the following solution would turn red if a few drops of quinaldine red were added?

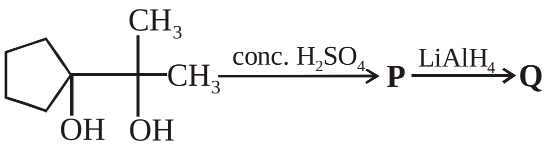
(i) 0.1 mol L^{-1} HCl

(ii) 0.05 mol L^{-1} NH_3

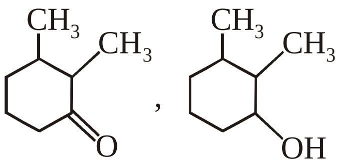
(iii) 0.0001 mol L^{-1} CH_3COOH

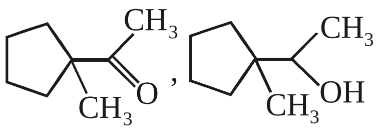
(1) (i) and (ii) only (2) (i) and (iii) only

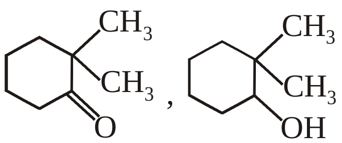
(3) (ii) and (iii) only (4) (ii) only

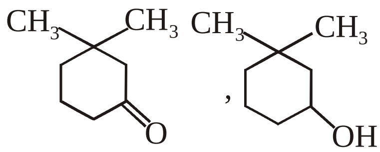
Q.44 

Identify P and Q respectively.

(1) 

(2) 

(3) 

(4) 

Q.45 Oxidising nature of H_2 is observed on reaction with .

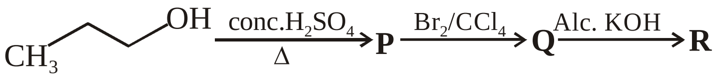
(1) Cl_2 (2) Na (3) Cu_2O (4) RCHO

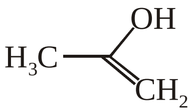
Q.46 A brown-black compound of thallium was found to contain 89.5% T*l* and 10.5% oxygen. What is oxidation number of thallium in this compound? [Atomic weight of T*l* = 204]

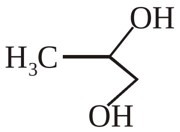
(1) zero (2) I (3) II (4) III

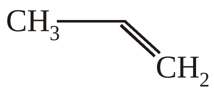
SPACE FOR ROUGH WORK

Q.47 Identify R in the following series of reaction.



(1) 

(2) 

(3) 

(4) $CH_3–C\equiv CH$

Q.48 Select the **incorrect** match regarding action of H_2O.

(1) $Na + H_2O$	:	Redox
(2) $P_4O_{10} + H_2O$	:	Hydrolysis
(3) $CrCl_3 + H_2O$	:	Hydrate formation
(4) $BaSO_4 + H_2O$	:	Dissolution

Q.49 Identify the **correct** statement :
(1) Physical adsorption may change into chemical adsorption with decrease in temperature.
(2) Water is adsorbed on anhydrous $CaCl_2$.
(3) At higher concentration of soap in water, it behaves as normal electrolyte.
(4) Values of colligative properties for colloidal solutions are less as compared to true solutions.

Q.50 In the mono chlorination of 3-Ethyl pentane, how many total products will be formed?
(1) 4 (2) 5 (3) 6 (4) 7

Q.51 Which of the following reaction form paramagnetic species?
(1) $Na(s) + NH_3$ (liq.) (2) $Na(s) + O_2$ (excess)
(3) $Na(s) + H_2O$ (4) $Na(s) + H_2$

Q.52 Let the energy of 2s level in a hydrogen atom be – E. What is the energy of 3p level ?
(1) $\frac{4}{9}E$ (2) $-\frac{4}{9}E$ (3) $-\frac{9}{4}E$ (4) $-\frac{2}{2}E$

Q.53 The product obtained on treatment of ethyl chloride with potassium cyanide is reduced by sodium and alcohol to give-
(1) Propyl amine (2) ethyl amine (3) diethyl amine (4) acetic acid

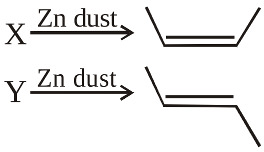
SPACE FOR ROUGH WORK

Q.54 Most basic oxide among the following is

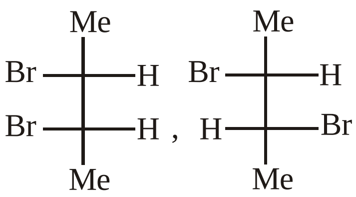
(1) Na_2O (2) BeO (3) MgO (4) K_2O

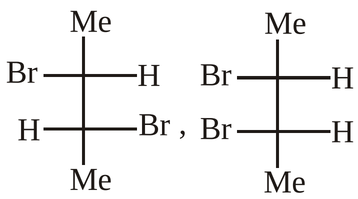
Q.55 200 ml of hard water contains 1.11 mg of $CaCl_2$ and 4.75 mg of $MgCl_2$. Then hardness of water will be:

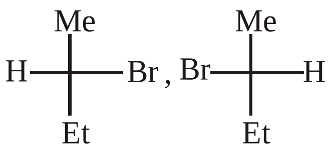
(1) 120 ppm (2) 15 ppm (3) 60 ppm (4) 30 ppm

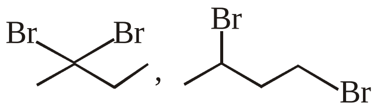
Q.56 

Compound X and Y will be respectively.

(1) 

(2) 

(3) 

(4) 

Q.57 Hydrolysis of Borax does not form:

(1) Buffer (2) Weak Lewis acid

(3) Salt of strong base with weak acid (4) Triprotic acid

Q.58 Ammonia is manufactured from N_2(g) and H_2(g) in Haber's process, which is governed by following equilibrium reaction :

$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$; $\Delta H = -92$ kJ/mol

Which of the following will decrease the concentration of ammonia(NH_3) ?

(1) Decrease in temperature.

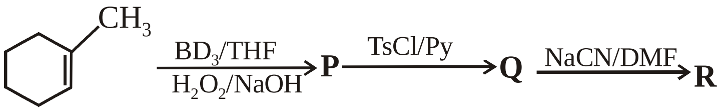
(2) Increasing amount of catalyst.

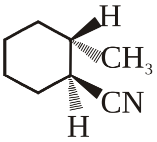
(3) Decreasing pressure by increasing volume of container.

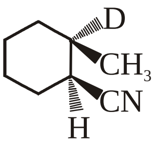
(4) Addition of NH_3(g).

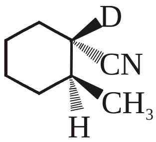
SPACE FOR ROUGH WORK

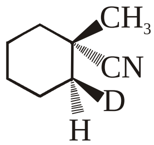
Q.59 Identify major product of the following reaction.



(1) 

(2) 

(3) 

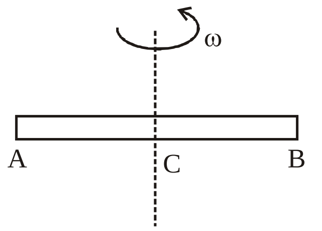
(4) 

Q.60 In which manufacturing process, underlined atom is not in elemental form as the raw material in reactant side.

