MELUHA INTERNATIONAL SCHOOL

HYDERABAD

SR MPC | **JEE MAINS UNIT TEST-5** | **Time: 3:00 Hrs.**
Date: 10-05-2020 | **Max. Marks: 300 M**

MATHEMATICS
SECTION-I
(SINGLE CORRECT ANSWER TYPE)

This section contains 20 multiple choice questions. Each question has 4 options (1), (2), (3) and (4) for its answer, out of which ONLY ONE option can be correct.

Marking Scheme: +4 for correct answer, 0 if not attempted and -1 if not correct

SYLLABUS: 3D AND VECTOR ALGEBRA

1. **If G is centroid of ΔABC, G^1 is centroid of $\Delta A^1B^1C^1$ then $\overline{AA^1}+\overline{BB^1}+\overline{CC^1}=$**

1) $\bar{0}$ 2) $\overline{GG^1}$ 3) $2\overline{GG^1}$ 4) $3\overline{GG^1}$

2. **If $\overline{AB}=-3\bar{i}+4\bar{k}.\overline{BC}=-\bar{i}-2\bar{k}$ are the sides of the triangle ABC. Then length of the median Am is**

1) $\sqrt{\frac{25}{2}}$ 2) $\sqrt{\frac{45}{2}}$ 3) $\sqrt{\frac{65}{2}}$ 4) $\frac{\sqrt{85}}{2}$

3. **Two sides of a parallelogram are given by $2\bar{i}+4\bar{j}-2\bar{k}$ and $\bar{i}+2\bar{j}$. Then length of diagonals are**

1) $\sqrt{24},\sqrt{5}$ 2) 9,49 3) 7, 3 4) $\sqrt{24},\sqrt{6}$

4. **If $\bar{a},\bar{b},\bar{c}$ are unit vectors and the maximum value of $|\bar{a}-\bar{b}|^2+,|\bar{b}-\bar{c}|^2+|\bar{c}-\bar{a}|^2$ is k then $k\left(2\bar{a}^2+3\bar{b}^2-4\bar{c}^2\right)=$**

1) 6 2) 8 3) 9 4) 12

5. **If $P(x_1,y_1),Q(x_2,y_2)$ are two points on the curve $y=x^2+3x+1$.If $\overline{OP}.\bar{i}=1,\overline{OQ}.\bar{i}=-1.$ Then $\left|2\overline{OP}+3\overline{OQ}\right|=$**

1) $2\sqrt{5}$ 2) $5\sqrt{2}$ 3) 8 4) 11

6. **In ΔABC $\overline{OA}=\bar{a},\overline{OB}=\bar{b},\overline{OC}=\bar{c}$. If $P(\bar{r})$ is any point in the plane of ΔABC such that $\bar{b}.\bar{c}+\bar{a}.\bar{r}=\bar{c}.\bar{a}+\bar{b}.\bar{r}=\bar{a}.\bar{b}=\bar{c}.\bar{r}$ then P is ___of the ΔABC**

1) incentre 2) circum centre 3) orthocentre 4) centroid

7. **If $\overline{AB}=\bar{b},\overline{AC}=\bar{c}$ then the length of the perpendicular from A to the line BC is**

1) $\left|\frac{\bar{b}\times\bar{c}}{\bar{b}+\bar{c}}\right|$ 2) $\left|\frac{\bar{b}\times\bar{c}}{\bar{b}-\bar{c}}\right|$ 3) $\frac{1}{2}\left|\frac{\bar{b}\times\bar{c}}{\bar{b}-\bar{c}}\right|$ 4) $2\left|\frac{\bar{b}\times\bar{c}}{\bar{b}-\bar{c}}\right|$

8. **A tetrahedron has vertices P(1,2,1), Q(2,1,3), R(-1,1,2) and O(0,0,0) then the angle between the faces OPQ and PQR is**

1) $\cos^{-1}\left(\frac{19}{35}\right)$ 2) $\cos^{-1}\left(\frac{7}{31}\right)$ 3) $\cos^{-1}\left(\frac{17}{31}\right)$ 4) $\cos^{-1}\left(\frac{9}{35}\right)$

9. **$\bar{\alpha}=P\left(\bar{b}\times\bar{c}\right)+Q\left(\bar{c}\times\bar{a}\right)+r\left(\bar{a}\times\bar{b}\right)$ and $\bar{\alpha}.\left(\bar{a}+\bar{b}+\bar{c}\right)=1$ then $\left[\bar{a},\bar{b},\bar{c}\right]=$**

1) $p+q+r$ 2) $\frac{1}{p+q+r}$ 3) $2\left(p+q+r\right)$ 4) $\frac{2}{p+q+r}$

10. **If the vectors** $a\bar{i}+\bar{j}+\bar{k},\ \bar{i}+b\bar{j}+\bar{k},\bar{i}+\bar{j}+c\bar{k}\left(\bar{a}\neq\bar{b}\neq\bar{c}\right)$ **are coplanar then**

$\frac{1}{1-a}+\frac{1}{1-b}+\frac{1}{1-c}=$

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

11. **The line passing through the points (5, 1,a) and (3,b,1) crosses yz-plane at the point** $\left(0,\frac{17}{2},\frac{-13}{2}\right)$ **then**

1) $a=4,\ b=6$ 2) $a=6,\ b=4$ 3) $a=8,\ b=2$ 4) $a=2,\ b=8$

12. **If a line makes angles** α,β,γ **with the positive coordinate axes then the range of** $\sin\alpha,\sin\beta+\sin\beta.\sin\gamma+\sin\gamma\sin\alpha$ **is**

1) $\left[\frac{-1}{2},1\right]$ 2) $\left[\frac{1}{2},2\right]$ 3) $\left[-1,1\right]$ 4) $\left[-1,2\right]$

13. **If** $A=(3,1,-2),\ B=(-1,0,1)$ **and** l,m **are the projections of AB on the y-axis , zx-plane respectively** $3l^2-m+1=$

1) -1 2) 0 3) 1 4) 9

14. **The image of (1,3,4) in the plane** $2x-y+z+3=0$

1) (3,-5,2) 2) (3,5,-2) 3) (-3,5,2) 4) (3,5,2)

15. **If** $P(0,1,0),\ Q(0,0,1)$ **then the projection of** $\overline{PQ}$ **on the plane** $x+y+z=3$ **is**

1) 2 2) 3 3) $\sqrt{2}$ 4) $\sqrt{3}$

16. **A variable plane is at a constant distance 3P from the origin and meets the axes in A, B and C. The locus of the centroid of the triangle ABC is**

1) $\bar{x}^2+\bar{y}^2+\bar{z}^2=\bar{P}^2$ 2) $\bar{x}^2+\bar{y}^2+\bar{z}^2=3\bar{P}^2$ 3) $\bar{x}^2+\bar{y}^2+\bar{z}^2=9\bar{P}^2$ 4) $\bar{x}^2+\bar{y}^2+\bar{z}^2=16\bar{P}^2$

17. **The equation of the line drawn through point (1,0,2) to meet the line** $\frac{x+1}{3}=\frac{y-2}{-2}=\frac{z+1}{-1}$ **at right angles**

