MELUHA INTERNATIONAL SCHOOL
HYDERABAD

SR MPC (ut1+ut2+ut3) | **MAINS MODEL – CT 2** | **Date: 12-06-2020**
Time: 3 Hours | **Max Marks : 300**

MATHS
SECTION – I
(SINGLE CORRECT ANSWER TYPE)

This section contains 20 multiple choice questions. Each question has 4 options (A), (B), (C) and (D) 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.

01. Consider functions $f(x)=\sin^{-1}\frac{x}{4}$ & $g:R\to[\lambda,\infty)$ such that $g(x)=x^2-3x+\mu;\ \lambda\in R$.
If $f(g(x))$ is defined for $x\in[-1,1]$ then μ can not be
A) –2 B) –1 C) 0 D) 1

02. Consider $f(x)=\lambda x-2\lambda$ & $g(x)=x^2+4x+3$. If equation: $f(x)=|g(x)|$ has exactly three real solutions, then λ can be
A) $\sqrt{15}-8$ B) $2\sqrt{15}-8$ C) $8-\sqrt{15}$ D) $8-2\sqrt{15}$

03. Let $f(n)=\sum_{r=1}^{n}\tan^{-1}\left(\frac{2r-1}{r^4-2r^3+r^2+1}\right)$, then
A) $\lim_{n\to\infty} f(n)=\frac{\pi}{4}$ B) $f(11)=\tan^{-1}(10)-\frac{\pi}{4}$
C) If $n=31$, then $\tan(f(n))=961$ D) If $n=32$, then $\tan(f(n))=961$

04. Let $f(x)=x^2-2|\sin\theta.\cos\phi|x\ \forall x\in R$; where
$\theta=\cos^{-1}\frac{4}{5}+2\cos^{-1}\frac{2}{\sqrt{5}}$ & $\phi=\cos^{-1}\frac{5}{13}+\sin^{-1}\frac{3}{5}+\tan^{-1}\frac{63}{16}$; then range of function $g(x)=\tan^{-1}f(x)\forall x\in R$ is
A) $\left[\frac{-\pi}{4},\frac{\pi}{4}\right]$ B) $\left[0,\frac{\pi}{2}\right)$ C) $\left(\frac{-\pi}{2},\frac{\pi}{4}\right]$ D) $\left[\frac{-\pi}{4},\frac{\pi}{2}\right)$

05. Let $f(x)=\lim_{n\to\infty}\sum_{r=1}^{n}\left(\frac{1}{2^r}\tan\frac{x}{2^r}\right)$; then
A) $\lim_{x\to0} f(x)=\frac{1}{2}$ B) $\lim_{x\to0} x.f(x)=\frac{1}{3}$
C) $\lim_{x\to0}\frac{f(x)}{x}=\frac{1}{3}$ D) $\lim_{x\to0}[f(x)\tan x+1]=0$
([.] is greatest integer function)

06. Consider a differentiable function g(x) such that $g(xy)+2xy=xg(y)+yg(x)$ where, $x,y>0$ & $g'(1)=3$. Let $f(x)=g(x)-2x$; then

A) f(x) is discontinuous at 1 point in $x \in (0,\infty)$

B) f(x) is not differentiable at 1 point in $x \in (0,\infty)$

C) |f(x)| is discontinuous at 2 points in $x \in (0,\infty)$

D) |f(x)| is not differentiable at 1 point in $x \in (0,\infty)$

07. If the function $f(x) = 8x^3 + 4x^2 + \lambda x + 1;\ \lambda \in R$ is strictly increasing function for all real values of x, then 'λ' cannot be

A) $\frac{7}{6}$ B) $\frac{1}{5}$ C) $\frac{13}{12}$ D) $\frac{11}{12}$

08. Let $h:[0,\infty) \to R$ be a strictly increasing function, such that function $f(x) = h(x) - \frac{5x^2}{2} - 15x$ is a decreasing function $\forall x \geq 0$ & function $g(x) = h(x) - \tan^{-1} x$ is an increasing function $\forall x \geq 0$; then function $\left(h(x) - x^2 + x\right)$ is

A) Increasing in $x \in (1,2)$ B) Decreasing in $x \in (1,2)$

C) Increasing in $x \in \left(0,\frac{1}{2}\right)$ D) Decreasing in $x \in \left(0,\frac{1}{2}\right)$

09. Let $\alpha \in R;$ then minimum value of $d = \sqrt{(\alpha+1)^2 + \left(4\alpha - \alpha^2 - 4\right)^2}$ is

A) $\sqrt{2}$ B) $\sqrt{5}$ C) $\sqrt{10}$ D) $2\sqrt{5}$

10. General solution of differential equation $10y^3dy - ydx = 2xdy$ is
(λ is arbitrary constant)

A) $y^5 - 2xy^2 = \lambda$ B) $y^5 - 2x^2y = \lambda$ C) $y^5 - xy^2 = \lambda$ D) $2y^5 - xy^2 = \lambda$

11. Consider $f: R \to R,$ such that $f(x) = 2x + 3x^3;$ then the area bounded by $f^{-1}(x)$ with x-axis & the ordinate at $x = 5$ is

A) $\frac{11}{4}$ B) $\frac{13}{4}$ C) $\frac{15}{4}$ D) $\frac{17}{4}$

12. Let $f: R \to R$ be a differentiable function, such that $f(x)f(y) = f(xy+1) + f(y) + x - 2\ \forall x, y \in R$ and $f(0) = 1, f'(0) = 1$ then area of region bounded by f(x) with co-ordinate axes, is

A) 1 B) $\frac{1}{2}$ C) $\frac{1}{4}$ D) $\frac{1}{6}$

13. Consider function $f(x) - \sin x = \int_0^x f'(t)(2 - \sin t)\sin t\, dt$, then $\lim_{x \to 0} \frac{f(x)}{x}$ is equal to

A) –1 B) 0 C) 1 D) $\frac{1}{2}$

14. Let $f(x)=\underset{n\to\infty}{Lim}\left(\frac{n}{n^2+x^2}+\frac{n}{n^2+4x^2}+\frac{n}{n^2+9x^2}\text{.... up to (}n\text{) terms}\right)$, $\underset{x\to 0}{Lim}\left[f(x)\right]=$

([.] is Greatest integer function)

A) -1 B) 0 C) 1 D) Does not exist

15. Area of region bounded by $x^2+y^2\le 1 \;\&\; \max\left(|x+y|,|x-y|\right)\ge 1$, where $y\ge 0$ is A; then [A] is ([.] is Greatest integer function)

A) 0 B) 1 C) 2 D) 3

16. $\underset{x\to 0}{Lim}\left(\frac{\int_0^x \frac{\sin t - t\cos t}{t^2}\,dt}{x^2}\right)=$

A) $\frac{1}{3}$ B) $\frac{1}{6}$ C) $\frac{2}{3}$ D) $\frac{5}{6}$

17. Let $\vec{a}=\hat{i}+\hat{j}+\hat{k} \;\&\; \hat{n}$ be the unit vector along the normal drawn to the curve $3x^2+2y^2=3-8xy$ at the point, where it meets positive direction of x-axis then $\left|\vec{a}.\hat{n}\right|$ is equal to

A) $\frac{2}{5}$ B) $\frac{5}{7}$ C) $\frac{7}{5}$ D) $\frac{14}{5}$

18. Consider ΔOAB where $O(0,0,0); A(7,-4,-4) \;\&\; B(-2,-1,2)$. Let $\vec{n}$ is a vector of magnitude $\sqrt{6}$ directed along internal angle bisector of $\angle AOB$; then $\left|\vec{n}.\overrightarrow{OA}\right|=$