(1) $H_2\underline{S}O_4$: Contact process
(2) $\underline{N}H_3$: Haber's process
(3) Water gas ($\underline{C}O + H_2$) : Coal gasification
(4) $H\underline{N}O_3$: Ostwald process

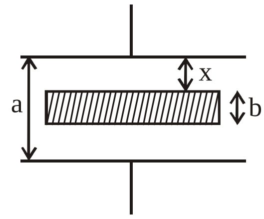
SPACE FOR ROUGH WORK

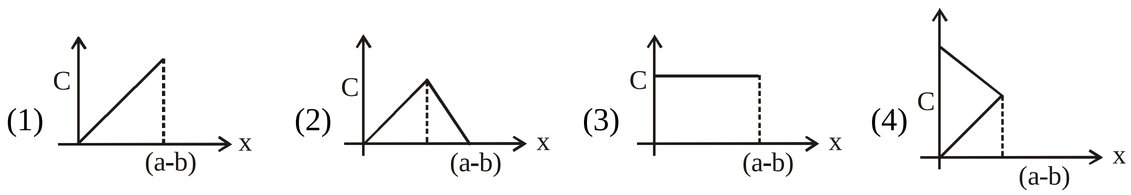
Q.61 A non-conducting rod AB of length l has a total charge q. The rod is rotated about an axis passing through its center of mass with a constant angular velocity ω as shown in the figure. The magnetic moment of the rod is



(1) $\frac{q\omega l^2}{12}$ (2) $\frac{q\omega l^2}{3}$ (3) $\frac{q\omega l^2}{24}$ (4) $\frac{q\omega l^2}{6}$

Q.62 The distance between two parallel plates of a capacitor is a. A conductor of thickness b(b < a) is inserted between the plates as shown in the figure. The variation of effective capacitance between the plates of the capacitor as a function of the distance (x) is best represented by



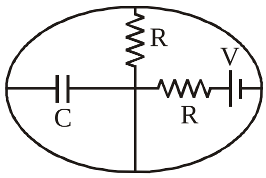


SPACE FOR ROUGH WORK

Q.63 A solid sphere of radius R, and dielectric constant 'k' has spherical cavity of radius R/4. A point charge q_1 is placed in the cavity. Another charge q_2 is placed outside the sphere at a distance of r from q_1. Then Coulombic force of interaction between them is found to be 'F_1'. When the same charges are separated by same distance in vacuum then the force of interaction between them is found to be F_2 then

(1) $F_1 = F_2 / k$ (2) $F_2 = F_1 / k$ (3) $F_1 F_2 = \frac{1}{k}$ (4) $F_1 = F_2$

Q.64 Energy stored in the capacitor in it's steady state is

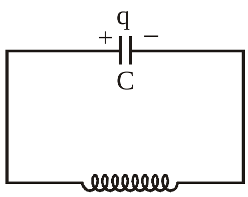


(1) CV (2) $\frac{CV}{2}$ (3) $\frac{1}{2}QV$ (4) Zero

Q.65 A point charge of 0.1C is placed on the circumference of a non-conducting ring of radius 1m which is rotating about an axis passing from centre and perpendicular to the plane of ring with a constant angular acceleration of 1 rad/sec^2. If ring starts from rest at t = 0, the magnetic field at the centre of the ring at t = 10 sec, is

(1) 10^{-6} T (2) 10^{-7} T (3) 10^{-8} T (4) 10^{7} T

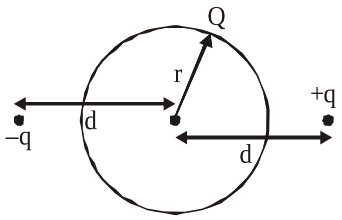
Q.66 In an L – C circuit shown in the figure, C = 1F, L = 4H. At time t = 0, charge in the capacitor is 4C and it is decreasing at a rate of $\sqrt{5}$ C/s. Choose the correct statements.



(1) maximum charge in the capacitor can be 6C
(2) maximum charge in the capacitor can be 8C
(3) charge in the capacitor will be maximum after time 2 $\sin^{-1}(2/3)$ sec
(4) None of these

SPACE FOR ROUGH WORK

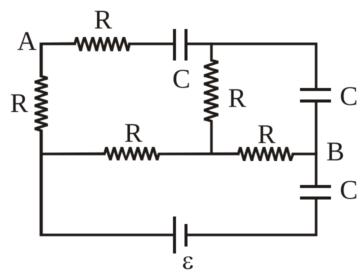
Q.67 A solid conducting sphere of radius r is having a charge Q and point charges +q and –q are kept at distances d from the center of sphere as shown in the figure. The electric potential at the centre of solid sphere



(1) $\frac{1}{4\pi\varepsilon_0}\left(\frac{Q}{r}+\frac{2q}{d}\right)$ (2) $\frac{1}{4\pi\varepsilon_0}\left(\frac{Q}{r}+\frac{Q-2q}{d}\right)$

(3) $\frac{1}{4\pi\varepsilon_0}\left(\frac{Q}{r}+\frac{q}{d}\right)$ (4) $\frac{1}{4\pi\varepsilon_0}\frac{Q}{r}$

Q.68 Consider the circuit in the adjacent figure. What will be potential difference between A and B in the steady state



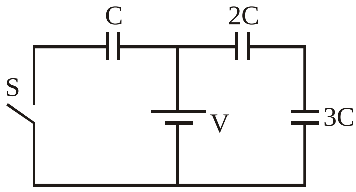
(1) ε (2) ε / 2 (3) ε / 3 (4) zero

Q.69 A charge q is placed at some distance along the axis of a uniformly charged disc of surface charge density σ C/m^2. The flux due to the charge q through the disc is ϕ. The electric force on charge q exerted by the disc is

(1) σϕ (2) $\frac{\sigma\phi}{4\pi}$ (3) $\frac{\sigma\phi}{2\pi}$ (4) $\frac{\sigma\phi}{3\pi}$

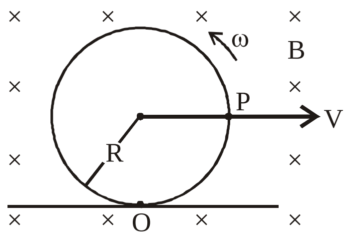
SPACE FOR ROUGH WORK

Q.70 In the given circuit diagram, find the heat generated on closing the switch S. (Initially the capacitor of capacitance C is uncharged)



(1) $\frac{3}{2}CV^2$ (2) CV^2 (3) $\frac{1}{2}CV^2$ (4) $2CV^2$

Q.71 A metallic ring of radius R moves in a vertical plane in the presence of a uniform magnetic field B perpendicular to the plane of the ring. At any given instant of time its centre of mass moves with a velocity v while ring rotates in its COM frame with angular velocity ω as shown in the figure. The magnitude of induced e.m.f. between points O and P is

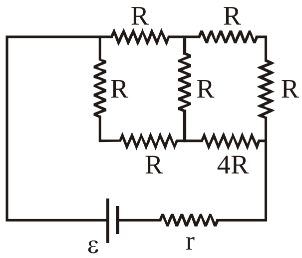


(1) zero (2) $vBR\sqrt{2}$ (3) vBR (4) 2 vBR

Q.72 An object is placed at 30 cm from a convex lens of focal length 15cm. On the other side of the lens a convex mirror of focal length 12cm is placed so that the principal axis of both coincide. It is observed that the object and image coincide (autocollimation). What is the separation between the lens and mirror?
(1) 6cm (2) 30cm (3) both (1) and (2) (4) none of the above

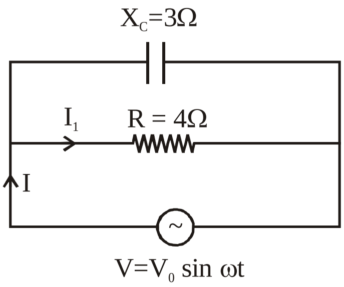
SPACE FOR ROUGH WORK

Q.73 The relation between R and r (internal resistance of the battery) for which the power consumed in the external part of the circuit is maximum



(1) $R = r$ (2) $R = \frac{r}{2}$ (3) $R = 2r$ (4) $R = 1.5\ r$

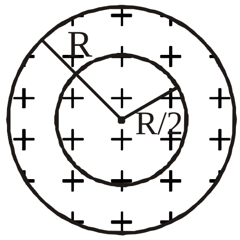
Q.74 A capacitor and resistor are connected with an A.C. source as shown in figure. Reactance of capacitor is $X_C = 3\Omega$ and resistance of resistor is 4Ω. Phase difference between current I and I_1 is



(1) 90° (2) zero (3) 53° (4) 37°

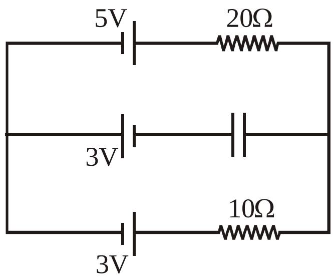
SPACE FOR ROUGH WORK

Q.75 Find the stress at distance $\frac{R}{2}$ from centre in a uniformly charged non conducting sphere having radius R and charge density ρ.