1) $\frac{x-1}{1}=\frac{y}{-2}=\frac{z-2}{7}$ 2) $\frac{x+1}{-1}=\frac{y-2}{-2}=\frac{z-2}{7}$

3) $\frac{x-1}{1}=\frac{y-2}{-2}=\frac{z-3}{7}$ 4) $\frac{x}{1}=\frac{y-1}{-2}=\frac{z}{7}$

18. **If** $P(-1,-5,-10)$ **and Q is the points of intersection of the line** $\frac{x-2}{3}=\frac{y+1}{4}=\frac{z-2}{12}$ **and the plane** $x-y+z=5$ **then PQ =**

1) 13 2) 139 3) 5 4) 12

19. **If the lines** $\frac{x-4}{1}=\frac{y-2}{1}=\frac{z-\lambda}{3}$ **and** $\frac{x}{1}=\frac{y+2}{2}=\frac{z}{4}$ **intersect each other, then** λ **lies in the interval**

1) (9, 11) 2) (-5, -3) 3) (13, 15) 4) (11, 13)

20. **The image of the line** $\frac{x-1}{3}=\frac{y-3}{1}=\frac{z-4}{-5}$ **in the plane** $2x-y+z+3=0$ **is the line**

1) $\frac{x-3}{3}=\frac{y+5}{1}=\frac{z-2}{-5}$ 2) $\frac{x-3}{-3}=\frac{y+5}{-1}=\frac{z-2}{5}$

3) $\frac{x+3}{3}=\frac{y-5}{1}=\frac{z-2}{-5}$ 4) $\frac{x+3}{3}=\frac{y-5}{-1}=\frac{z+2}{5}$

SECTION-II
(Numerical Value Answer Type)

This section contains 5 questions. The answer to each question is a Numerical values comprising of positive or negative decimal numbers.

Marking Scheme: +4 for correct answer, 0 in all other cases.

21. **If** $\left[\bar{a}\times\bar{b}\ \bar{b}\times\bar{c}\ \bar{c}\times\bar{a}\right]=\lambda\left[\bar{a}.\bar{b},\bar{c}\right]^2$ **then** $\lambda=$

22. **Let** $\bar{u}$ **be a vector coplanar with the vectors** $\bar{a}=2\bar{i}+3\bar{j}-\bar{k},\ \bar{b}=\bar{j}+\bar{k}.$ **If** $\bar{u}$ **is perpendicular to** $\bar{a}$ **and** $\bar{u}.\bar{b}=24$ **then** $|\bar{u}|^2=$

23. $A=(2,3,5),\ B=(-1,3,2)$ *and* $C(\lambda,5,\mu)$ **are the vertices of a triangle. If the median** $\overline{Am}$ **is Equally inclined to the coordinate axes then** $\lambda=$

24. **In the** ΔABC **if** $A=(-2,3,4)$ **and the mid points of BC, CA, AB are (1, -4, 2), (-5, 2, -3),F respectively then** $F_x+F_z=$ _____

25. **If the plane** $2x-3y+5z-2=0$ **divides the line segment joining the points (1,2,3) and (2,1,k) in 9:1 then k =** _____

PHYSICS
SECTION-I
(SINGLE CORRECT ANSWER TYPE)

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SYLLABUS: ELECTRICITY

26. **The average current is a sinusoidally varying a.c of peak value 5A with initial phase zero, between the instants** $t=\frac{T}{8}$ *to* $t=\frac{T}{4}$ **is.**

1) $\frac{10}{\pi}\sqrt{2}A$ 2) $\frac{5}{\pi}\sqrt{2}A$ 3) $\frac{20}{\pi}\sqrt{2}A$ 4) $\frac{10}{\pi}A$

27. **A circuit operating at** $\frac{360}{2\pi}Hz$ **contains** $1\mu F$ **capacitor and** 20Ω **resistor. The inductor must be added in series to make the phase angle for the circuit zero is**

1) $9H$ 2) $7.7H$ 3) $14H$ 4) $18H$

28. **A** $8\mu F$ **capacitor is connected across 220V and 50Hz line. The peak value of charge through the capacitor is**

1) $2.5\times10^{-4}C$ 2) $5\times10^{-5}C$ 3) $2.5\times10^{-3}C$ 4) $7.5\times10^{-2}C$

29. **A coil of resistance** 20Ω **and inductance 0.5H is switched to** $dc\,200V$ **supply. Calculate the rate of increase in current at the instants of closing the switch.**

1) $200\,A/s$ 2) $300\,A/s$ 3) $100\,A/s$ 4) $400\,A/s$

30. **A square of side 'L' meter lies in the XY-plane in a region where the magnetic field is given by** $\vec{B}=B_0\left(2\hat{i}+3\hat{j}+4\hat{k}\right)T,$ **'**B_0**' is constant. Find the magnetic flux passing through the square (in wb)**

1) $4B_0L^2$ 2) $2B_0L^2$ 3) $3B_0L^2$ 4) B_0L^2

31. Calculate the maximum power induced in the coil of 100 turns of $0.01m^3$ area rotating at the rate of 50 rps about an axis perpendicular to uniform magnetic field of 0.05T. The resistance of the coil is 30Ω

1) 4.23 w 2) 8.03 w 3) 8.23 w 4) 8.52 w

32. A proton is projected with a velocity of 10^7 m/s at right angles to uniform magnetic field by induction 100 mT. The time taken by proton to traverse 60^0 arc is.

1) $0.81\times10^{-7}\,s$ 2) $1.05\times10^{-7}\,s$ 3) $1.62\times10^{-7}\,s$ 4) $3.34\times10^{-7}\,s$

33. The instantaneous acceleration of an electron in a magnetic field $\vec{B}=2\hat{i}+3\hat{j}+4\hat{k}$ is $\vec{a}=x\hat{i}+\hat{j}-\hat{k}$. The magnitude of acceleration is $\left(ms^{-1}\right)$

1) 1.5 2) $\sqrt{1.5}$ 3) 0.5 4) $\sqrt{2.5}$

34. A charge 'q' move with a velocity $2ms^{-1}$ along x-axis in a uniform magnetic field $\vec{B}=\hat{i}+2\hat{j}+3\hat{k}\ T$, charge experiences force in

1) X-Y Plane 2) along Y axis 3) along Z axis 4) Z-Y Plane

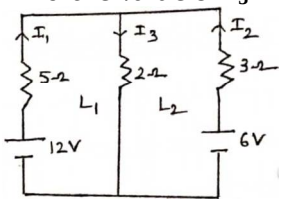
35. A current 1A flows downwards in a long straight vertical conductor and the earths horizontal magnetic field is $5\times10^{-7}T$, then the neutral point occurs

1) due north 10cm from the wire 2) due east 10cm from the wire
3) due east 0.4cm from the wire 4) due west 5cm from the wire

36. A battery is connected to resistance of 10Ω the current in the circuit is 0.12 A. The same battery gives 0.07A current with 20Ω. Find the emf of the battery

1) 1.5 v 2) 1.68 v 3) 1.8 v 4) 1.78 v

37. Find the value of I_3



1) 2.129 A 2) 3.2 A 3) 3.219 A 4) 4.62 A

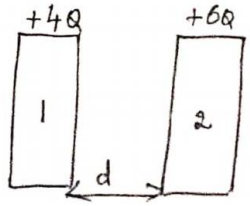
38. In a potentiometer experiment the balancing length a cell is 560 cm. When an external resistance is connected in parallel to the cell the balancing length changes by 60cm. If the internal resistance of the cell is 1.2Ω. Find the external resistance.