A) 3 B) 6 C) 9 D) 12

19. Consider the tetrahedron formed by points $A(1,0,1)$, $B(3,0,1)$, $C(4,-1,2)$ and $D(0,0,2)$; then length of altitude from vertex D on face ABC is

A) $\sqrt{2}$ B) $\frac{1}{\sqrt{2}}$ C) $\frac{1}{\sqrt{3}}$ D) $\frac{1}{2}$

20. Consider the line $5x+y+3z=0, y-3x-z=1$. Let Π be the plane passing through point (4, 2, A) and perpendicular to above line; then volume of tetrahedron formed by Π with co-ordinate axes is

A) $\frac{4}{3}$ B) $\frac{8}{3}$ C) $\frac{16}{3}$ D) $\frac{32}{3}$

SECTION-II
(Numerical Value Answer Type)

This section contains 5 questions. The answer to each question is a Numerical value. If the numerical value has more than two decimal places, **round-off the value** of Two decimal places. Answer to each question will be evaluated according to the following marking scheme:
Marking scheme: +4 for correct answer, 0 in all other cases.

21. Let T represents the tangent drawn from origin to the curve $y^2=2(x-3/2)$; then the area of region bounded by T with curve & $y\ge 0$ is

22. Consider tetrahedron OABC; where O is origin & vertices are $A(\vec{a}), B(\vec{b})$ and $C(\vec{c})$. Given that $|\vec{a}| = 3, |\vec{b} - \vec{c}| = 4$ and the angle between $\vec{a}$ & $(\vec{b} - \vec{c})$ is $\frac{\pi}{6}$. If volume of tetrahedron is 12 units, then square root of shortest distance between OA & BC is

23. Let $f(x) = 2x - \cos x$, then the derivative of $f^{-1}(x)$ w.r.t. x at $x = \frac{\pi}{2} - \frac{1}{\sqrt{2}}$ is λ where $\frac{1}{\lambda} =$

24. Consider cubic polynomial $f(x) = 2x^3 - 3tx^2 + 6tx - 6x - 12$ having local extremum at $x = \alpha, \beta$ where $\beta = 2\alpha$; then t^2 may be equal to

25. Consider functions $f(x) = e^x + 1$ & $g(x) = e^x + 3$. Let $x_0 (> 0)$ be the point of intersection of $f(|x|)$ and $g(-|x|)$; then $\lim\limits_{x \to x_0} \{\max(f(|x|), g(-|x|))\}$ is equal to

({.} is fractional part function)

PHYSICS

SECTION – I

(SINGLE CORRECT ANSWER TYPE)

This section contains 20 multiple choice questions. Each question has 4 options (A), (B), (C) and (D) 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.

26. If the error in the measurement of the volume of a sphere is 6%, then the error in the measurement of its surface area will be

A) 2% B) 3% C) 4% D) 7.5%

27. A small planet is revolving around a very massive star in a circular orbit of radius r with a period of revolution T. If the gravitational force between the planet and the star were proportional to $r^{-5/2}$, then T would be proportional to

A) $r^{3/2}$ B) $r^{5/3}$ C) $r^{7/4}$ D) r^3

28. Two stars each of mass m and radius R are approaching each other for a head on collision. They start approaching each other when their separation is r>>R. If their speeds at this separation are negligible, the speed with which they collide would be

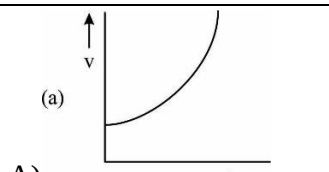
A) $v = \sqrt{Gm\left(\frac{1}{R} - \frac{1}{r}\right)}$ B) $v = \sqrt{Gm\left(\frac{1}{2R} - \frac{1}{r}\right)}$

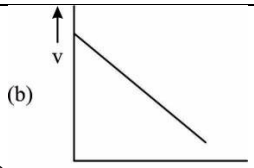
C) $v = \sqrt{Gm\left(\frac{1}{R} + \frac{1}{r}\right)}$ D) $v = \sqrt{Gm\left(\frac{1}{2R} + \frac{1}{r}\right)}$

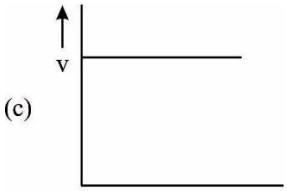
29. A ray of light is incident at an angle of 60^0 on one face of prism of refracting angle 30^0. The ray emerges out of the prism making an angle of 30^0 with the incident ray. The refractive index of the material of the prism is

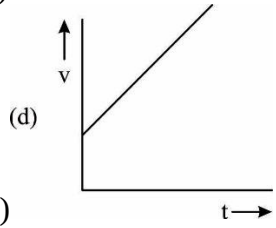
A) $\sqrt{2}$ B) 1.5 C) $\sqrt{3}$ D) $\frac{1}{2}(1 + \sqrt{3})$

30. Starting from rest, an observer moves with a constant acceleration a towards a stationary source emitting a sound of frequency v_0. Which of the graphs shown in figure correctly represents the variation of the apparent frequency v of sound as heard by the observer with time t?

A) 

B) 

C) 

D) 

31. A progressive wave in a medium is represented by the equation $y = 0.1\sin\left(10\pi t - \frac{5}{11}\pi x\right)$ where y and x are in cm and t in seconds. The maximum speed of a particle of the medium due to the wave is

A) $1 cm\, s^{-1}$ B) $10\, cm\, s^{-1}$ C) $\pi\, cm\, s^{-1}$ D) $10\pi\, cm\, s^{-1}$

32. A tuning fork produces 4 beats per second when sounded with a sonometer wire of vibrating length 48 cm. It produces 4 beats per second also when the vibrating length is 50 cm with same tension. What is the frequency of the tuning fork?

A) 196 Hz B) 284 Hz C) 375 Hz D) 460 Hz

33. A wave represented by the equation $y = a\cos(kx - \omega t)$ is superposed with another wave to form a stationary wave such that the point x=0 is a node. The equation of the other wave is

A) $y' = a\sin(kx + \omega t)$ B) $y' = -a\cos(\omega t - kx)$

C) $y' = -a\cos(kx + \omega t)$ D) $y' = -a\sin(kx - \omega t)$

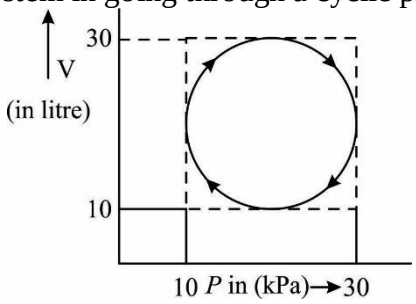
34. Two rods of different materials having coefficients of thermal expansion $\alpha_1 \text{ and } \alpha_2$ and Young's modulii $Y_1 \text{ and } Y_2$ are fixed between two rigid and massisve walls (side by side without touching each other). The rods are heated to the same temperature. If there is no bending of the rods, the thermal stresses developed in them are equal provided

A) $\frac{Y_1}{Y_2} = \sqrt{\frac{\alpha_1}{\alpha_2}}$ B) $\frac{Y_1}{Y_2} = \sqrt{\frac{\alpha_2}{\alpha_1}}$ C) $\frac{Y_1}{Y_2} = \frac{\alpha_1}{\alpha_2}$ D) $\frac{Y_1}{Y_2} = \frac{\alpha_2}{\alpha_1}$