(1) $\frac{\rho^2 R^2}{24\varepsilon_o}$ (2) $\frac{\rho^2 R^2}{8\varepsilon_o}$ (3) $\frac{\rho^2 R^2}{6\varepsilon_o}$ (4) None of these

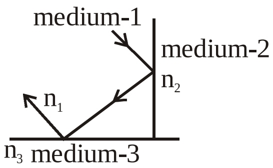
Q.76 The capacitor is initially uncharged. Find ratio of current through the 10 Ω resistance and through the 20 Ω resistance initially.



(1) 3/2 (2) 6/5 (3) 1/1 (4) 2/3

SPACE FOR ROUGH WORK

Q.77 In the diagram below, light is incident on the interface between media 1 and 2 as shown and is totally reflected. The light is then also totally reflected at the interface between media 1 and 3, after which it travels in a direction opposite to its initial direction. The two interfaces are perpendicular. The refractive indices are related as



(1) $n_1 < n_2 < n_3$ (2) $n_1^2 - n_3^2 < n_2^2$ (3) $n_1^2 - n_2^2 > n_3^2$ (4) $n_1^2 + n_2^2 > n_3^2$

Q.78 Which of the following transitions of He^+ ion will give rise to spectral line which has same wavelength as some spectral line in hydrogen atom ?
(1) n = 4 to n = 2 (2) n = 6 to n = 5 (3) n = 6 to n = 3 (4) None of these

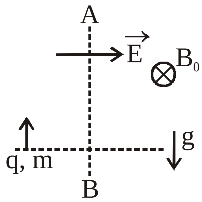
Q.79 Two imaginary spherical surfaces of radius R and 2R respectively surround a positive point charge Q located at the center of the concentric spheres. When compared to the number of field lines N_1 going through the sphere of radius R, the number of electric field lines N_2 going through the sphere of radius 2R is

(1) $N_2 = \frac{1}{4}N_1$ (2) $N_2 = \frac{1}{2}N_1$ (3) $N_2 = 2N_1$ (4) $N_2 = N_1$

Q.80 A radioactive sample contains two radioactive nucleus A and B having decay constant λ hr^{-1} and 2λ hr^{-1}. Initially 20% of decay comes from A. How long (in hr) will it take before 50% of decay comes from A. [Take $\lambda = ln\ 2$]
(1) 1 (2) 2 (3) 3 (4) None of these

SPACE FOR ROUGH WORK

Q.81 A uniform electric field $\vec{E}$ is present horizontally along the paper throughout region but uniform magnetic field B_0 is present (perpendicular to plane of paper in inward direction) right to the line AB as shown. A charge particle having charge q and mass m is projected vertically upward and crosses the line AB after time $t_0 = \frac{3}{20}$ seconds. Find the speed (in m/s) of projection if particle moves after t_0 with constant velocity. (Given : qE = mg)



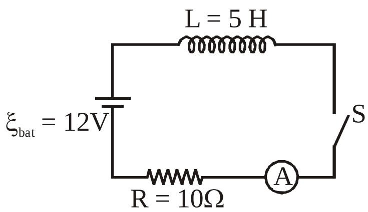
(1) 1 (2) 2 (3) 3 (4) 4

Q.82 In a moving coil galvanometer the number of turns N = 24, area of the coil $A = 2 \times 10^{-3}\ m^2$, and the magnetic field strength B = 0.2 T. To increase its current sensitivity by 25% we

(1) Increase B to 0.30 T (2) Decrease A to $1.5 \times 10^{-3}\ m^2$

(3) Increase N to 30 (4) None of the above

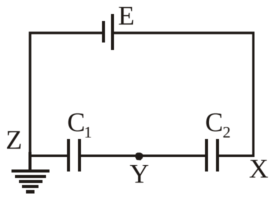
Q.83 For the ideal RL circuit shown, the resistance is R = 10 Ω, the inductance is L = 5 H and the battery has voltage ξ_{bat} = 12 volts. Some time after the switch S in the circuit is closed, the ammeter in the circuit reads 0.40 A. If the rate at which energy is being stored by the inductor at this instant is $\frac{16}{x}$ Watts, what is the value of x ?



(1) 20 (2) 15 (3) 10 (4) 5

SPACE FOR ROUGH WORK

Q.84 Capacitors C_1 and C_2 are connected in series with a battery of emf e = 30V. $V_x - V_y = 10V$ and $V_y - V_z = 20$ V. Then



(1) $C_1 = 2C_2$ (2) $C_2 = 3C_1$ (3) $C_1 = 3C_2$ (4) $C_2 = 2C_1$

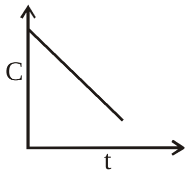
Q.85 Eight cells, each of emf 1.5V and internal resistance 0.5Ω, are available. The maximum power that can be obtained from them in an external resistance is

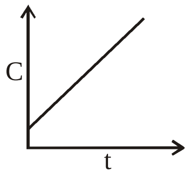
(1) 36W (2) 9W (3) 18W (4) 12W

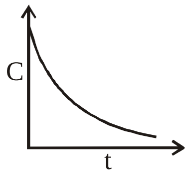
Q.86 A parallel beam of light, travelling in air, is incident at an angle of incidence 60° on a plane boundary of refractive index $\sqrt{3}$. The angle between incident and refracted wavefronts, is

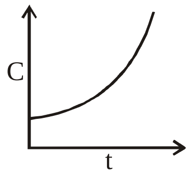
(1) 0° (2) 30° (3) 60° (4) 150°

Q.87 A parallel plate capacitor with a dielectric slab completely occupying the space between the plates is charged by a battery and then disconnected. The slab is pulled out with a constant speed. Which of the following curves represent qualitatively the variation of the capacitance C of the system with time ?

(1) 

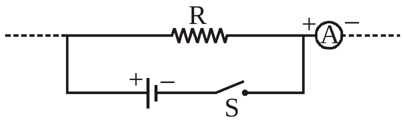
(2) 

(3) 

(4) 

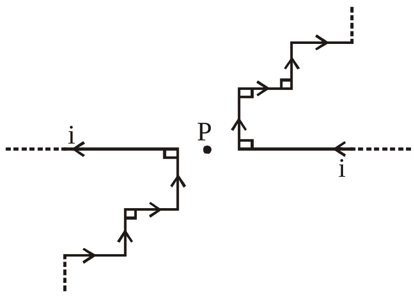
SPACE FOR ROUGH WORK

Q.88 The circuit shown is part of a larger circuit, shown by dotted lines. The switch S is initially open. The potential difference across R is equal to the emf of the ideal cell. The ammeter reading is I. If S is now closed, the ammeter reading will be



(1) zero (2) 2I (3) $\frac{I}{2}$ (4) I

Q.89 Two infinitely long conductors carrying equal currents are shaped as shown. The short sections are all of equal lengths. The point P is located symmetrically with respect to the two conductors. The magnetic field at P due to any one conductor is B. The total field at P is



(1) zero (2) B (3) $\sqrt{2}$ B (4) 2B

Q.90 A biconvex lens made of material with refractive index n_2. The radii of curvatures of its left surface and right surface are R_1 and R_2. The media on its left and right have refractive indices n_1 and n_3 respectively. The first and second focal lengths of the lens are respectively f_1 and f_2.