1) 10Ω. 2) 20Ω. 3) 30Ω. 4) 40Ω.

39. If the length of the filament of a heater is reduced by 10% the power of the heater will be

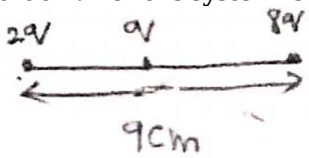
1) 12% 2) 11% 3) 13% 4) 14%

40. Two similar conducting plates are placed at a distance of 'd' as shown in the figure. What is potential difference between them



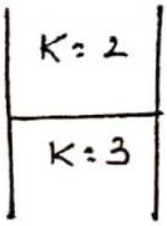
1) $\frac{Qd}{A\in_0}$ 2) $\frac{5Qd}{A\in_0}$ 3) $\frac{-Qd}{A\in_0}$ 4) $\frac{-5Qd}{A\in_0}$

41. Three point charges are arranged as shown in the figure. Find the position of the charges such that P.E of the system is minimum (in cm)



1) 3,10,0 2) 0,3,8 3) 0,9,3 4) 0,3,9

42. **A parallel plate capacitor with air as the medium has a capacitance of $0.5\mu F$. Half of its space is filled with a dielectric of k = 2 and the other half is filled with a dielectric of k = 3 Find its net capacity (in μF)**



1) 2.5 2) 3.125 3) 2.6 4) 1.25

43. **Semi circular ring of radius 0.5 m is uniformly charged with a total charge of** $1.4\times10^{-19}C$. **The electric field intensity at the centre of the ring is (in V/m)**

1) 12 2) 16 3) 32 4) 30

44. **Find the net electric dipole moment of the system of charges as shown in the figure**

1) $\frac{ql}{\sqrt{2}}\left(\hat{i}+\hat{j}\right)$ 2) $-\sqrt{3}q\hat{j}$ 3) $\sqrt{3}\,q\,l\,\hat{j}$ 4) $2\,q\,l\,\hat{j}$

45. **An electron initially at rest falls at a distance of 1.5 m in a uniform electric field of magnitude** $2\times10^{4}\,N/c.$ **The time taken by the electron to fall this distance is (in sec)**

1) 2.9×10^{-9} 2) 1.3×10^{-2} 3) 1.6×10^{-10} 4) 2.1×10^{-12}

SECTION-II
(Numerical Value Answer Type)

This section contains 5 questions. The answer to each question is a Numerical values comprising of positive or negative decimal numbers.

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46. **The bob of a simple pendulum has mass of 40g and a positive charge** $4\times10^{-6}C$. **It makes 20 oscillations in 45 sec. A vertical electric field pointing upward and a magnitude** $2.5\times10^{4}\,N/C$ **is switched on. How much time will it take for 20 oscillations___**

47. **An electric field** $\vec{E}=10x\hat{i}+30y\,\hat{j}+40z\hat{k}\ N/C$ **exists in the space. Take the potential at (0,0,0) to be zero, find the potential at (1m, 2m, 3m). ____**

48. **In a meter bridge, the null point is found at a distance of 33.7 cm from 'A'. If a resistance of** 12Ω **is connected in parallel with 's' the null point occurs at 51.9 cm. Find the value of 's'____**

49. **A charged particle of charge 4 milli coulomb enters uniform magnetic field** $\vec{B}=3\hat{i}+6\,\hat{j}+6\hat{k}\ T$ **with a velocity** $\vec{V}=4\hat{i}-x\hat{j}+y\hat{k}.$ **If the particle moves undeviated find the magnitude of its velocity._____**

50. **The magnetic flux through a coil perpendicular to the plane is varying according to the relation** $\phi=\left(5t^{3}+4t^{2}+2t-5\right)wb.$ **If the resistance of the coil is** $5\Omega,$ **find the induced current in it at** $t=2\,\text{sec}$_____

CHEMISTRY
SECTION-I
(SINGLE CORRECT ANSWER TYPE)

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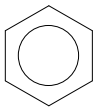
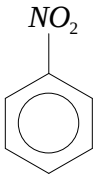
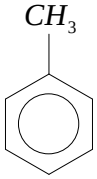
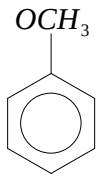
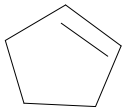
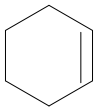
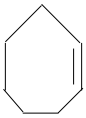
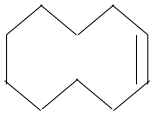
SYLLABUS: FIRST YEAR ORGANIC CHEMISTRY

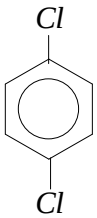
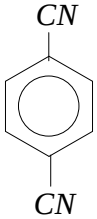
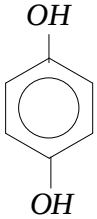
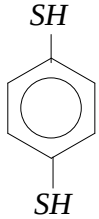
51. Which of the following will have fastest rate of reaction with $Br_2 / FeBr_3$

1) 
2) 
3) 
4) 

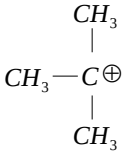
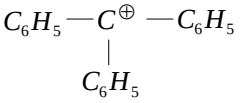
52. Geometrical Isomerism is possible in

1) 
2) 
3) 
4) 

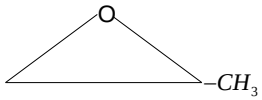
53. Which of the following molecule significant $\mu \neq 0$.

1) 
2) 
3) 
4) 

54. Which of the following is most stable cation.

1) $CH_3 - \overset{\oplus}{C}H\,CH_3$
2) 
3) $CH_3 - CH_2 - \overset{\oplus}{C}H_2$
4) 

55. The IUPAC name of the compound



1) propylene oxide 2) 1,2 – 0 × 0 propane 3) 1,2 - epoxy propane 4) 1,2 - prop oxide

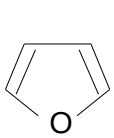
56. 2,3 – pentadiene exhibits optical Isomerism since it.