35. 5 g of water at $30^0 C$ and 5 g of ice at $-20^0 C$ are mixed together in a calorimeter. What is the final temperature of the mixture. Given specific heat of ice $= 0.5\, cal\, g^{-1}\left({}^0C\right)^{-1}$ and latent heat of fusion of ice $= 80\, cal\, g^{-1}$. (neglect the specific heat of calorimeter)

A) $-5^0 C$ B) $0^0 C$ C) $+5^0 C$ D) $+10^0 C$

36. Heat energy absorbed by a system in going through a cyclic process shown in figure

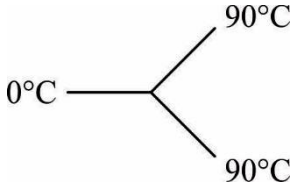


A) $10^7\, \pi\ joule$ B) $10^4\, \pi\ joule$ C) $10^2\, \pi\ joule$ D) $10^{-3}\, \pi\ joule$

37. The mass of an oxygen molecule is about 16 times that of a hydrogen molecule. At room temperature the rms speed of oxygen molecules is v. The rms speed of the hydrogen molecule at the same temperature will be

A) v/16 B) v/4 C) 4 v D) 16 v

38. Three identical rods made of the same material and having the same cross-section have been joined as shown in figure. Each rod is of the same length. The left and right ends are kept at $0^0 C \, and \, 90^0 C$ respectively as shown. The temperature of the junction of the three rods will be



A) $45^0 C$ B) $60^0 C$ C) $30^0 C$ D) $20^0 C$

39. Three point charges 4q, Q and q are placed in a straight line of length l at points distant 0 (zero), $l/2 \, and \, l$ respectively from a fixed reference. If the net electrostatic force on charge q is zero, the magnitude of the electrostatic force on charge Q is

A) $\frac{q^2}{\pi\varepsilon_0 l^2}$ B) $\frac{2q^2}{\pi\varepsilon_0 l^2}$ C) $\frac{3q^2}{\pi\varepsilon_0 l^2}$ D) $\frac{4q^2}{\pi\varepsilon_0 l^2}$

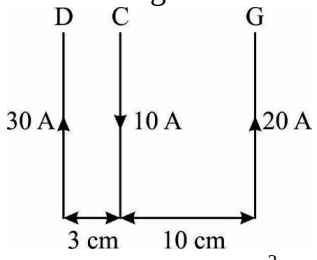
40. Two parallel plate capacitors of capacitances C and 2C are connected in parallel and charged to a potential difference V by a battery. The battery is then disconnected and the space between the plates of capacitor of capacitance C is completely filled with a material of dielectric constant K. The potential difference across the capacitors now becomes

A) $\frac{V}{K+1}$ B) $\frac{2V}{K+2}$ C) $\frac{3V}{K+2}$ D) $\frac{3V}{K+3}$

41. You are given 48 cells each of emf 2V and internal resistance 1Ω. How will you connect them so that the current through an external resistance of 3Ω is the maximum?

A) 8 cells in series, 6 such groups in parallel
B) 12 cells in series, 4 such groups in parallel
C) 16 cells in series, 3 such groups in parallel
D) 24 cells in series, 2 such groups in parallel

42. Three long, straight and parallel wires C,D and G carrying currents are arranged as shown in figure. The force experienced by a 25 cm length of wire C is



A)0.4 N B) 0.04 N C) $4\times10^{-3} N$ D) $4\times10^{-4} N$

43. The magnetic field due to a current carrying circular loop of radius 3 cm at a point on its axis at a distance of 4cm from the centre is $54\mu T$. The magnetic field $(in\,\mu T)$ at the centre of the loop will be

A) 250 B) 150 C) 125 D) 72

44. In an ac circuit the potential difference V and current I are given respectively by $V = 100\sin(100t) volt \; and \; I = 100\sin\left(100t + \frac{\pi}{3}\right) mA$. The power dissipated in the circuit will be

A) $10^4 W$ B) 10 W C) 2.5 W D) 5 W

45. A thin circular ring of area A is held perpendicular to a uniform magnetic field of induction B. A small cut is made in the ring and a galvanometer is connected across the ends such that the total resistance of the circuit is R. When the ring is suddenly squeezed to zero area, the charge flowing through the galvanometer is

A) $\frac{BR}{A}$ B) $\frac{AB}{R}$ C) ABR D) $\frac{B^2 A}{R^2}$

SECTION-II
(Numerical Value Answer Type)

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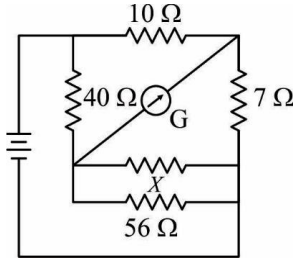
46. In figure the galvanometer shows no deflection. What is the resistance X(in Ω) ?



47. A capacitor of capacitance $C_1 = 1.0\,\mu F$ can with stand a maximum voltage $V_1 = 6.0\,kV$. Another capacitor of capacitance $C_2 = 2.0\,\mu F$ can with stand a maximum voltage $V_2 = 4.0\,kV$. If the capacitors are connected in series, the combination can withstand a maximum voltage of(in kV)

48. There is a uniform electrostatic field of strength $10^3\,Vm^{-1}$ along the y-axis. A body of mass 1 g and charge $10^{-6}C$ is projected into the field from the origin along the positive x-axis with a velocity of $10\,ms^{-1}$. Its speed $\left(in\,ms^{-1}\right)$ after 10 second will be (neglect gravitation)

49. Two moles of hydrogen are mixed with n moles of helium. The root mean square speed of the gas molecules in the mixture is $\sqrt{2}$ times the speed of sound in the mixture. The value of n is

50. If the pressure of an ideal gas in a closed container is increased by 2%, the temperature of the gas increases by 5^0C . The initial temperature of the gas in Kelvin is

CHEMISTRY

SECTION – I
(SINGLE CORRECT ANSWER TYPE)

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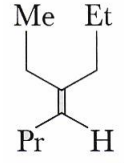
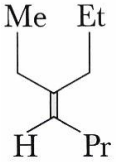
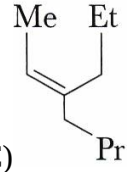
51. 

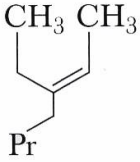
Product (A) is

$\mathrm{Pr} = n-propyl, Et = Ethyl, Me = Methyl$

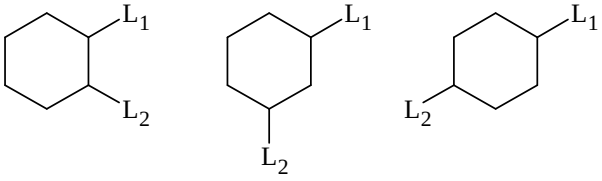
A) 

B) 

C) 

D) 

52. Let us consider, three types of disubstituted cyclohexanes



(L_1 and L_2 are two different groups)

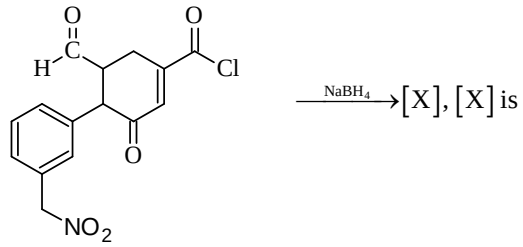
These compounds may exist in various stereoisomeric forms (both geometric and optical). Correct statement is

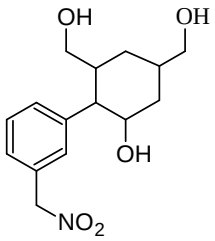
A) Total no of stereo isomers possible form all three compounds given, are eight

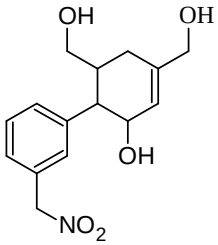
B) Every positional isomer given above can have its enantiomer

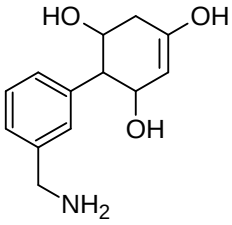
C) Optically active compounds possible from the given compounds are 8

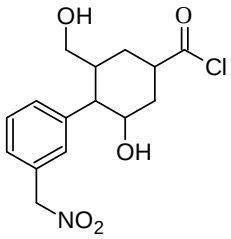
D) Out of all possible stereo isomers 2 pairs are diastereomers

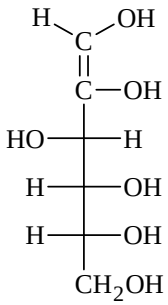
53.  $\xrightarrow{NaBH_4}$ [X], [X] is

(A) 

(B) 

(C) 

(D) 

54. 