The ratio, $\frac{f_1}{f_2}$, of the two focal lengths is equal to

(1) $\frac{n_1}{n_3}$ (2) $\frac{(n_1-1)}{(n_3-1)}$ (3) $\frac{(n_1+1)}{(n_3+1)}$ (4) $\frac{(n_2+n_3)}{(n_2+n_1)}$

SPACE FOR ROUGH WORK

BANSAL CLASSES
PRIVATE LIMITED
Ideal for Scholars

ANSWER KEY

COURSE
NUCLEUS

JEE-MAIN MOCK TEST-5
XII

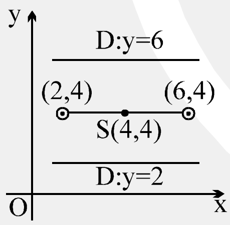
TEST CODE				
1	1	2	7	0

Q.No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans	2	3	2	1	1	3	2	4	1	1	1	4	4	4	2
Q.No.	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Ans	1	2	4	2	2	2	1	3	1	1	4	3	2	4	1
	PC	OC	IOC	PC	OC	IOC	PC	OC	IOC	PC	OC	IOC	PC	OC	IOC
Q.No.	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
Ans	4	3	1	1	4	2	2	2	3	1	2	4	3	3	2
	PC	OC	IOC	PC	OC	IOC	PC	OC	IOC	PC	OC	IOC	PC	OC	IOC
Q.No.	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
Ans	4	4	4	4	1	1	2	1	4	4	2	4	3	2	4
Q.No.	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
Ans	3	3	4	4	2	1	4	4	1	3	3	3	2	3	1
Q.No.	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
Ans	1	3	1	4	2	3	3	4	4	2	2	1	4	1	1

HINTS & SOLUTIONS

MATHEMATICS

Q.1 focus is (4, 4) & D can be y = 6 or y = 2



where 'O' is origin and S is the focus and D is directrix

Q.2 Apply $R_3 \to R_3 - R_1$, we get

$$\Delta = \begin{vmatrix} 1 & 3\cos\theta & 1 \\ \sin\theta & 1 & 3\cos\theta \\ 0 & \sin\theta - 3\cos\theta & 0 \end{vmatrix}$$

$= (3\cos\theta - \sin\theta)^2$

So, maximum value of Δ equals 10.

We have $- 4z = \bar{z}^2 - 4\bar{z}$

$\Rightarrow (z - \bar{z})\ (z + \bar{z} - 4) = 0$

$\Rightarrow z = \bar{z} = x\ (x \neq 2)$

So, $x^2 = 4x + x^2 + \dfrac{16}{|x|^3} \Rightarrow x = \dfrac{-4}{|x|^3}$

$\Rightarrow x = -\sqrt{2}$

$\therefore z = -\sqrt{2}$

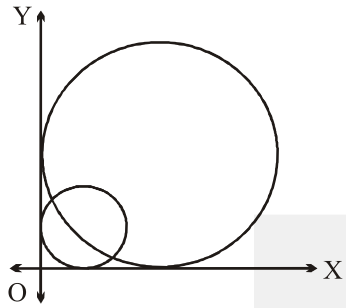
Hence only one z will satisfy above equation.

Q.4 Circle is $(x - r)^2 + (y - r)^2 = r^2$

$\Rightarrow \quad x^2 + y^2 - 2xr - 2yr + r^2 = 0$

Hence the circles are

$x^2 + y^2 - 2xr_1 - 2yr_1 + r_1{}^2 = 0$ ......(1)



$x^2 + y^2 - 2xr_2 - 2yr_2 + r_2^2 = 0$ .....(2)

As (1) and (2) are orthogonal so

$$2r_1r_2 + 2r_1r_2 = r_1^2 + r_2^2$$

$$4\frac{r_1}{r_2} = \left(\frac{r_1}{r_2}\right)^2 + 1$$

$$\Rightarrow \left(\frac{r_1}{r_2}\right)^2 - 4\left(\frac{r_1}{r_2}\right)^2 + 1 = 0$$

$$\Rightarrow \frac{r_1}{r_2} = \frac{4 \pm \sqrt{16-4}}{2} = \frac{2 \pm 2\sqrt{3}}{2}$$

$$= 2 + \sqrt{3} \text{ or } 2 - \sqrt{3} \text{ (rejected)}$$

Q.6 $2x\,dx - 3y\,dy = 0$ gives, on integration,

$x^2 - 3\dfrac{y^2}{2} = \dfrac{c}{2}$. The solution represents a family of hyperbolas given by $\dfrac{x^2}{\frac{c}{2}} - \dfrac{y^2}{\frac{c}{3}} = 1$

whose eccentricity $= \sqrt{\dfrac{\frac{c}{2}+\frac{c}{3}}{\frac{c}{2}}} = \sqrt{\dfrac{5}{3}}$, if $c > 0$

and eccentricity $= \sqrt{\dfrac{5}{2}}$, if $c < 0$. For $c = 0$, it gives a pair of lines which are the asymptotes of the hyperbolas.

Q.7 $L : (y - 4) = \dfrac{-1}{3}(x - 1)$

put $y = 0$, $x = 13$

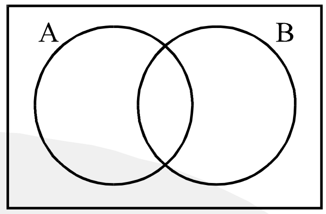
Q.8 $B = AA^T$.

Hence, det.

$B = |A A^T| = |A||A^T| = |A|^2 = 4^2 = 16.$

Q.9 Total $-$ $n(A \cup B)$

$$\frac{6!}{2!2!} - \left(n(A) + n(B) - n(A \cap B)\right)$$



Set A represents number of ways when G's are together
Set B represents number of ways when E's are together

$$\frac{6!}{2!2!} - \left(\frac{5!}{2!} + \frac{5!}{2!} - 4!\right) = 180 - 96 = 84$$

Aliter: GG EE A R

Number of words when

G's are separated $= \dfrac{4!}{2!}\cdot {}^5C_2 = 120$

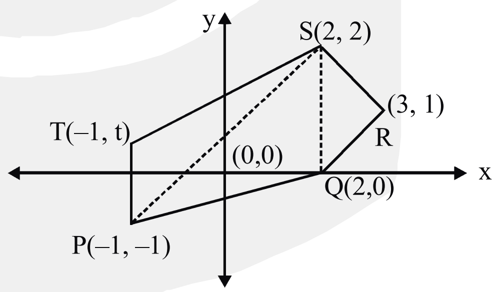
Number of words when G's are separated but E's are together $= 3! \times {}^4C_2 = 36$

$\therefore$ Number of ways when no two alike letters are together $= 120 - 36 = 84$

Q.10 We have $\sin\alpha = \dfrac{3}{5}$, $\cos\beta = \dfrac{2+2}{\sqrt{5}\sqrt{5}} = \dfrac{4}{5}$

So, $(\cos^2\alpha + \sin^2\beta) = \dfrac{16}{25} + \dfrac{9}{25} = 1.$

Q.11



Area of pentagon PQRST = 7

$\Rightarrow$ ar.(trapezium PQST) + ar.(ΔQRS) = 7

$$\Rightarrow \frac{1}{2}\left((t+1)+2\right) \times 3 + \frac{1}{2}(2)(1) = 7$$

$\Rightarrow$ $t = 1$ **Ans.**

Q.12 $\begin{vmatrix} 2 & 1 & 1 \\ 3 & 2\lambda & 4 \\ 1 & 1 & -3\lambda \end{vmatrix} = 0$;

$$\begin{vmatrix} 1 & 0 & 1 \\ 3-3\lambda & 2\lambda-4 & 4 \\ 0 & 1+3\lambda & -3\lambda \end{vmatrix} = 0 \;;$$

$$\begin{vmatrix} 0 & 0 & 1 \\ -2\lambda-1 & 2\lambda-4 & 4 \\ 3\lambda & 1+3\lambda & -3\lambda \end{vmatrix} = 0$$

$(3\lambda + 1)(2\lambda + 1) + 3\lambda(2\lambda - 4) = 0$

$\Rightarrow \quad 6\lambda^2 + 5\lambda + 1 + 6\lambda^2 - 12\lambda = 0$

$\Rightarrow \quad 12\lambda^2 - 7\lambda + 1 = 0$

$\Rightarrow \quad (3\lambda - 1)(4\lambda - 1) = 0$

$\Rightarrow \quad \lambda = \frac{1}{3}, \frac{1}{4} \Rightarrow$ Sum $= \frac{7}{12}$ **Ans.**