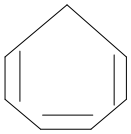
1) contains one chiral carbon
2) contains two chiral carbons
3) does not contains any chiral carbon but molecule as a whole is chiral
4) does not exhibits optical isomerism

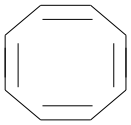
57. The major product obtained in the photobromination of 2-methyl butane is

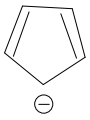
1) 1-bromo-2-methyl butane
2) 1-bromo-3-methyl butane
3) 2-bromo-3-methyl butane
4) 2-bromo-2-methyl butane

58. Which of the following compounds are Anti-Aromatic


(I)


(II)

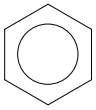

(III)

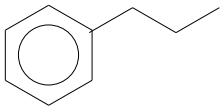

(IV)

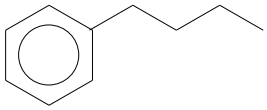
1) only III 2) I, II 3) II, III 4) I, II, III

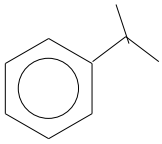
59. $B \xleftarrow[Catalyst]{Lindlar's} R-C\equiv C-R \xrightarrow{Na/Liq.NH_3} A$

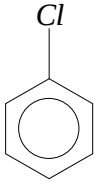
1) A-trans, B-cis 2) A-cis, B-trans 3) A,B are cis 4) A, B are trans

60.  $+CH_3CH_2CH_2Cl \xrightarrow{AlCl_3} A,$ **what is A.**

1) 

2) 

3) 

4) 

61. $CH\equiv CH + NaNH_2 \rightarrow A \xrightarrow[CH_3Cl]{2\,moles} B,$ **then B is**

1) 1-Butyne 2) 2-Butyne 3) 2-pentyne 4) propyne.

62. $C_2H_6 \xrightarrow{450^0C} A \xrightarrow{S_2Cl_2} B,$ **then B is**

1) $(C_2H_5)_2 S$ 2) $(C_2H_4Cl)_2 S$ 3) $(CH_3Cl)_2 S$ 4) $(CH_3)_2 S$

63. The compound which is not purified by sublimation is

1) phenol 2) benzoic acid 3) camphor 4) naphthalene

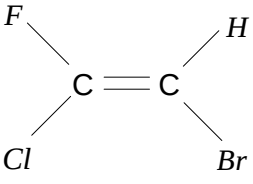
64. In allene (C_3H_4) ,the type of hybridization of the carbon atoms is

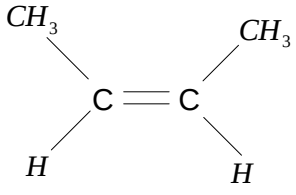
1) Sp, Sp^2 2) Sp, Sp^3 3) only Sp^2 4) Sp^2, Sp^3

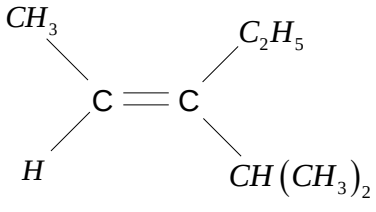
65. The IUPAC name of the following compound is

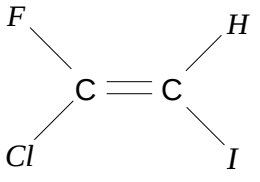
1) 3,4-diethyl hexane 2) 4-ethyl-3 methyl hexane
3) 4-methyl-3-ehtyl hexane 4) 3-ethyl-4-methyl hexane

66. The 'E' isomer is

1) 

2) 

3) 

4) 

67. $C_2H_5Cl \xrightarrow{ale\,K_2H} A \xrightarrow[H_2O]{dil.H_2SO_4} B.$ **Here A and B are**

1) C_2H_5OH, C_2H_4 2) C_2H_4, C_2H_5OH 3) C_3H_5, C_2H_5OH 4) C_2H_2, C_2H_5OH

68. The correct order of acidity ?

1) $CH \equiv CH > CH_3C \equiv CH > CH_2 = CH_2 > CH_3 - CH_3$

2) $CH \equiv CH > CH_2 = CH_2 > CH_3C \equiv CH > CH_3 - CH_3$

3) $CH_3 - CH_3 > CH_2 = CH_2 > CH_3C \equiv CH > CH \equiv CH$

4) $CH_2 - CH_2 > CH_3C \equiv CH > CH_2 = CH_2 > CH \equiv CH$

69. Which of the following would not give 1-phenyl butane as the major product in the friedas craft alkylation reaction .

1) 1-butane +HF 2) 2-butanol + H_2SO_4

3) butunoyl chloride $+AlCl_3$ then Zn + HCl 4) butyl chloride $+AlCl_3$

70. Nitrobenzene can be prepared from benzene by using a mixing of HNO_3 and con. H_2SO_4 in nitrating mixture HNO_3 acts as

1) base 2) acid 3) reducing agent 4) catalyst

SECTION-II

(Numerical Value Answer Type)

This section contains 5 questions. The answer to each question is a Numerical values comprising of positive or negative decimal numbers.

Marking Scheme: +4 for correct answer, 0 in all other cases.

71. How many cyclic Isomers are possible for C_4H_6 *is*

72. 3-methyl pent-2-ene on reaction with HBr in presence peroxide forms an addition product. The number of possible stereo isomers.

73. 295 mg of an organic compound containing nitrogen digested according to kjeldahls method And evolved NH_3 gas was absorbed in 20 ml of 0.1M HCl solution. The excess of acid required 15ml of .01M NaOH solution for complete neutralization. The % of Nitrogen is

74. The number of moles of ozone required to the benzene undergoes ozonalysis

75. The maximum no.of Isomers for an alkene with the molecular formula C_4H_8 is

MELUHA INTERNATIONAL SCHOOL

HYDERABAD

SR MPC | **JEE MAINS UNIT TEST-5** | **Time: 3:00 Hrs.**
Date: 10-05-2020 | **Max. Marks: 300 M**

KEY SHEET

MATHS

1) **4**	2) **4**	3) **3**	4) **3**	5) **2**	6) **3**	7) **2**	8) **1**	9) **2**	10) **4**
11) **2**	12) **4**	13) **1**	14) **3**	15) **3**	16) **1**	17) **1**	18) **1**	19) **4**	20) **3**
21) **1**	22) **336**	23) **7**	24) **13**	25) **0**					

PHYSICS

1) **1**	2) **2**	3) **3**	4) **4**	5) **1**	6) **3**	7) **2**	8) **1**	9) **4**	10) **3**
11) **2**	12) **1**	13) **1**	14) **2**	15) **3**	16) **4**	17) **4**	18) **3**	19) **2**	20) **1**
21) **52**	22) **-245**	23) **13.47**	24) **12**	25) **15.6A**					

CHEMISTRY

1) **4**	2) **4**	3) **1**	4) **4**	5) **2**	6) **3**	7) **4**	8) **1**	9) **1**	10) **3**
11) **2**	12) **2**	13) **1**	14) **1**	15) **4**	16) **3**	17) **2**	18) **1**	19) **3**	20) **1**
21) **3**	22) **4**	23) **23.7**	24) **3**	25) **4**					

HINTS & SOLUTIONS

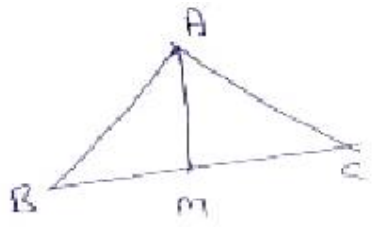
MATHEMATICS

1. $\overline{OG} = \dfrac{\overline{OA}+\overline{OB}+\overline{OC}}{3}$, $\overline{OG}^1 = \dfrac{\overline{OA}^1+\overline{OB}^1+\overline{OC}^1}{3}$

$AA^1 + BB^1 + CC^1 = \overline{OA}^1 + \overline{OB}^1 + \overline{OC}^1 - \left(\overline{OA}+\overline{OB}+\overline{OC}\right)$

$= 3\overline{OG}^1 - 3\overline{OG}$

$= 3\overline{GG}^1$

2. 