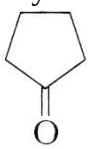
The Fischer projection formula shown above is the enolic form of

A) D-fructose only

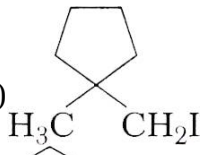
B) D-mannose only

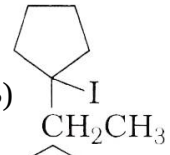
C) D-glucose only

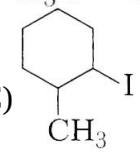
D) D-fructose, D-mannose, D-glucose

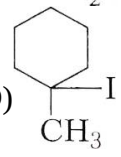
55. $CH_3MgBr +$  $\xrightarrow{H_3O^+} A \xrightarrow{HBr} B$ E (major)is

$\xrightarrow{Mg/ether} C \xrightarrow[H_3O^+]{HCHO} D \xrightarrow{HI} E$

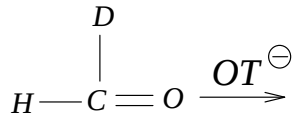
A) 

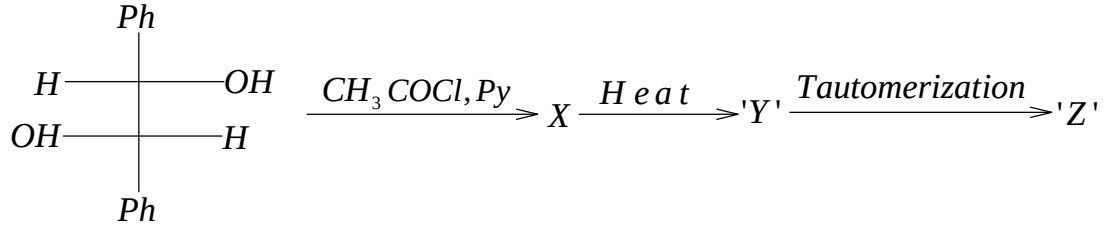
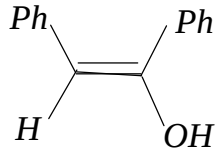
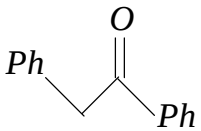
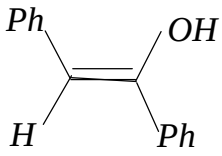
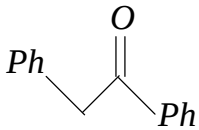
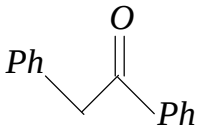
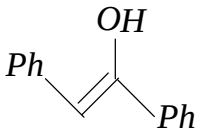
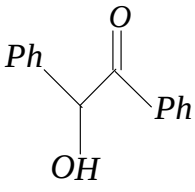
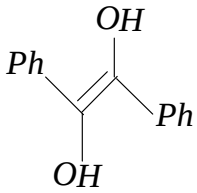
B) 

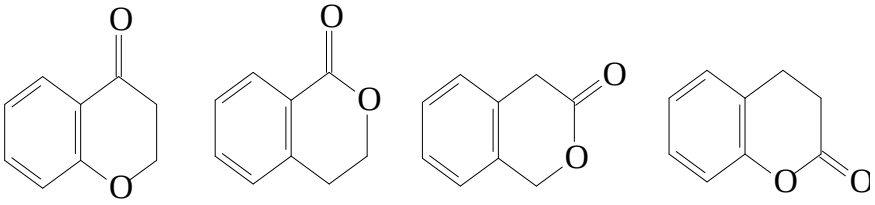
C) 

D) 

56. Consider the following statements:
I. Monosaccharide are optically active polyhydroxy carbonyl compounds.
II. Fructose does not reduce Fahiling's solution.
III. α-D(+)-glucose and β-D(+) – glucose are anomers.
IV. D-glucose and D-mannose are C-2 epimers.
Which of the given statements are correct?
A) I, II B) I, II, III, IV C) I, II, IV D) I, III, IV

57. 
P and Q will be
A) $HCOO^{-}, CH_2D-OT$ B) $DCOO^{-}$ and CH_2DOT
C) $HCOO^{-}$, CH_2TOT D) $DCOO^{-}$ and CHD_2OT

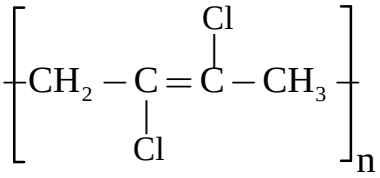
58. 
If one equivalent of acetyl chloride is used, then main product, Y and Z are respectively
A)  and 
B)  and 
C)  and 
D)  and 

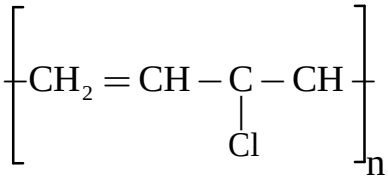
59. Decreasing order of the reactivity of the following compounds towards the nitration will be

(I) (II) (III) (IV)
A) I > IV > III > II B) IV > I > III > II C) III > IV > I > II D) IV > I > II > III

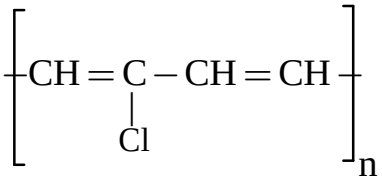
60. Diethyl ketone and methyl ethyl ketone can be distinguished from each other by using the reagent
A) $AgNO_3 / NH_4OH$ B) $2,4-DNP$ C) aqueous Na_2CO_3/I_2 D) Fehling solution

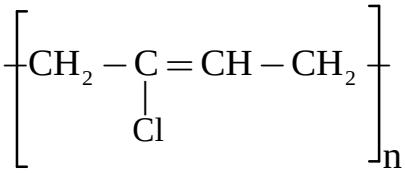
61. Which of the following is not correctly matched?
A) Teflon –Additional polymer B) Gun cotton –synthetic polymer
C) Protein – natural polymer D) Nolon-6, 6 – condensation polymer

62. $HC\equiv CH \xrightarrow[(1eq)]{NaNH_2} A \xrightarrow[(ii)H_2O/H^+]{(i)H_3C-\overset{O}{\overset{\|}{C}}-H} B \xrightarrow{Al_2O_3/\Delta} C \xrightarrow{HCl(1eq)} D \xrightarrow{Polymerisation} E$
Final product E is

A) 

B) 

C) 

D) 