Q.14 Distance between centre and focus = ae = 10

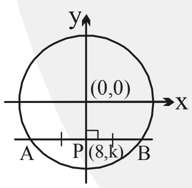
Distance between directrices $= \frac{2a}{e} = 4$

$\therefore \frac{ae}{\frac{2a}{e}} = \frac{10}{4} \Rightarrow e^2 = 5 \Rightarrow \frac{4e^2}{5} = 4.$

Q.15 The slope of the chord is $m = -\frac{8}{k}$

$\Rightarrow \quad k = \pm 1, \pm 2, \pm 4, \pm 8$

but (8, k) must also lie inside the circle $x^2 + y^2 = 125$



$\Rightarrow \quad 64 + k^2 - 125 < 0$

$\Rightarrow \quad k^2 < 61$

$\Rightarrow$ k can be equal to $\pm 1, \pm 2, \pm 4$

$\Rightarrow$ 6 values

Q.16 $\big|\,|z-(1+2i)| - |z-(3+4i)|\,\big| = 2$

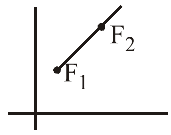
represents a hyperbola with foci (1, 2) and (3, 4) and length of transverse axis = 2.

$\therefore 2a = 2 \Rightarrow a = 1$

$\because$ Feet of perpendiculars from foci on any tangent lie on auxilliary circle of the hyperbola.

$\therefore$ Locus will be auxilliary circle.

$\therefore$ Centre = mid point of foci = (2, 3)



and radius = semi transverse axis = 1

$\therefore$ Equation of auxilliary circle is $|z-(2+3i)| = 1$

Q.17 $\square\square\square\boxed{0}\square\square\square = \frac{6!}{2!\,3!\,1!} = 60$

$\square\square\square\square\square\square\boxed{5} = \frac{6!}{2!\,3!\,1!} - \frac{5!}{2!\,3!}$

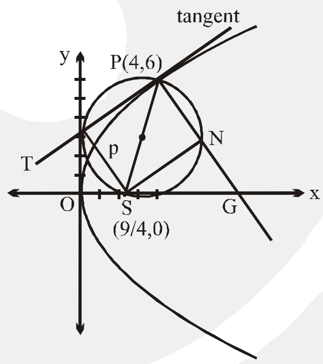
$= 50 \quad \Rightarrow \quad 60 + 50 = 110$]

Q.18 In dual statement $\vee$ replace by $\wedge$ and $\wedge$ replace by $\vee$ so answer is $(p \wedge \sim q) \vee (\sim p)$.

Q.19 Required intercept will be equal to the perpendicular distance from the focus on the tangent at P.

Tangent at P,

$y \cdot 6 = 2 \cdot \frac{9}{4}(x + 4)$



$\Rightarrow 12y = 9x + 36$

$\Rightarrow 9x - 12y + 36 = 0$

$$p = \left|\frac{\frac{81}{4} + 36}{\sqrt{81+144}}\right| = \left|\frac{225}{4 \cdot 15}\right| = \frac{15}{4}$$

Q.20 E : $\frac{x^2}{9}+\frac{y^2}{4}=1 \Rightarrow P\,(3\cos\theta, 2\sin\theta)$

and C (0, 0)

$m_{CP}=\frac{2\tan\theta}{3}$; $m_T=\frac{-2\cot\theta}{3}$

$\therefore$ angle between then $=\frac{2}{3}\left|\frac{\tan\theta+\cot\theta}{1-\frac{4}{3}}\right|$

$\therefore$ angle is minimum, when $\theta=45°$

$\Rightarrow\ P\left(\frac{3}{\sqrt{2}},\sqrt{2}\right)$.

Q.21 $\sum_{i=1}^{20}(x_i-30)=20$

$\sum x_i - \sum 30 = 20$

$\sum x_i - 30\times 20 = 20$

$\sum x_i = 620$

Mean $=\frac{\sum x_i}{20}=\frac{620}{20}=31$.

Q.22 We have $[\hat{a}\ \ \hat{b}\ \ \hat{a}\times\hat{b}]=\frac{1}{4}$

$\Rightarrow (\hat{a}\times\hat{b})\cdot(\hat{a}\times\hat{b})=\frac{1}{4} \Rightarrow |\hat{a}\times\hat{b}|=\frac{1}{4}$

$\Rightarrow \sin^2\theta=\frac{1}{4} \Rightarrow \sin\theta=\frac{1}{2}$

Hence $\theta=\frac{\pi}{6}$ $\left(\text{As } |\vec{a}|=1=|\vec{b}|\right)$

Q.25 We have $z=\frac{2^8\left(\sqrt{3}+i\right)^8}{(1-i)^6}+\frac{(1+i)^6}{2^8\left(\sqrt{3}-i\right)^8}$

$=\frac{2^8\left(2e^{\frac{i\pi}{6}}\right)^8}{\left(\sqrt{2}\,e^{\frac{-i\pi}{4}}\right)^6}+\frac{\left(\sqrt{2}\,e^{\frac{i\pi}{4}}\right)^6}{2^8\left(2e^{\frac{-i\pi}{6}}\right)^8}$

$=\frac{2^{16}e^{\frac{i4\pi}{3}}}{2^3e^{\frac{-3\pi i}{2}}}+\frac{2^3e^{\frac{3\pi i}{2}}}{2^{16}e^{\frac{-4\pi i}{3}}}$

$=2^{13}e^{i\left(\frac{4\pi}{3}+\frac{3\pi}{2}\right)}+\frac{1}{2^{13}}e^{i\left(\frac{3\pi}{2}+\frac{4\pi}{3}\right)}$

$=\left(2^{13}+\frac{1}{2^{13}}\right)e^{i\left(\frac{4\pi}{3}+\frac{3\pi}{2}\right)}$

Hence $|z|=2^{13}+\frac{1}{2^{13}}$ and

amp $z=\frac{4\pi}{3}+\frac{3\pi}{2}-2\pi=\frac{5\pi}{6}$

Q.26 L_1 and L_2 are intersecting lines.

The position vector of their point of intersection is $5\hat{i}-7\hat{j}+6\hat{k}$ (For $\lambda=2$ or $\mu=1$).

Also, angle between L_1 and $L_2=\frac{70}{11\sqrt{42}}$.

Q.27 Since, both the planes are parallel

$P_1 : 4x-6y+12z+10=0$

$P_2 : 4x-6y+12z+d=0$

$b=-6,\ c=12$

Now, $\left|\frac{d-10}{2\sqrt{4+9+36}}\right|=3$

$|d-10|=42 \Rightarrow d=52$ or -32

$\therefore$ P_2 is $4x-6y+12z+52=0$

or $4x-6y+12z-32=0$

$\because$ Point (–3, 0, –1) is lying between planes P_1 and P_2

$\therefore$ On substituting the point in the equation of the planes both expressions must be of opposite sign.