$\overline{Bm} = \frac{1}{2}\overline{Bc} = \frac{1}{2}\left(-\bar{i} - 2\bar{k}\right)$

$\overline{Am} = \overline{AB} + \overline{Bm} = -3\bar{i} + 4\bar{k} - \frac{1}{2}\bar{i} - \bar{k}$

$= \frac{-7\bar{i}}{2} + 3\bar{k}$

$\left|\overline{Am}\right| = \sqrt{\frac{49}{4} + 9} = \frac{\sqrt{85}}{2}$

3. $\overline{AC} = \bar{a} + \bar{b} = 3\bar{i} + 6\bar{j} - 2\bar{k}$

$\overline{BD} = \bar{b} - \bar{a} = -\bar{i} - 2\bar{j} - 2\bar{k}$

$\left|\overline{AC}\right| = \sqrt{9 + 36 + 4} = 7$

$\left|\overline{BD}\right| = \sqrt{1 + 4 + 4} = 3.$

4. $\left|\bar{a} + \bar{b} + \bar{c}\right|^2 > 0$

$1 + 1 + 1 + 2\left(\bar{a}.\bar{b} + \bar{b}.\bar{c} + \bar{c}.\bar{c}\right) > 0$

$\Rightarrow \bar{a}.\bar{b} + \bar{b}.\bar{c} + \bar{c}.\bar{a} > \frac{-3}{2} \_\_\_\_ (1)$

$\max k = \left|\bar{a} - \bar{b}\right|^2 + \left|\bar{b} - \bar{c}\right|^2 + \left|\bar{c} - \bar{a}\right|^2$

$= 2(1 + 1 + 1) - 2\left(\bar{a}.\bar{b} + \bar{b}.\bar{c} + \bar{c}.\bar{a}\right)$

$= 6 - 2\left(\frac{-3}{2}\right) = 9$

$k\left[2\left|\bar{a}\right|^2 + 3\left|\bar{b}\right|^2 - 4\left|\bar{c}\right|^2\right] = 9(2 + 3 - 4) = 9$

5. $\overline{OP}.\bar{i} = 1 \qquad \overline{OQ}.\bar{i} = -1$

$x_1 = 1 \qquad x_2 = -1$

$y_1 = 5 \qquad y_2 = -1$

$P = (1, 5) \qquad Q = (-1, -1)$

$\left|2\overline{OP} + 3\overline{OQ}\right| = \left|-i + 7\bar{j}\right| = \sqrt{50} = 5\sqrt{2}$

6.

$\bar{b}.\bar{c} + \bar{a}.\bar{r} = \bar{c}.\bar{a} + \bar{b}.\bar{r}$

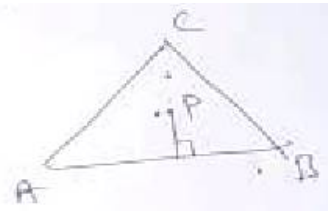
$\left(\bar{b} - \bar{a}\right).\bar{c} = \left(\bar{b} - \bar{a}\right).\bar{r}$

$\left(\bar{b} - \bar{a}\right).\left(\bar{c} - \bar{r}\right) = 0$

$\overline{AB}.\overline{PC} = 0$

Slly $\overline{BC}.\overline{PC} = 0$

P is Ortho Centre



7. $\overline{BC} = \overline{BA} + \overline{AC} = -\bar{b} + \bar{c}$

$Am = \left|\frac{\overline{BA} \times \overline{BC}}{\left|B\bar{c}\right|}\right| = \frac{\left|-\bar{b} \times \left(-\bar{b} + \bar{c}\right)\right|}{\left|-\bar{b} + \bar{c}\right|} = \frac{\left|\bar{b} \times \bar{c}\right|}{\left|\bar{b} - \bar{c}\right|}$

8. Normal vector of OPQ is $\overline{op} \times \overline{oq}$

$$= \begin{vmatrix} i & j & k \\ 1 & -1 & 2 \\ -2 & -1 & 1 \end{vmatrix} = \bar{i} - 5\bar{j} - 3\bar{k}$$

$$\cos\theta = \frac{5+5+9}{\sqrt{35}.\sqrt{35}} = \frac{19}{35}$$

$$\theta = \cos^{-1}\left(\frac{19}{35}\right)$$

9. $\bar{\alpha}.\left(\bar{a}+\bar{b}+\bar{c}\right)=1$

$$p\left[\bar{a}\,\bar{b}\,\bar{c}\right]+q\left[\bar{c}\,\bar{a}\,\bar{b}\right]+r\left[\bar{a}\,\bar{b}\,\bar{c}\right]=1$$

$$\left[\bar{a}\,\bar{b}\,\bar{c}\right]=\frac{1}{p+q+r}$$

10. $\begin{vmatrix} a & 1 & 1 \\ 1 & b & 1 \\ 1 & 1 & c \end{vmatrix} = 0$

$R_2 \to R_2 - R_1$

$R_3 \to R_3 - R_1$

$$\begin{vmatrix} a & 1 & 1 \\ 1-a & b-1 & 0 \\ 1-a & 0 & c-1 \end{vmatrix} = 0$$

$$a(b-1)(c-1)-1(1-a)(c-1)-(1-a)(b-1)=0$$

$$\frac{a}{1-a}+\frac{1}{(1-b)}+\frac{1}{(1-c)}=0$$

$$1+\frac{a}{1-a}+\frac{1}{1-b}+\frac{1}{1-c}=1$$

11. $\overline{AB}$ divides yz plane in the ratio $-x_1 : x_2$

$$\left(0,\frac{13}{2},\frac{-13}{2}\right)=\left(\frac{-15+15}{-5+3},\frac{-5b+3}{-5+3},\frac{-5+3a}{-5+3}\right)$$