63. Arrange the following in the correct order of their reactivity in S_{N^1} reaction

I) $C_6H_5CH_2Br$ II) $(C_6H_5)_2CHBr$

III) $C_6H_5CH(CH_3)Br_2$ IV) $(C_6H_5)_2C(CH_3)Br$

A) I>II>III>IV B) IV>II>III>I C) I>III>II>IV D) IV>III>II>I

64. The disaccharide which on hydrolysis gives β -D galactose and $\beta - D$ glucose is

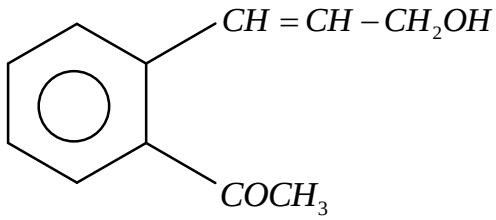
A) Maltose B) Sucrose C) Lactose D) Starch

65. Compound (X) gives positive test with 2, 4-DNP and with I_2 / $NaOH$ compound $[X]$ may be

A) $C_6H_5COCH_3$ B) CH_3COCH_3 C) $CH_3 - CHO$ D) all of these

66. An organic compound containing one oxygen gives red colour with cerric ammonium nitrate solution , decolorises alkaline $KMnO_4$ solution , responds iodoform test and shows geometrical isomerism .It should be :

A) $C_6H_5 - CH = CH - CH_2OH$ B) $C_6H_5 - CH = CH - CHOHCH_3$

C) $C_6H_5 - CH = CHCOCH_3$ D) 

67. Non –bio degradable pollutants are

A) DDT B) BHC C) Plastics D) All of these

68. Which of the following vitamins is not stored in the body and hence has to be supplemented regualry?

A) Vitamin A B) Vitamin D C) Vitamin E D) Vitamin B_6

69. Correct statements regarding amino acids are

(P) Amino acids are colourless, crystalline solids.
(Q) They have high melting points owing to their salt like character.
(R) In aqueous solutions they exist in dipolar ionic forms at all pH values.
(S) Zwitter ionic form of amino acids is amphoteric.
(T) In solid state amino acids exist as zwitter ions.

A) PQRST B) PQS C) PQST D) PQ

70. $LiH + BCl_3 \xrightarrow[dry]{ether} 'P' \xrightarrow{CH_3-CH=CH_2} 'Q' \xrightarrow{OH^-/H_2O_2} 'R'.$ $'R'$ is

A) $B(CH_2CH_2CH_3)_3$ B) $CH_3CH_2CH_2OH$

C) $CH_3CHOHCH_3$ D) $CH_2OH - CHOHCH_2OH$

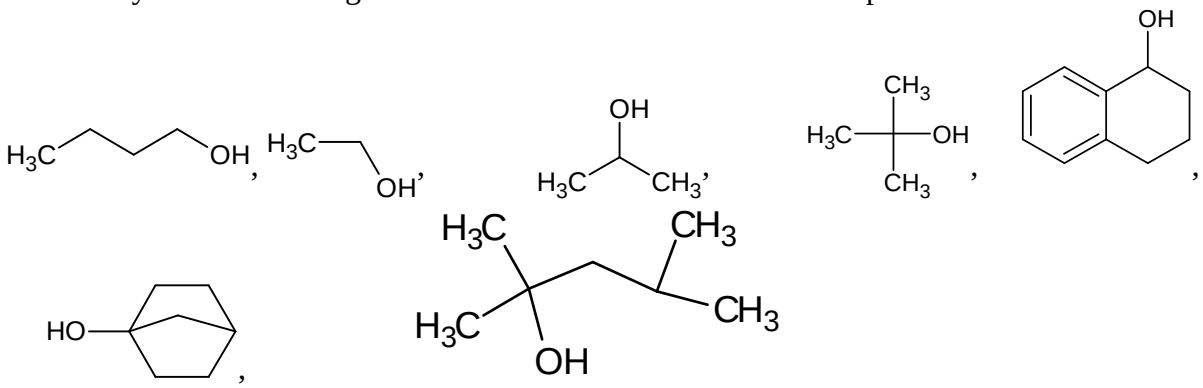
SECTION-II
(Numerical Value Answer Type)

This section contains 5 questions. The answer to each question is a Numerical value. If the numerical value has more than two decimal places, **round-off the value** of Two decimal places. Answer to each question will be evaluated according to the following marking scheme:
Marking scheme: +4 for correct answer, 0 in all other cases.

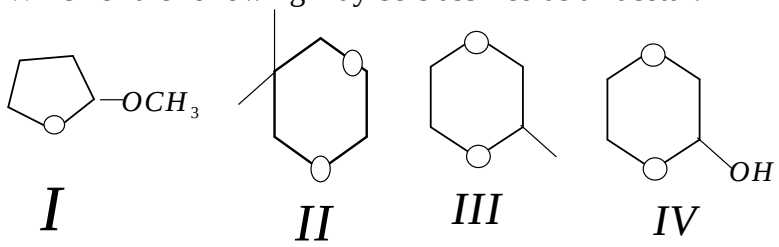
71. In Kjeldahl 's method, the gas evolved from 1.325 g sample of a fertilizer is passed into 50.0 mL of 0.2030 N H_2SO_4. 25.32mL of 0.1980 N $NaOH$ are required for the titration of unused acid. The percentage of nitrogen in fertilizer is

72. A mixture of L-glycine and L-alanine are allowed to condense. The number of dipeptides that can be formed is

73. How many of the following will not answer Lucas test at room temperature?

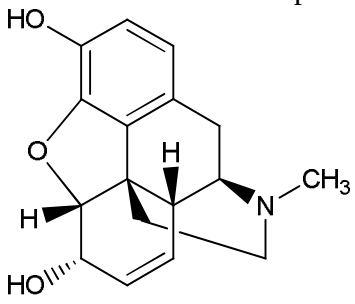


74. Which of the following may be classified as an acetal?



I *II* *III* *IV*

75. How many stereogenic carbon centers are there in morphine, structure shown below?



MELUHA INTERNATIONAL SCHOOL
HYDERABAD

SR MPC (ut1+ut2+ut3) | **MAINS MODEL – CT 2** | **Date: 12-06-2020**
Time: 3 Hours | **Max Marks : 300**

KEY SHEET

MATHS

1) **D**	2) **B**	3) **C**	4) **D**	5) **C**	6) **D**	7) **B**	8) **C**	9) **B**	10) **D**
11) **B**	12) **B**	13) **C**	14) **B**	15) **A**	16) **B**	17) **C**	18) **C**	19) **B**	20) **C**
21) **0.866**	22) **3.4641**	23) **2.7071**	24) **2.25**	25) **0.4141**					

PHYSICS

26) **C**	27) **C**	28) **B**	29) **C**	30) **D**	31) **C**	32) **A**	33) **C**	34) **D**	35) **B**
36) **C**	37) **C**	38) **B**	39) **C**	40) **C**	41) **B**	42) **D**	43) **A**	44) **C**	45) **B**
46) **56**	47) **9**	48) **14.14**	49) **2**	50) **250**					

CHEMISTRY

51) **C**	52) **C**	53) **B**	54) **D**	55) **D**	56) **D**	57) **B**	58) **A**	59) **A**	60) **C**
61) **B**	62) **D**	63) **B**	64) **C**	65) **D**	66) **B**	67) **D**	68) **D**	69) **C**	70) **B**
71) **5.43**	72) **4**	73) **3**	74) **12**	75) **5**					