From P_1 :

$4\times(-3)-6\times 0+12(-1)+10=-ve$

From P_2 :

$4\times(-3)-6\times 0+12(-1)+52=+ve$

$\therefore$ d must be 52

Hence, $(b+c+d)=-6+12+52=58$

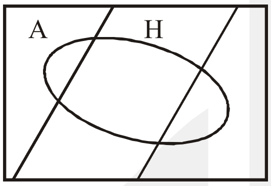
Q.28 H : Victim was hit

A : Event that Mr. A was given the live bullet ; $P(A) = \frac{1}{3}$

B : Mr. B had live bullet ; $P(B) = \frac{1}{3}$

C : Mr. C has live bullet ; $P(C) = \frac{1}{3}$

$$P(C/H) = \frac{P(C \cap H)}{P(H)} = \frac{P(C) \cdot P(H/C)}{P(H)}$$



$$P(H) = P(H \cap C) + P(H \cap B) + P(H \cap A)$$

$$= \frac{1}{3}\,[P(H/C) + P(H/B) + P(H/A)]$$

$$= \frac{1}{3}\,[0.8 + 0.7 + 0.6] = \frac{0.21}{3}$$

$$P(C/H) = \frac{0.8}{0.21} = \frac{8}{21}$$

Q.29 $(a, a) \in R$ since $a = 3^0 \cdot a$

$\Rightarrow$ R is reflexive

if $(a, b) \in R \Rightarrow a = 3^k \cdot b,\ k \in I$

$\Rightarrow b = 3^{-k} \cdot a,\ -k \in I \Rightarrow (b, a) \in R$

$\Rightarrow$ R is symmetric

if (a, b) and $(b, c) \in R$

$\Rightarrow a = 3^{k_1} \cdot b,\ b = 3^{k_2} \cdot c, \quad k_1, k_2 \in I$

$\Rightarrow a = 3^{k_1 + k_2} \cdot c,\ -(k_1 + k_2) \in I$

$\Rightarrow (a, c) \in R \Rightarrow$ R is transitive.

$\therefore$ R is an equivalence relation

Q.30 Solving the equation of planes, we get equation of line containing planes

$$\frac{x}{0} = \frac{y}{-10} = \frac{z}{-5} \qquad ....(1)$$

Any point P on (1) is $(0, -10\lambda, -5\lambda)$.

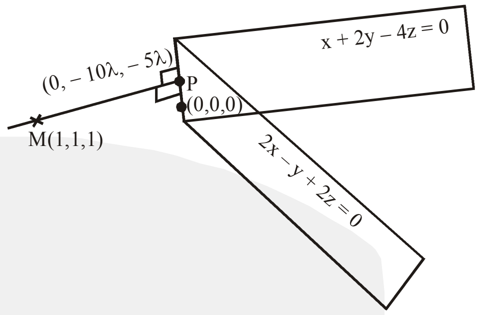
Now, direction ratios of the line joining P and M is $\langle 1, 1+10\lambda, 1+5\lambda \rangle$

As line MP is perpendicular to line (1), so

$0\,(1) - 10\,(1 + 10\lambda) - 5\,(1 + 5\lambda) = 0$

$\Rightarrow \lambda = \frac{-3}{25} \Rightarrow P\left(0, \frac{6}{5}, \frac{3}{5}\right)$

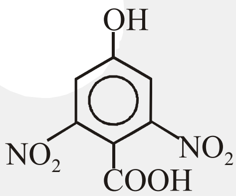
So, d.r's of MP are $\left\langle -1, \frac{1}{5}, \frac{-2}{5} \right\rangle$



So, equation of required line is $\frac{x-1}{5} = \frac{y-1}{-1} = \frac{z-1}{2}$. **Ans.**

CHEMISTRY

Q.31 Theory based

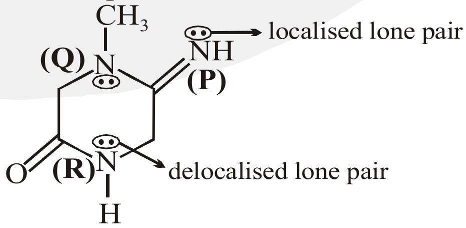
Q.32 

Due to S.I.R. effect

Q.33 As we move left to right metallic character decreases and as we move top to bottom metallic character increases, so correct is

P (group15) < Si (group14) < Be (group 2 II period) < Mg (group 2 III period) < Na (group1)

Q.34 Theory based

Q.35 

Basicity order of indicated atoms P, Q, R is

P > Q > R

Q.36 Theory based

Q.37 $n_{mix} = \left(\dfrac{1 \times 0.0249}{0.083 \times 300}\right) \text{mol} = 0.001 \text{ mol}$

$\therefore\ n_{O_2} = n_{F_2} = \dfrac{0.001}{2}$ mol

$\therefore\ n_{O_2F_2}$ (decomposed) $= \dfrac{0.001}{2}$ mol.

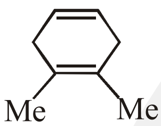
$\therefore\ m_{O_2F_2}$ (decomposed) =

$\dfrac{0.001}{2} \times 70\text{g} = (0.001 \times 35)\text{g}$

$\therefore$ % of O_2F_2 decomposed =

$\dfrac{0.001 \times 35}{0.1} \times 100\% = 35\ \%$ **Ans.**

Q.38



Cyclohexene does not show Geometrical Isomerism

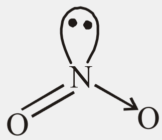
Q.40 $n_{Ba^{2+}} = n_{BaSO_4} = \dfrac{0.233}{233}$ mol

$\therefore\ [Ba^{2+}] = \left(\dfrac{0.233/233}{50/1000}\right)$ M

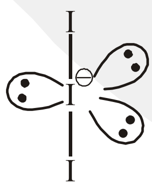
$= \left(\dfrac{1000}{50} \times \dfrac{0.233}{233}\right)$M

Q.41 Ethers are more volatile than same number of carbon containing alcohol due to absence of H-bonding.

Q.42 (1) NO_2

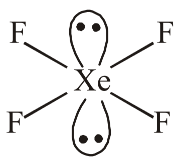


(2) I_3^-



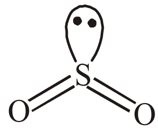
(Linear)

(3) XeF_4



(Square planar)

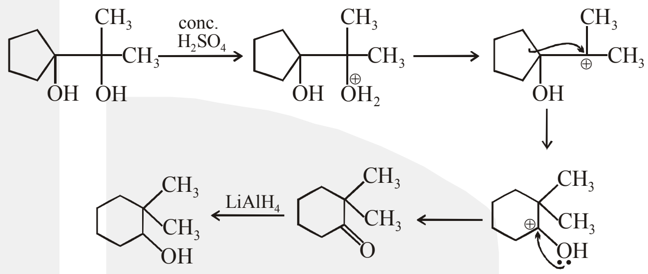
(4) SO_2



(Bent, due to lone pair-bond pair repulsion)

Q.43 Theory based

Q.44



Q.45 (1) $H_2 + Cl_2 \longrightarrow$

2HCl → H^+ act as reducing agent
→ Cl^-

(2) $2Na + H_2 \longrightarrow$

2NaH → Na^+
→ H^- act as oxidising agent

(3) $Cu_2O + H_2 \longrightarrow 2Cu + H_2O$
→ act as reducing agent

(4) $RCHO + H_2 \longrightarrow R - CH_2 - OH$
→ act as reducing agent

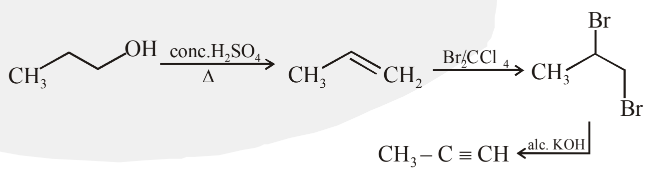
Q.46 Empirical formula of the compound $= Tl_{\frac{89.5}{204}} O_{\frac{10.5}{16}}$

$= Tl_{0.439}\ O_{0.656} = TlO_{1.5}$

i.e. E.F. $= Tl_2O_3$

$\therefore$ O.N. of $Tl = +3$

Q.47



Q.48 (1) $Na + H_2O \longrightarrow 2Na^+ + 2OH^- + H_2$ (redox)

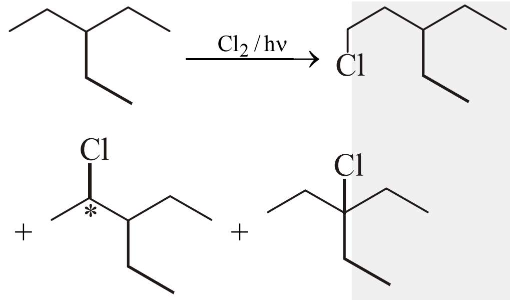
(2) $P_4O_{10} + H_2O \longrightarrow H_3PO_4$ (Hydorlysis)

(3) $CrCl_3 + H_2O \longrightarrow CrCl_3.6H_2O$ (Hydrated formation)

(4) $BaSO_4 + H_2O \longrightarrow$ ppt. formation (Insoluble)

Q.49 Theory based

Q.50



(1) (2) (1)

Total products = 4

Q.51 (1) $Na(s) + NH_3\ (liq.) \longrightarrow Na^+\ (ammoniated) + e^- + NH_2\uparrow$

(2) $Na(s) + O_2\ (excess) \longrightarrow Na_2O_2$

(3) $Na(s) + H_2O \longrightarrow NaOH + H_2$

(4) $Na(s) + H_2 \longrightarrow NaH$

Q.52 $E_{2s} = -13.6 \times \frac{1^2}{2^2}\,eV = -E$

and $E_{3p} = -13.6 \times \frac{1^2}{3^2}\,eV$

$\therefore \frac{E_{3p}}{E_{2s}} = \frac{4}{9}$

$\therefore E_{3p} = -\frac{4}{9}E$

Q.53 $C_2H_5 - Cl \xrightarrow[S_N2]{KCN} C_2H_5 - CN \xrightarrow{Na/C_2H_5OH} C_2H_5 - CH_2 - NH_2$

Q.54 As we move top to bottom basic nature of oxide increases.