$$\frac{-5b+3}{-2}=\frac{17}{2}\Rightarrow -5b+3=-17$$

$$\Rightarrow -5b=-20$$

$$\Rightarrow b=4$$

$$\frac{-13}{2}=\frac{-5+3a}{-2}\Rightarrow 3=-5+3a$$

$$\Rightarrow a=\frac{18}{3}=6$$

12. $l^2+m^2+n^2=k,$ range of $lm+mb+nl$ is

$$\left[\frac{-k}{2},k\right]$$

13. $m=\sqrt{\left(x_2-x_1\right)^2+\left(z_2-z_1\right)^2}$

$$=\sqrt{\left(-1-3\right)^2+\left(1+2\right)^2}$$

$$=\sqrt{16+9}=5$$

$l = |y_2 - y_1| = |0-1| = 1$

$3l^2 - m + 1 = 3(1)^2 - 5 + 1 = -1$

14. $P = (1,3,4)$

$\pi = 2x - y + z + 3 = 0$

$$\frac{h-1}{2} = \frac{k-3}{-1} = \frac{l-4}{1} = -2\frac{(2-3+4+3)}{4+1+1}$$

$$\frac{h-1}{2} = \frac{k-3}{-1} = \frac{l-4}{1} = -2(1)$$

$h = -3,\ k = 5,\ l = 2$

15. $A = Foot\ of\ \perp r\ \ from\ P\ to\ x + y + z = 3$

$$\frac{h-0}{1} = \frac{k-1}{1} = \frac{l-0}{1} = \frac{-(0+1+0-3)}{1+1+1}$$

$$\frac{h}{1} = k-1 = z = \frac{2}{3}$$

$$h = \left(\frac{2}{3}, \frac{5}{3}, \frac{2}{3}\right)$$

$B = Foot\ of\ the \perp r\ \ from\ Q\ to\ x + y + z = 3$

$$\frac{h-0}{1} = \frac{k-0}{1} = \frac{l-1}{1} = \frac{-(0+1+0-3)}{1+1+1}$$

$$h = \frac{2}{3},\ k = \frac{2}{3},\ l = \frac{5}{3}$$

$AB = \sqrt{0+1+1} = \sqrt{2}$

16. $\left(\frac{a}{3}, \frac{b}{3}, \frac{c}{3}\right) = (x_1, y_1, z_1)$

$a = 3x_1,\ b = 3y_1,\ c = 3z_1$

$$\boxed{3P = \sqrt{\frac{1}{a^2} + \frac{1}{b^2} + \frac{1}{c^2}}}$$

$$3P = \frac{|-1|}{\sqrt{\frac{1}{a^2} + \frac{1}{b^2} + \frac{1}{c^2}}}$$

$$\Rightarrow \frac{1}{a^2} + \frac{1}{b^2} + \frac{1}{c^2} = \frac{1}{9P^2}$$

$$\Rightarrow \frac{1}{9x_1^2} + \frac{1}{9y_1^2} + \frac{1}{9z_1^2} = \frac{1}{9P^2}$$

$\therefore Locus\ of\ 'P'\ is\ \frac{1}{x^2} + \frac{1}{y^2} + \frac{1}{z^2} = \frac{1}{P^2}$

17. $Put\ \ \frac{x+1}{3} = \frac{y-2}{-2} = \frac{z+1}{-1} = r$

$P=(3r-1,-2r+2,-r-1)$

$A=(1,0,2)$

$d'rs\ of\ \overline{AP}=(3r-2,\ -2r+2,\ -r-3)$

$\overline{AP}\perp r\ \ L=0$

$\Rightarrow(3r-2)3+(-2r+2)-2+(-r-3)(-1)=0$

$\Rightarrow 9r-6+4r-4+r+3=0$

$14r-7=0\Rightarrow r=\frac{1}{2}$

$d.r's\ \overline{AP}\ are\left(\frac{-1}{2},1,\frac{-7}{2}\right)$

$\Rightarrow\frac{x-1}{1}=\frac{y-2}{-2}=\frac{z-3}{7}$

18. $\frac{x-2}{3}=t\Rightarrow x=3t+2$

$\frac{y+1}{4}=t\Rightarrow y=4t-1$

$\frac{z-1}{12}=t\Rightarrow z=12t+2$

Substitute

$x-y+z=5\Rightarrow t=0\Rightarrow x=2,y=-1,z=2$

$Q=(2,-1,2),P(-1,-5,-10)$

19. $\frac{x-4}{1}=\frac{y-2}{1}=\frac{z-\lambda}{3}=r_1$

$x=r_1+4,\ y=r_1+2,\ z=3r_1+\lambda$

$\frac{x}{1}=\frac{y+2}{2}=\frac{z}{4}=r_2$

$x=r_2,\ y=2r_2-2,\ z=4r_2$

$\therefore$ both the lines intersect

$(r_1+4,\ r_1+2,\ 3r_1+\lambda)=(r_2,2r_2-2,4r_2)$

Compare both sides and solve it

We get

$r_1=-4,\ r_2=0$

$\therefore\lambda=12$

20. Take the Mid-Point of P and Q and substitute in $2x-y+z+3=0$

Numerical Value Questions:-

21. $\left[\bar{a}\times\bar{b}\ \ \bar{b}\times\bar{c}\ \ \bar{c}\times\bar{a}\right]=\lambda\left[\bar{a}\,\bar{b}\,\bar{c}\right]^2$

$\left[\bar{a}\ \ \bar{b}\ \ \bar{c}\right]^2=\lambda\left[\bar{a}\,\bar{b}\,\bar{c}\right]^2=\lambda=1$

22. $\bar{\mu} = x\bar{a} + y\bar{b}$

$\bar{\mu}.\bar{a} = 0 \Rightarrow \quad 7x + y = 0$

$\bar{\mu}.\bar{b} = 24 \Rightarrow \quad x + y = 12$

$x = -2,\ y = 14$

$\bar{\mu} = -2\bar{a} + 14\bar{b} = 4\bar{i} + 8\bar{j} + 16\bar{k}$

$\left|\mu^2\right| = 16 + 64 + 256 = 336$

23. Mid-Point of BC is $m = \left(\frac{\lambda - 1}{2}, 4, \frac{\mu + 2}{2}\right)$

$\overline{Am} = \left(\frac{\lambda - 5}{2}\right)\bar{i} + \bar{j} + \left(\frac{\mu - 8}{2}\right)\bar{k}$

$\overline{Am}.\bar{i} = \overline{Am}.\bar{j} = \overline{Am}.\bar{k}$

$\frac{\lambda - 5}{2} = 1 = \frac{\mu - 8}{2}$

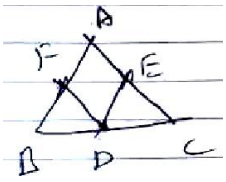
$\lambda = 7,\ \mu = 10$

24. $F_x = A + D - E$

$F = (-2, 3, 4) + (1, -4, 2) - (-5, 2, -3)$

$F = (4, -3, 9)$

$F_x + F_z = 4 + 9 = 13$



25. $\pi = 2x - 3y + 5z - 2 = 0$

$A = (1, 2, 3), B(2, 1, k)$

$-\pi_{111} : \pi_{222} = 9 : 1$

$\Rightarrow -\left[\frac{2 - 6 + 15 - 2}{4 - 3 + 5k - 2}\right] = \frac{9}{1}$

$\Rightarrow -\left[\frac{9}{5k - 1}\right] = 9$

$5k - 1 = -1$

$5k = 0$

$\boxed{k = 0}$

PHYSICS

26. $\int_{t_1}^{t_2} i\,dt \Big/ \int_{t_1}^{t_2} dt \quad i = i_0 \sin wt$

$\int_{\frac{T}{8}}^{\frac{T}{4}} 5\sin wt\,dt \Big/ \int_{T/8}^{T/4} dt$

$= \frac{5}{w}\left[-\cos wt\right]_{T/8}^{T/4} / \left[t\right]_{T/8}^{T/4}$

$$= \frac{-5\left[\cos\frac{2\pi}{T}\times\frac{T}{4}-\cos\frac{2\pi}{T}\times\frac{T}{8}\right]}{\frac{2\pi}{T}\left(\frac{T}{4}-\frac{T}{8}\right)}$$

$$= \frac{5}{\sqrt{2}}/\frac{\pi}{4} = \frac{10\sqrt{2}}{\pi}$$

27. $\cos\phi = \frac{R}{Z}\ \phi = 0^0 \Rightarrow \cos\phi = 1$

$\Rightarrow R = Z$

$Z = \sqrt{R^2 + \left(X_L - X_C\right)^2}$

$Z^2 = R^2 + \left(X_L - X_C\right)^2$

$R^2 = R^2 + \left(X_L - X_C\right)^2$

$\Rightarrow X_L - X_C = 0 \Rightarrow X_L = X_C$

$WL = \frac{1}{WC} \Rightarrow L = \frac{1}{W^2C}$

$L = \frac{1}{4\pi^2 f^2 c}$

$$L = \frac{1}{4\pi^2 \times \left(\frac{360}{2\pi}\right)^2 \times 1\times 10^{-6}}$$