HINTS & SOLUTIONS
MATHEMATICS

01. D_f is $x \in [-4,4]$

$\therefore g(-1) \le 4$ & $g(1) \ge -4$

02. Draw tangent (2, 0) to from $y = -x^2 - 4x - 3$

$\therefore \lambda = 2\sqrt{15} - 8$

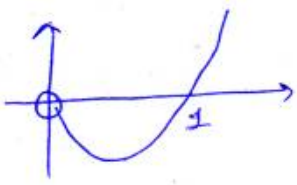
03. $f(n) = \sum_{r=1}^{n} \left(\tan^{-1}\left(r^2\right) - \tan^{-1}(r-1)^2 \right) = \tan^{-1}\left(n^2\right)$

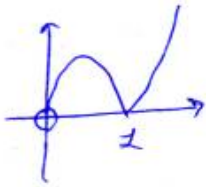
04. Clearly $f(x) = x^2 - 2x \in [-1, \infty)$

05. $f(x) = \underset{n\to\infty}{Lim}\left(\frac{1}{2^n}\cot\frac{x}{2^n} - \cot x \right) = \frac{1}{x} - \frac{1}{\tan x}$

$\therefore f(x) = \frac{\tan x - x}{x \tan x}$

06. Here $g(x) = x\ln x + 2x \Rightarrow f(x) = x\ln x$

$f(x)$: 

$f(x)$: 

07. $f'(x) \geq 0 \ \forall x \in R \therefore \lambda \geq \frac{2}{3}$

08. $f'(x) \leq 0 \rightarrow h'(x) \leq 15 + 5x$

$\& g'(x) \geq 0 \rightarrow h'(x) \geq \frac{1}{1+x^2}$

$\therefore F(x) = h(x) - x^2 + x$

$\Rightarrow F'(x) = h'(x) - (2x-1) \geq 0 \text{ in } x \in \left(0, \frac{1}{2}\right)$

09. $P(-1,4) \text{ and } Q(\alpha, 4\alpha - \alpha^2)$

Find least distance of $P(-1,4)$

from $y = 4x - x^2 \ \therefore \alpha = 1 \Rightarrow Q(1,3)$

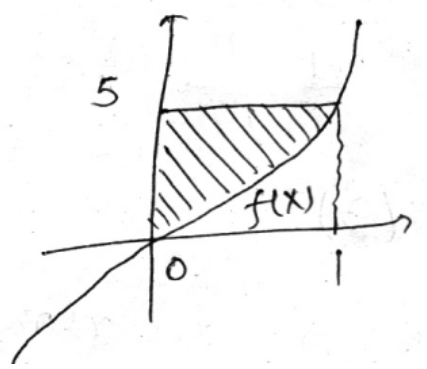
$\therefore PQ = \sqrt{4+1} = \sqrt{5}$

10. $2xyxy + y^2 dx = 10y^4 dy$

$\Rightarrow d\left(xy^2\right) = 10y^4 dy$

$\Rightarrow xy^2 = \frac{10}{5} y^5 + C$

11.



$= 5 - \int_0^1 f(x)\,dx$

$= 5 - \left(x^2 + \frac{3}{4}x^4\right)_0^1$

$= 5 - 1 - \frac{3}{4} = \frac{13}{4}$

12. Clearly $f(x) = x + 1 \Rightarrow A = \frac{1}{2}$

13. $f'(x) = \cos x + f'(x)(2 - \sin x)\sin x$

$$\therefore f'(x)=\frac{\cos x}{(\sin x-1)^2}$$

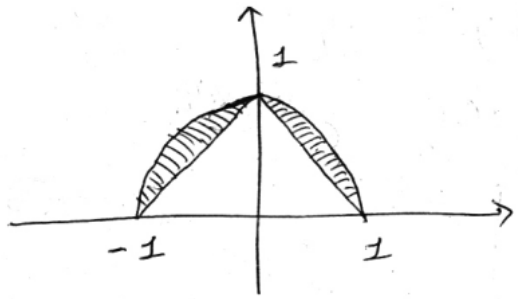
$$\Rightarrow f(x)=\frac{\sin x}{1-\sin x}$$

14. $$f(x)=\underset{n\to\infty}{Lim}\sum_{r=1}^{n}\left(\frac{n}{n^2+r^2x^2}\right)$$

$$f(x)=\underset{n\to\infty}{Lim}\frac{1}{n}\sum_{r=1}^{n}\frac{1}{1+\left(\frac{r}{n}\right)^2x^2}$$

$$f(x)=\int_0^1\frac{dt}{1+t^2x^2}=\frac{1}{x}\tan^{-1}x$$

15.



$$\therefore A=\frac{1}{2}\pi-\frac{1}{2}.2.1=\frac{\pi}{2}-1$$

16. $$=\underset{x\to0}{Lim}\frac{\sin x-x\cos x}{2x^3}=\frac{1}{6}$$

17. $$f(x,y)=3x^2+2y^2+8xy-3$$

$$m=\frac{2y+4x}{3x+4y}$$

At point $P(1,0)\to m=\frac{4}{3}$

$\therefore$ Normal is $3y=4x-4$

$$\therefore \hat{n}=\frac{3\hat{i}+4\hat{j}}{5}$$

18. Here $\vec{n}=\sqrt{6}\left(\frac{\hat{i}-7\hat{j}+2\hat{k}}{3\sqrt{6}}\right)=\frac{\hat{i}-7\hat{j}+2\hat{k}}{3}$

$$\&\ \overrightarrow{OA}=7\hat{i}-4\hat{j}-4\hat{k}$$

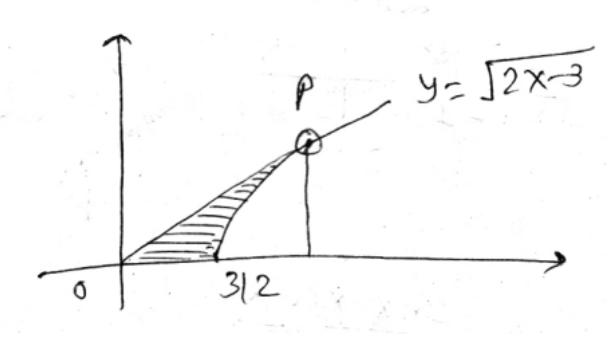
$$\therefore \vec{n}\,\overrightarrow{OA}=\frac{1}{3}(7+28-8)=9$$

19. $$H=\left|\frac{\left[\overrightarrow{AD}\ \overrightarrow{BD}\ \overrightarrow{CD}\right]}{\left|\overrightarrow{AB}\times\overrightarrow{AC}\right|}\right|=\frac{1}{\sqrt{2}}$$

20. $\Pi : x+y-2z=4$

$$V=\frac{1}{6}abc=\frac{1}{6}\times 4\times 4\times 2=\frac{16}{3}$$

21.



$$\therefore A=\frac{\sqrt{3}}{2}$$

22. $$SD=\left|\frac{\left[\vec{a}\ \vec{b}\ \vec{c}\right]}{\left|\vec{a}\times\left(\vec{b}-\vec{c}\right)\right|}\right|$$

$$SD=\left|\frac{6\text{ volume}}{3.4.\frac{1}{2}}\right|=\frac{6.12}{6}=12$$

$$\therefore \sqrt{SD}=2\sqrt{3}$$

23. $$g'\left(f\left(x\right)\right)=\frac{1}{f'\left(x\right)}\Rightarrow g'\left(2x-\cos x\right)=\frac{1}{2+\sin x}$$