Q.55 In 1L hard water equivalent

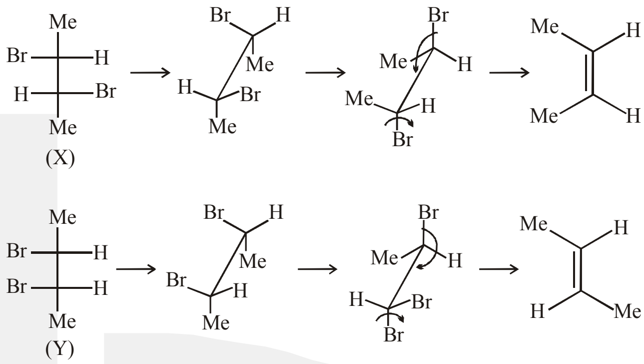
$$n_{CaCO_3} = \left(\frac{1.11}{111} + \frac{4.75}{95}\right) \times 5\ mmol.$$

$= 0.3\ mmol$

$\therefore m_{CaCO_3} = (0.3 \times 100)\ mg = 30\ mg$

$\therefore$ Hardness of water = 30 mg/L = 30 ppm

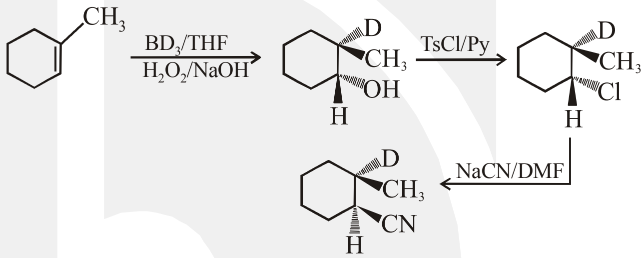
Q.56



Q.57 $Na_2B_4O_7\ (Borax) + 7H_2O \longrightarrow 2NaOH + 4H_3BO_3$ (Ortho boric acid)

Q.58 Theory based

Q.59



Q.60 (i) $2SO_2\ (g) + O_2(g) \xrightarrow{V_2O_5} 2SO_3\ (g)$

$SO_3(g) + H_2SO_4 \longrightarrow H_2S_2O_7$ (oleum)

$H_2S_2O_7 + H_2O \longrightarrow 2H_2SO_4$

(ii) $N_2\ (g) + 3H_2\ (g) \rightleftharpoons 2NH_3\ (g)$

(iii) $C(s) + H_2O\ (g) \xrightarrow{473K-1273K} CO(g) + H_2\ (g)$ water gas

(iv) $4NH_3(g) + 5O_2\ (g) \xrightarrow[500K,\,9\,bar]{Pt/Rhy\ Gauge\ catalyst} 4NO(g) + 6H_2O(g)$

$2NO\ (g) + O_2\ (g) \rightleftharpoons 2NO_2\ (g)$

$3NO_2\ (g) + H_2O\ (l) \longrightarrow 2HNO_3\ (aq.) + NO\ (g)$

PHYSICS

Q.61 $\frac{L}{M}=\frac{2m}{q} \Rightarrow M=\frac{Lq}{2m}=\frac{I\omega q}{2m}=\frac{ml^2\omega q}{24m}$

Q.62 $\frac{1}{C}=\frac{1}{C_1}+\frac{1}{C_2}$

$=\frac{x}{\varepsilon_0 A}+\frac{a-b-x}{\varepsilon_0 A} \Rightarrow C=\frac{\varepsilon_0 A}{a-b}$

Q.63 Coulombic force between them remains same.

$v_i=\frac{1}{2}\frac{6}{5}CV^2$; $q_i=\frac{6}{5}CV$; $q_f=\frac{11}{5}CV$

$U_f=\left(\frac{1}{2}\frac{6}{5}CV^2+\frac{1}{2}CV^2\right)$

Charge flown from battery = CV
Work done = CV^2
Heat produced $\Delta H=\Delta U+\Delta W$

$=\left[\left(\frac{1}{2}\frac{6}{5}CV^2+\frac{1}{2}CV^2\right)-\frac{1}{2}\frac{6}{5}CV^2\right]-CV^2$

$=-\frac{1}{2}CV^2$

Q.64 Potential across capacitor is zero, hence energy stored is zero.

Q.65 $\omega=0+1\times10=10$ rad/sec^2
$\therefore$ $v=r\omega=1\times10=10$ m/s

$\overline{B}=\frac{\mu_0}{4\pi}\frac{q(\vec{V}\times\vec{r})}{r^3} \Rightarrow |\overline{B}|=\frac{\mu_0 qv}{4\pi r^2}$

$B=\frac{10^{-7}\times0.1\times10}{(1)^2}=10^{-7}T$

Q.66 $i=\sqrt{5}A$

$\frac{q_m^2}{2C}=\frac{q^2}{2C}+\frac{1}{2}Li^2 \Rightarrow q_{max}=6C$

Q.67 $V_{centre}=\frac{kq}{d}-\frac{kq}{d}+\frac{\Sigma kQ_{in}}{r}=\frac{kQ}{r}$

Q.68 There will be no current any where in the circuit.

Q.69 $\phi=\frac{q}{\varepsilon_0}\times\frac{2\pi(1-\cos\theta)}{4\pi}$

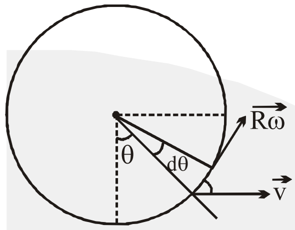
$\phi=\frac{q}{2\varepsilon_0}(1-\cos\theta)$

and $F=qE=q\cdot\frac{\sigma}{2\varepsilon_0}(1-\cos\theta)$

Q.70 Only charge is that capacitor 'C' will get charged.

Hence heat $=\frac{1}{2}CV^2$.

Q.71



$dl=R d\theta$

$dl=(\vec{v}\times\vec{B}).dl$

$=\left[(\vec{v}+\overrightarrow{R\omega})\times B\right].\overrightarrow{dl}$

$=(\vec{v}\times\vec{B}).\overrightarrow{dl}+(\overrightarrow{R\omega}\times\vec{B}).\overrightarrow{dl}$

$=(\vec{v}\times\vec{B}).Rd\theta$

$=vBRd\theta\cos\theta$

$e=vBR\int_0^{\pi/2}\cos\theta\,d\theta$

$|e|=vBR$

Q.72 For image to be coincident, either the rays should retrace or the image due to the lens should formed just at the pole of the mirror in thin case. The image formed due to lens is at 30 cm (2f) be from the lens. Thus either this image should be at centre of curvature of the convex mirror or at the pole of the mirror. Hence 6cm or 30cm should be the separation between the lens and the mirror.

Q.73 Its a wheat stone bridge with equivalent 2R.