$L = 7.7H$

28. $q_0 = CV_0 = C\times\sqrt{2}V_{rms}$

$q_0 = 8\times10^{-6}\times220\sqrt{2} = 2.5\times10^{-3}C$

29. $i = i_0\left(1-e^{-t/\tau}\right)$

$\frac{di}{dt} = \frac{i_0}{\tau}e^{-t/\tau}$

At $t = 0, \frac{di}{dt} = \frac{i_0}{\tau}$

$\frac{di}{dt} = \frac{E/R}{L/R} = \frac{E}{L}$

$\frac{di}{dt} = \frac{200}{0.5} = 400\,A/S$

30. Area vector is in 'z' direction

$\vec{A} = L^2\hat{k}$

$\phi = \vec{B}.\vec{A}$

$= B_0\left(2\hat{i}+3\hat{j}+4\hat{k}\right).L^2\hat{k}$

$\phi = 4L^2B_0 = 4B_0L^2\ wb$

31. $E_0 = NBAW = NBA\times2\pi f$

$E_0 = 100\times0.05\times0.01\times2\pi\times50 = 15.7V$

$I_0 = \frac{E_0}{R} = \frac{15.7}{30} = 0.524A$

$P_0 = E_0 I_0 = 15.7 \times 0.524$

$P_0 = 8.23W$

32. $t = \frac{m\infty}{Bq}$

$t = \frac{1.67 \times 10^{-27}}{100 \times 10^{-3} \times 1.6 \times 10^{-19}} \times \frac{\pi}{3}$

$t = 1.05 \times 10^{-7}$ sec

33. $\vec{a} \perp \vec{B} \Rightarrow \vec{a}.\vec{B} = 0$

$\left(x\hat{j} + \hat{j} - \hat{k}\right).\left(2\hat{i} + 3\hat{j} + 4\hat{k}\right) = 0$

$2x + 3 - 4 = 0 \Rightarrow x = 0.5$

$\vec{a} = 0.5\hat{i} + \hat{j} - \hat{k}$

$a = \sqrt{0.5^2 + 1^2 + (-1)^2} = 1.5$

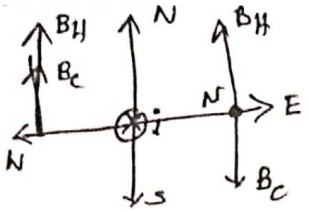
34. $\vec{F} = q\left(\vec{V} \times \vec{B}\right)$

$= q\left[\left(2\hat{i}\right) \times \left(\hat{i} + 2\hat{j} + 3\hat{k}\right)\right]$

$= q\left[4\hat{k} - 6\hat{j}\right]$

$\vec{F}$ is in Y-Z Plane.

35. At 'N'



$B_C = B_H = \frac{\mu_0 i}{2\pi r}$

$5 \times 10^{-7} = 2 \times 10^{-7} \times \frac{1}{r}$

$r = \frac{2}{5} = 0.4m$ from the wire due east.

36. $r = \frac{i_2 R_2 - i_1 R_1}{i_1 - i_2}$

$r = \frac{0.07 \times 20 - 0.12 \times 10}{0.12 - 0.07} = 4\Omega$

$E = i_1 r + i_1 R_1 = i_1 (r + R_1)$

$= 0.12(4 + 10) = 1.68V$

37. From KVL

For …L_1

$-5I_1 - 2I_3 + 12 = 0 ------ (1)$

$5I_1 + 2I_3 = 12 ------ (2)$

For L2

$-3I_2 - 2I_3 + 6 = 0$

$3I_2 + 2I_3 = 6 ---------- (3)$

From 1,2 & 3

From KCL

$I_1 + I_2 = I_3$

$I_1 = 1.549A, \quad I_2 = 0.58A$

$I_3 = 1.549 + 0.58 = 2.129A$

38. $R = \dfrac{rl_2}{l_1 - l_2}$

$R = \dfrac{1.2 \times 500}{60} = 10\Omega$

39. $P = \dfrac{V^2}{R} \Rightarrow P \propto \dfrac{1}{R}$ *but* $R \propto l$

$\Rightarrow P \propto \dfrac{1}{l}$

$\Rightarrow \dfrac{P_1}{P_2} = \dfrac{l_2}{l_1} = \dfrac{l - \dfrac{10}{100}l}{l} = \dfrac{9}{10}$

$\dfrac{P_2 - P_1}{P_1} \times 100 = \dfrac{10-9}{9} \times 100 = 11\%$ *Increase*

40. $\sigma = \dfrac{2 \in_0}{d}(V_1 - V_2)$ $\sigma = \sigma_1 - \sigma_2$

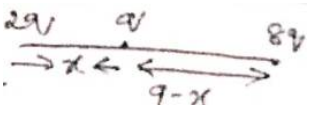
$\sigma_1 = \dfrac{4Q}{A}, \ \sigma_2 = \dfrac{6Q}{A}$

$\sigma = \sigma_1 - \sigma_2 = -\dfrac{2Q}{A}$

$\dfrac{2 \in_0}{d}(V_1 - V_2) = \dfrac{-2Q}{A} \Rightarrow V_1 - V_2 = \dfrac{-Qd}{A \in_0}$

41. $U = \dfrac{1}{4\pi \in_0}\left[\dfrac{q_1 q_2}{r_{12}} + \dfrac{q_2 q_3}{r_{23}} + \dfrac{q_3 q_1}{r_{31}}\right]$

$U = \dfrac{1}{4\pi \in_0}\left[\dfrac{2q.q}{x} + \dfrac{q.8q}{9-x} + \dfrac{2q.8q}{9}\right]$



As U is minimum $\dfrac{dU}{dx} = 0$

$\dfrac{dU}{dx} = 2(-1)x^{-2} + 8(-1)(9-x)^2 - 1 = 0$

$\Rightarrow x = 3cm$

So the charges are placed at 0, 3 and 6cm

42. $C_0 = \dfrac{\in_0 A}{d} = 0.5$

$C_1 = \dfrac{k_1 \in_0 A}{d_1} = \dfrac{2 \in_0 A}{2d} = \dfrac{\in_0 A}{d} = 0.5$