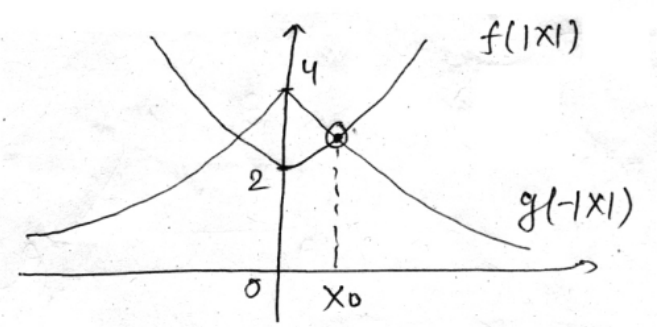
Put $x=\frac{\pi}{4}\Rightarrow g'\left(\frac{\pi}{2}-\frac{1}{\sqrt{2}}\right)=\frac{1}{2+\frac{1}{\sqrt{2}}}=\frac{\sqrt{2}}{2\sqrt{2}+1}$

$$\frac{1}{\lambda}=\frac{2\sqrt{2}+1}{\sqrt{2}}=2+\frac{1}{\sqrt{2}}=2.7071$$

24. $f'\left(x\right)=6x^2-6tx+6t-6$ has root $\alpha,2\alpha$

$\Rightarrow\therefore t=3$ or 1.5

25.



Here $e^{x_0}=\sqrt{2}+1$

$$\&\left\{e^{x_0}\right\}=\left(\sqrt{2}+1\right)-2=\sqrt{2}-1$$

PHYSICS

26. $V = \frac{4}{3}\pi r^3,\ A = 4\pi r^2$

$\frac{\Delta V}{V} = \frac{3\Delta r}{r}$ and $\frac{\Delta A}{A} = \frac{2\Delta r}{r} = 4.1$

= 6. 1

27. $F = k r^{-\frac{5}{2}} = m\omega^2 r$

or $\omega^2 \alpha r^{-\frac{7}{2}}$ or $\omega \alpha r^{-\frac{7}{4}}$

or $T \alpha r^{\frac{7}{4}}$

28. From the conservation of energy

$-\frac{6m}{r} + 0 = -\frac{6mm}{2R} + 2.\frac{1}{2}mv^2$

$V^2 = \frac{Gm}{2R} - \frac{Gm}{r}$

29. $\delta = i + e - A$

$30 = 60 + e - 30$

$e = 0$

If e = 0, r = 30

i) $\sin 60 = \mu \sin 30$

$\mu = \sqrt{3}$

30. $f = f_0\left(\frac{V + V_0}{V}\right) = f_0\left(1 + \frac{at}{V}\right) \rightarrow$ straight line

31. $V_0 = A\omega = (0.1) \times 10^{-2} \times 10\pi = \pi cm/s$

32. As $f \alpha \frac{1}{l}$

$f_1 - f_0 = 4$

$f_0 - f_2 = 4$

$f_1 - f_2 = 8 \Rightarrow \frac{V}{2l_1} - \frac{V}{2l_2} = \frac{V}{2}\left(\frac{1}{48} - \frac{1}{50}\right)100 = \left(\frac{50}{48} - 1\right)V$

$8 = \frac{2V}{48}$ or $V = 192\,m/s$

$f_q = \frac{V}{2l_2} = \frac{192}{100\,cm} = 192Hz$

$f_0 = 196\,Hz$

33. $y + y' = A\sin x\ x\cos\omega t\ (or) = A\sin x \sin\omega t$

$= a\cos(kx - \omega t) - a\cos(kxf\omega t)$

$= +2a\sin kx \sin\omega t$

34. Thermal stress = $y\alpha\Delta T$

$\Rightarrow y_1\alpha_1\Delta T = y_2\alpha^2\Delta T$

$\frac{y_1}{y_2} = \frac{\alpha_2}{\alpha_1}$

35. Heat released by the water as its temperature falls from $30^0 + 0^0 C$ is $\Delta\theta_1 = ms\Delta T = 5(1)30 = 150cal.$

heat that can be absorbed by the ice to each to $0^0 C$ is $\Delta Q_2 = ms\Delta^+ + mL$

$= 5(+20)\frac{1}{2} + 5$ so

$= 50 + 400 = 450$ cal

as $\Delta\theta_1 < \Delta\theta_2$ final temp is $0^0 C$

36. $\Delta s = \Delta\omega$ as $\Delta\mu = 0$

= under curve = $\alpha ab = \pi\left(10\alpha 10^{-3}\right) = 10\times10^3$

$\pi\times100J$

37. $V_{rms} = \sqrt{\frac{3RT}{m}}, \frac{V_{H_2}}{V_{0_2}} = \sqrt{\frac{M\sqrt{0_0}}{M(H_2)}} = \sqrt{\frac{16}{1}} = 4$

$V_{H_2} = 4V$

38. $\frac{KA}{2}(a_0 - \tau) = i$

$(T_0 - 0)\frac{KA}{l} = 2i = \frac{2KA}{l}(a_0 - T)$

$T = 2\times90 - 2T$

$3T = 180^0$ or $T = 60^0 C$

39. on q $\frac{k_0 42(q)}{l^2} = \frac{k_0 Qq}{Q^2/4}$

force on Q $\frac{K_0 4qQ}{l^2/4} - \frac{K_0 qQ}{l^2/4} = \frac{4K_0 qQ}{l^2}3$ Q = - q

$= \frac{3qQ}{\pi\varepsilon l^2} = \frac{3q^2}{\pi\varepsilon l^2}$

40. $V^1 = \frac{Q_V}{left} = \frac{q_1 + q_2}{2c + kc} = \frac{2CV + CV}{2C + KC}$

$= \frac{3V}{2 + K}$

41. To get the maximum current

$nr = mR$

$\frac{n}{m} = \frac{R}{r} = \frac{3}{1} = 3:1 = \frac{3}{1} = \frac{12}{4}$

42. $F = \left(\frac{\mu_0 i_1}{2\pi r}\right) i_2 \ell$

$F_{net} = \mu_o i_o \ell\left[\frac{i_1}{2\pi r_1} - \frac{i_2}{2\pi r_2}\right] = \frac{\mu_0 i_0 \ell}{2T}\left[\frac{30}{3\times10^{-2}} - \frac{20}{10\times10^{-2}}\right]$

$= 2\times10^{-7}\times10\times25\times10^{-2}[1000 - 200] = 5\times10^{-7}\times800$

$= 4\times10^{-4} N$

43. $B(x) = \frac{\mu_0 i a^2}{2(a^2\times x^2)^{3/2}}$

$54\mu T = \frac{\mu_0 i a^2}{2(5^2)^{3/2}} = \frac{\mu_0 i a^2}{2\times125}$

$B_0 = \frac{\mu_0 i}{2a} = \frac{1}{a}\times\frac{54\mu T\times125}{a^2}$

$= \frac{54\times125}{27} = 250\mu T$

44. $p = E_{rms} i_{rms} Cos\theta$

$$= \frac{.100}{52} \times \frac{100}{52} \times 10^{-3} \times \cos 60 = \frac{10}{4} = 2.5w$$

45. $\Delta Q = \frac{\Delta Q}{R} = \frac{BA}{R}$

46. $\frac{10}{40} = \frac{7}{x_0}$ or $x_0 = 28\Omega \quad x = 56\Omega$

47. $\frac{V_1}{V_2} = \frac{C_2}{C_1} = \frac{2}{1} = \frac{4}{2} = \frac{6}{3} = \frac{8}{4}$