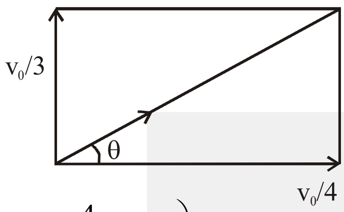
Q.74 Let I_2 be current in capacitor

$I_1=\frac{v_0}{4}\sin\omega t$

$I_2=\frac{v_0}{3}\sin(\omega t+\pi/2)$

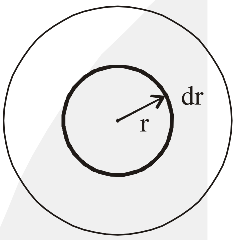
$$I = I_1 + I_2 = \frac{v_0}{4}\sin\omega t + \frac{v_0}{3}\sin(\omega t + \pi/2)$$

$$\tan\theta = \frac{v_0/3}{v_0/4}$$



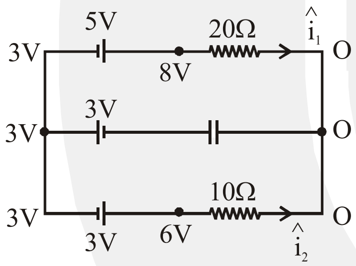
Q.75 $$(4\pi r^2)dp = \left(\frac{1}{4\pi\epsilon_0}\frac{\rho\frac{4}{3}\pi R^3}{R^3}r\right)\rho 4\pi r^2 dr$$

$$\int_0^P dp = \frac{\rho^2}{3}\int_0^r r\,dr$$



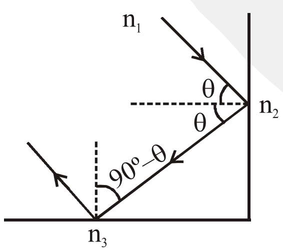
$$p = \frac{\rho^2}{3}\frac{r^2}{2} = \frac{\rho^2}{6} = \left(\frac{R^2}{4}\right) = \frac{\rho^2 R^2}{24}$$

Q.76



$$\frac{i_2}{i_1} = \frac{6/10}{8/20} = \frac{6}{10}\times\frac{20}{8} = \frac{6}{4} = \frac{3}{2}$$

Q.77



At 1 – 2, $\theta > i_c \Rightarrow \sin\theta > \frac{n_2}{n_1}$ ...(1)

and at 1 – 3, $90° - \theta > i_c \Rightarrow \cos\theta > \frac{n_3}{n_1}$

$\Rightarrow \sin^2\theta < 1 - \frac{n_3^2}{n_1^2}$ ...(2)

$\therefore$ from (1) and (2), $n_1^2 - n_2^2 > n_3^2$

Q.78 If $n_2 \to n_1$ in H (z = 1) gives λ
then $z n_2 \to z n_1$ gives λ in H-like ion
for He^+ ion, z = 2

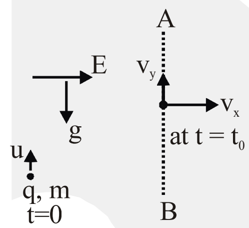
Q.79 No. of field lines $\propto \phi = \frac{q_{in}}{\varepsilon_0}$

Q.80 At t = 0, $\frac{A_{0_A}}{A_{0_B}} = \frac{25}{75} = \frac{1}{3}$ ...(1)

at t = t, $\frac{A_{t_A}}{A_{t_B}} = \frac{A_{0_A}e^{-\lambda t}}{A_{0_B}e^{-2\lambda t}} = \frac{75}{25} = 3$ ...(2)

$\therefore$ from (1) and (2), $e^{\lambda t} = 9$
$\Rightarrow \lambda t = 2\ln 3 \Rightarrow t = 2.$

Q.81



$t \le t_0 : v_x = \frac{qE}{m}t_0 = g\,t_0$

$v_y = u - gt_0$

just after AB, $\vec{v}$ = constant $\Rightarrow \vec{F}_{net} = 0$

$\Rightarrow q\vec{E} + q(\vec{v}\times\vec{B}) + m\vec{g} = 0$

$\Rightarrow qE\,\vec{i} + qv_x B\,\vec{j} - q v_y B\,\vec{i} - mg\,\vec{j} = 0$
$\Rightarrow E = B(u - gt_0)$ and $qB\,t_0 = m$
$\Rightarrow u = 2gt_0 = 3$ m/s.

Q.82 $K = \frac{\theta}{i} = \frac{NAB}{C} \propto NAB$

$\therefore$ To increase K by 25% either N or A or B should be increased by 25%

Q.83 $\frac{dU}{dt} = \frac{d}{dt}\left(\frac{1}{2}Li^2\right) = Li\frac{di}{dt}$

By KVL, $L\frac{di}{dt} + i(10) = 12$

$$\Rightarrow L\frac{di}{dt} = 8 \text{ when } i = 0.4A$$

$$\Rightarrow Li\frac{di}{dt} = 3.2 = \frac{16}{x} \Rightarrow x = 5$$

Q.84 $V_{C_1} = 20$ V

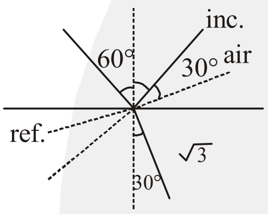
$$\Rightarrow V_{C_2} = E - V_{C_1} = 10 \text{ V}$$

$$\frac{C_1}{C_2} = \frac{V_{C_2}}{V_{C_1}} = \frac{1}{2} \Rightarrow C_2 = 2C_1$$

Q.85 $E_{eq} = 8\varepsilon = 8 \times 1.5 = 12$ V
$r_{eq} = 8r = 8 \times 0.5 = 4\Omega$
$\therefore$ For P_{max}, $R_{ext} = r_{eq} = 4\Omega$

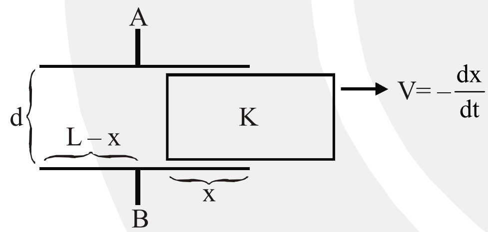
$$\Rightarrow P_{max} = \frac{\varepsilon_{eq}^2}{4r_{eq}} = 9W$$

Q.86 $1 \sin 60° = \sqrt{3} \sin\phi$



$\phi = 30°$

Q.87



$$C_{AB} = C = C_{air} + C_{slab}$$

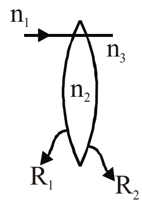
$$\Rightarrow C = \frac{\epsilon_0 b}{d}[L + (K - 1)x]$$

$$\therefore \frac{dc}{dt} = -\frac{\epsilon_0 b}{d}(K - 1)V \Rightarrow -\text{ve constant}$$

Q.88 No change in p.d across 'R' = ammeter reads I only

Q.89 By symmetry $\vec{B}_P$ due to left and right conductors cancel each other.

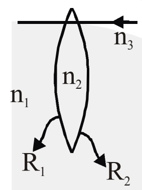
Q.90



$$\frac{n_2}{v_1} - \frac{n_1}{\infty} = \frac{n_2 - n_1}{R_1}$$

$$\text{and } \frac{n_3}{f_2} - \frac{n_2}{v_1} = \frac{n_3 - n_2}{-R_2}$$

$$\Rightarrow \frac{n_3}{f_2} = \frac{n_2 - n_1}{R_1} + \frac{n_2 - n_3}{R_2} \quad ....(1)$$



$$\frac{n_2}{v_1} - \frac{n_3}{\infty} = \frac{n_2 - n_3}{R_2}$$

$$\text{and } \frac{n_1}{f_1} - \frac{n_2}{v_1} = \frac{n_1 - n_2}{-R_1}$$

$$\Rightarrow \frac{n_1}{f_1} = \frac{n_2 - n_1}{R_1} + \frac{n_2 - n_3}{R_2} \quad ....(2)$$

$$\therefore \text{ from (1) and (2)}, \frac{f_1}{f_2} = \frac{n_1}{n_3}$$