$C_1 = \dfrac{k_2 \in_0 A}{d_2} = \dfrac{3 \in_0 A}{2d} = 3 \times 0.5 = 0.75$

$C = C_1 + C_2 = 0.5 + 0.75 = 1.25\mu F$

43. $E = \dfrac{Q}{2\pi^2 \in_0 R^2} = \dfrac{1.4 \times 10^{-9} \times 7 \times 7}{2 \times 22 \times 22 \times 8.57 \times 10^{-12} \times \left(\dfrac{1}{2}\right)^2}$

$E = 32 \ V/m$

44. $P = \sqrt{P_1^2 + P_2^2 + 2P_1P_2\cos\theta}$ $P_1 = P_2$

$$= \sqrt{2P_1^2 + 2P_2^2 \cos 60^0}$$
$$= \sqrt{3}P_1 = \sqrt{3} \times q \times l$$
$$\vec{P} = -\sqrt{3}\, ql\hat{j}$$

45. $s = ut + \frac{1}{2}at^2,\ a = \frac{qE}{m}$

$$a = \frac{1.6\times10^{-19}\times2\times10^4}{9\times10^{-31}} = \frac{32}{9}\times10^{15}$$
$$1.5\times10^{-2} = \cos t + \frac{1}{2}\times\frac{32}{9}\times10^{15}t^2$$
$$t = \sqrt{\frac{135}{16}}\times10^{-9} = 2.9\times10^{-9}\,\text{sec.}$$

Numerical Value Questions:-]

46. $T = 2\pi\sqrt{\frac{L}{g}} = \frac{45}{20}, a = \frac{qE}{m}$

$$T^1 = 2\pi\sqrt{\frac{L}{g-a}} = 2\pi\sqrt{\frac{L}{g-\frac{qE}{m}}}$$
$$\frac{T}{T^1} = \sqrt{\frac{g-\frac{qE}{m}}{g}} = \sqrt{1-\frac{qE}{mg}}$$
$$\frac{T}{T^1} = \sqrt{1-\frac{4\times10^{-6}\times2.5\times10^4}{40\times10^{-3}\times10}}$$
$$\frac{45}{20\times T^1} = \sqrt{1-0.25}$$
$$T^1 = 2.6\,\text{sec}$$
$$t = T^1\times20 = 2.6\times20 = 52\,\text{sec.}$$

47. $V_{(1,2,3)} - V_{(0,0,0)} = \int_{(0,0,0)}^{(1,2,3)} \vec{E}.d\vec{r}$

$$= -\left[\int_0^1 E_x dx + \int_0^2 E_y dy + \int_0^3 E_z dz\right]$$
$$= -\left[\int_0^1 10x\,dx + \int_0^2 30y\,dy + \int_0^3 40z\,dz\right]$$
$$= -\left[\frac{10}{2}\left(x^2\right)_0^1 + \frac{30}{2}\left(y^2\right)_0^2 + \frac{40}{2}\left(z^3\right)_0^3\right]$$
$$= -\left[5\left(1^2-0\right)+15\left(2^2-0\right)+20\left(3^2-0\right)\right]$$
$$= -\left[5+60+180\right] = -245V$$

48. For first balance point

$$\frac{R}{S} = \frac{l}{100-l} = \frac{33.7}{66.3}$$

Second time $S^1 = \dfrac{12S}{12+S}$

For second balance point

$$\frac{R}{S^1} = \frac{l^1}{100-l^1} = \frac{51.9}{48.1}$$

$$\frac{R}{\frac{12S}{12+S}} = \frac{51.9}{48.1}$$

$$= \frac{51.9}{48.1} = \frac{S+12}{12} \times \frac{33.7}{66.3}$$

$$S = 13.47\,\Omega$$

49. $\vec{V} // \vec{B} \Rightarrow \dfrac{V_x}{B_x} = \dfrac{V_y}{B_y} = \dfrac{V_z}{B_z}$

$$\frac{4}{3} = \frac{-x}{6} = \frac{y}{6}$$

$$\frac{4}{3} = \frac{-x}{6} \Rightarrow x = -8$$

$$\frac{4}{3} = \frac{y}{6} \Rightarrow y = 8$$

$$\vec{V} = 4\hat{i} + 8\hat{j} + 8\hat{k}$$

$$V = \sqrt{4^2 + 8^2 + 8^2} = 12\ ms^{-1}$$

50. $E = \dfrac{d\phi}{dt} = \dfrac{d}{dt}\left(5t^3 + 4t^2 + 2t - 5\right)$

$$E = 15t^2 + 8t + 2$$

$$at\ t = 2\sec$$

$$E = 15\left(2^2\right) + 8(2) + 2 = 78V$$

$$i = \frac{E}{R} = \frac{78}{5} = 15.6A$$

CHEMISTRY

51. $-OCH_3\ group\ is + ME$ group which activates the benzene ring.
52. Alkene with large ring size exhibit geometrical Isomerism
53. C,D are Non-planar molecules
54. Conceptual
55. Conceptual
56. Conceptual
57. The reactivity of Bromination : $\overset{0}{3} > \overset{0}{2} > \overset{0}{1}$.
58. According to $4x\pi\bar{e}s$.
59. Conceptual
60. Conceptual
61.

$$CH \equiv CH + NaNH_2 \rightarrow Na - C \equiv C - Na \xrightarrow{2CH_3Cl} CH_3 - C \equiv C - CH_3$$

62. $C_2H_6 \xrightarrow{450^0 C} C_2H_4 \xrightarrow{S_2Cl_2} (C_2H_4Cl)_2 S$

63. Conceptual

64. $CH_2 = C = CH_2$

65. Conceptual

66. Conceptual

67. Conceptual

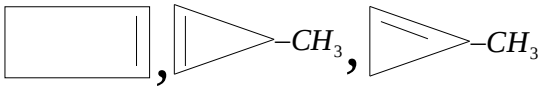
68. Conceptual

69.

$$C_6H_6 + CH_3CH_2CH_2COCl \xrightarrow{AlCl_3} C_6H_5COCH_2CH_2CH_3 \xrightarrow[Zn]{HCl} C_6H_5 - CH_2 - CH_2 - CH_2 - CH_3$$

70. Conceptual

Numerical Value Questions:-

71. 

72.

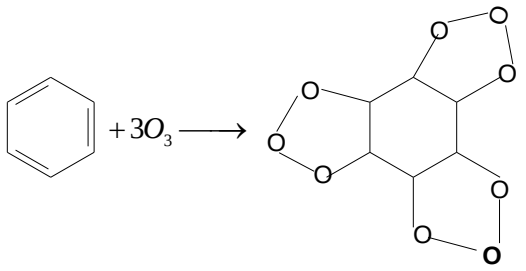
$$CH_3 - \underset{CH_3}{\underset{|}{C}} = CH_2 - CH_3 \xrightarrow[Peroxide]{HBr} CH_3 - \overset{*}{\underset{Br}{\underset{|}{C}}}H - \overset{*}{\underset{CH_3}{\underset{|}{C}}}H\,CH_2CH_3$$

2-Chiral centres,
No.of stereo Isomers = $2^2 = 4$

73. $\%N = \dfrac{1.4 \times N \times V(m_1)}{W}$

$= \dfrac{1.4 \times 0.1 \times 5}{0.0295} = 23.7$

74.



75. 1-Butene, cis and trans -2-butene, 2- methyl propene