If $V_1 \le 6KV$ then $V_2 = 3KV$

48. $V_x = U_x = 10\ m/s$

$$V_y = a_y t = \frac{9E}{m} t = \frac{10^{-6} \times 10^3}{10^{-3}} \times 10 = 10\ m/s$$

$$V = \sqrt{V_x^2 + V_y^2} = 10\sqrt{2}$$

49. $\frac{n_1 + n_2}{r-1} = \frac{n_1}{r_1 - 1} + \frac{n_2}{r-1}$

$$\frac{2+n}{r-1} = \frac{2}{\frac{7}{8}-1} + \frac{n}{\frac{5}{3}-1} = 5 + \frac{3n}{2} = \frac{10 \times 3n}{2}$$

$4 \times 2n = (r-1)(10+3n).....(1)$

$$\frac{V_{rms}}{V_s} = \frac{\sqrt{\frac{3RT}{m}}}{\sqrt{\frac{rRT}{m}}} = \sqrt{\frac{3}{r}} = \sqrt{2} \quad \text{or} \quad 3 = 2r$$

(1) & (2) $\Rightarrow 84n = 10 + 3n \Rightarrow n = 2$

50. $\frac{p_1}{p_2} = \frac{T_1}{T_2}$

$$\frac{p_1}{(1.02)p_1} = \frac{T_1}{T_1 + 5}$$

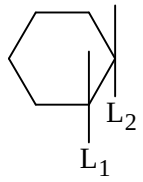
$(1.02)T_{1=}T_1 + 5$

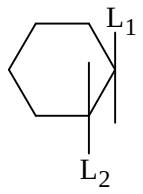
$0.02T_1 = 5$

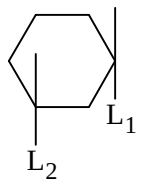
$T_1 = 250K$

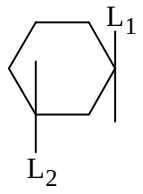
CHEMISTRY

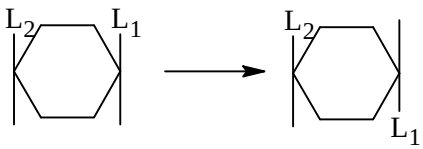
51. More Stable alkene is formed.

52.  + enantiomer

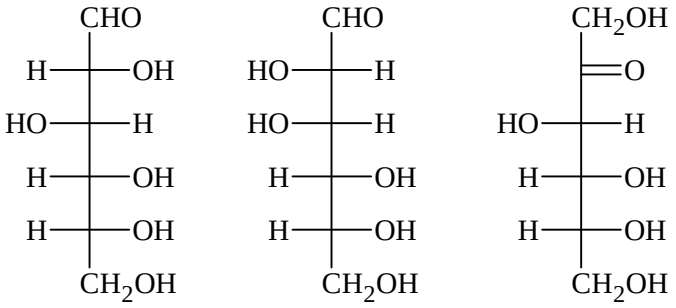
 + enantiomer

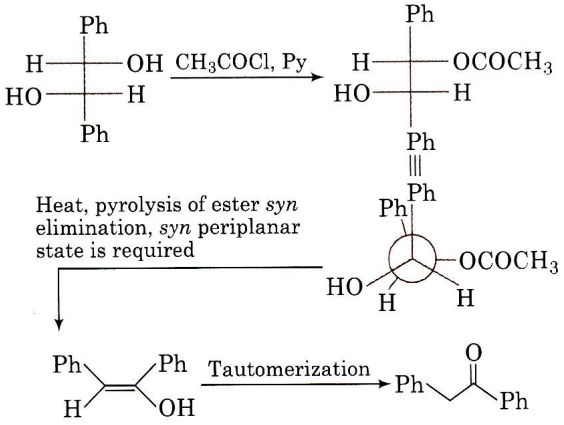
 + enantiomer

 + enantiomer

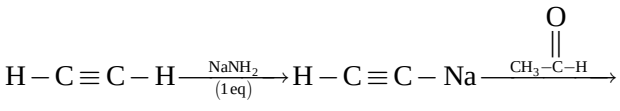
 No chiral carbon

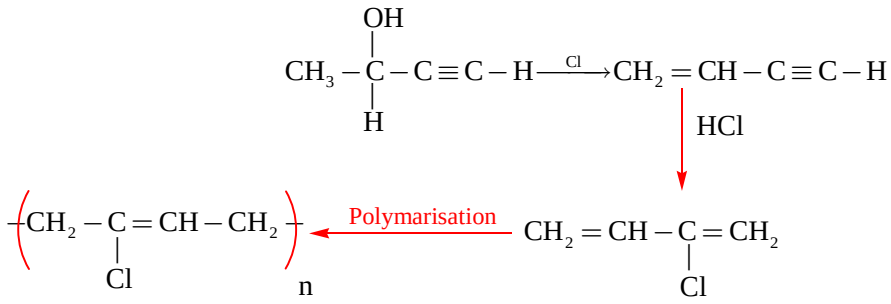
53. $NaBH_4$ is a weak reducing agent.
54. The keto forms could be either of



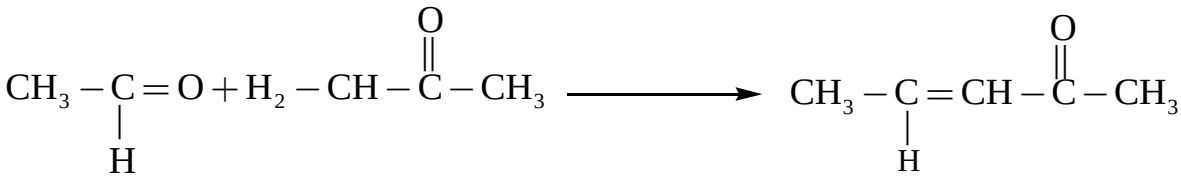
55. Major product is formed by more stable carbocation.
56. Fructose has hemiacetal structure so reducing sugar.
57. In the Cannizaro reaction hydride transfer is RDS.
58. 

59. +M effect makes benzene more reactive for ArS_E^2 .
60. Methyl –ethyl ketone will give iodoform test, but diethyl ketone do not.
61. Gun cotton is natural.

62. 



63. In the S_N^1, stability of carbocation is considered.

64. 

Textual

65. Methyl ketones give +ve test of Iodoform.
66. Alcohol gives red colour with CAN.
67. DDT, BHC and plastics are non biodegradable.
68. Water soluble vitamins are not stored in our body.
69. Due to ionic structure of Amino acid they have high M.P, B.P.
70. $P: B_2H_6,\quad Q: B\left(CH_2CH_2CH_3\right)_3 \xrightarrow{OH^-/H_2O_2} CH_3CH_2CH_2OH\left(R\right)$
71. $Meq.$ of H_2SO_4 taken to absorb $NH_3 = 50\times 0.2030$

$Meq.$ of H_2SO_4 left after NH_3 absorption

$= Meq.$ of $NaOH$ used for $H_2SO_4 = 25.32\times 0.1980$

$\therefore Meq.$ of H_2SO_4 used for $NH_3 = 50\times 0.2030 - \left(25.32\times 0.1980\right)$

Or $\left(NV\right)$ used for $NH_3 = 5.137$

$$\therefore \quad \%N = \frac{1.4\times NV}{wt.of\ subs\tan ce} = \frac{1.4\times 5.137}{1.325} = 5.43\%$$

72. gly-gly, Ala-Ala, gly-Ala, Ala-gly.
73. compounds 1 and 2 are primary alcohols and 6 th compound cannot form carbocation according to Bredt's rule or doesn't undergo SN^2 reaction due to steric hinderance to form chloride.
74. Two oxygen attached to single carbon.
75. Chiral carbons are stereogenic centre.