MELUHA INTERNATIONAL SCHOOL

HYDERABAD

SR MPC | **JEE MAINS TOTAL GT** | **Date: 16-05-2020**

Time: 3 Hours | **Max. Marks: 300**

JEE MAIN MODEL

MATHEMATICS

Section	Question type	+Ve Marks	- Ve Marks	No.of Qs	Total marks
Sec–I(Q.N: 01 –20)	QuestionswithSingleAnswerType	4	-1	20	80
Sec–II(Q.N: 21–25)	QuestionswithNumericalAnswerType (+/-DecimalNumbers)	4	0	5	20
Total				25	100

PHYSICS

Section	Question type	+Ve Marks	- Ve Marks	No.of Qs	Total marks
Sec–I(Q.N: 26 –45)	QuestionswithSingleAnswerType	4	-1	20	80
Sec–II(Q.N: 46 –50)	QuestionswithNumericalAnswerType (+/-DecimalNumbers)	4	0	5	20
Total				25	100

CHEMISTRY

Section	Question type	+Ve Marks	- Ve Marks	No.of Qs	Total marks
Sec–I(Q.N: 51 –70)	QuestionswithSingleAnswerType	4	-1	20	80
Sec–II(Q.N: 71 –75)	QuestionswithNumericalAnswerType (+/-DecimalNumbers)	4	0	5	20
Total				25	100

SECTION – I
(SINGLE CORRECT ANSWER TYPE)

Thissectioncontains20multiplechoicequestions.Eachquestionhas4options(A),(B),(C)and(D) forits answer,outofwhich**ONLYONE**optioncan becorrect.

Markingscheme:+4forcorrectanswer,0ifnotattemptedand-1if notcorrect.

MATHEMATICS

1. **If n=10 ,** $\bar{x}=12$ **and** $\sum x^2=1530,$ **then coefficient of variations is**

A) 16 B) 9 C) 25 D) 36

2. **If p, q are 2 statements, then** $\sim(\sim p\wedge q)\wedge(p\vee q)$ **is logically equivalent to ------**

A) p B) q C) $p\wedge q$ D) $(\sim p)\wedge q$

3. **Given f(x)=** $x^2+\alpha x+\beta\,(where\ \alpha,\beta\in R)$**. If f(f(x))=0 has 2 roots 1 and 2,then f(0)=-------**

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

4. **If the sequence** $\{b_n\}$ **is a geometric progression with** $\frac{b_4}{b_6}=\frac{1}{4}$ **and $b_2+b_5=216$. If** $b_n\in Z\ \ (\forall n\in N)$**, then the value of b_1 is---------**

A) 8 B) 10 C) 12 D) 14

5. **If the system of equations x-4y+7z=g, 3y-5z=h,-2x+5y-9z=k is consistent, then --------**

A) g+h+k=0 B) 2g+h+k=0 C) g+h+2k=0 D) g+2h+k=0

6. **Consider a triangular plot ABC with sides AB=7m, BC=5m, CA=6m. A vertical lamp post at the midpoint D of AC subtends an angle 30^0at B. The height of the lamp post is -------m.**

A) $7\sqrt{3}$ B) $\frac{2\sqrt{21}}{3}$ C) $\frac{2\sqrt{21}}{2}$ D) $2\sqrt{21}$

7. **If all the roots of $z^3+az^2+bz+c=0$ are of unit modulus, then -------**

A) $|a|\le 3$ B) $|b|>3$ C) $|C|\ge 3$ D) $|C|=0$

8. **Let P_n denotes the number of ways of selecting 3 people out of n sitting in a row , so that no two of them are consecutive; $Q_n$is the corresponding case when they are on a circle.**
If P_n-Q_n **=6, then n=?**

A) 8 B) 9 C) 6 D) 10

9. **The sum of all solutions of the equation 2(cosx+cos2x)+sin2x(1+2cosx)=2sinx** $(-\pi\le x\le\pi)\,is\ \frac{-\pi}{k}$**, then k=------**

A)5 B) 4 C) 2 D) 3

10. **If** $\bar{a},\bar{b},\bar{c}$ **are any 3non zero vectors such that** $\bar{a}\times(\bar{b}\times\bar{c})=(\bar{a}\times\bar{b})\times\bar{c}$ **, then**

A) $\bar{b},\bar{c}$ are collinear B) $\bar{a},\bar{c}$ are collinear

C) $\bar{a}\ and\ \bar{b}$ are collinear D)Only 2vectors among $\bar{a},\bar{b},\bar{c}$ are $\perp^{lr}$

11. **If** $\int(\sin 2x-\cos 2x)\,dx=\frac{1}{\sqrt{2}}\sin(2x-a)+b$ **,then**

A) $a=\frac{\pi}{4},b=0$ B) $a=-\frac{\pi}{4},b=0$

C) $a=\frac{5\pi}{4}$, b=any constant D) $a=-\frac{5\pi}{4}$, b=any constant

12. **The value of** $\lim_{x\to\infty}\frac{x^2\sin\frac{1}{x}-x}{1-|x|}\ is$

A)0 B) 1 C) -1 D) None of these

13. The interval, in which $f(x)=\cos^{-1}\left(\frac{1-x^2}{1+x^2}\right)$ **is decreasing**

A) $(-\infty,\infty)$ B) $(-\infty,0)$ C) $(0,\infty)$ D) $(1,\infty)$

14. $\int_{\frac{-\pi}{2}}^{\frac{\pi}{2}} \frac{|x|dx}{8\cos^2 2x+1}$ has the value

A) $\frac{\pi^2}{6}$ B) $\frac{\pi^2}{12}$ C) $\frac{\pi^2}{24}$ D) None of these

15. The value of f(0) , so that the function $f(x)=\frac{\sqrt{a^2-ax+x^2}-\sqrt{a^2+ax+x^2}}{\sqrt{a+x}-\sqrt{a-x}}$ becomes continuous for all x, is given by

A) $a^{3/2}$ B) $a^{1/2}$ C) $-a^{1/2}$ D) $-a^{3/2}$

16. A function y=f(x) has a second order derivates $f''(x)=6(x-1)$**. If its graph passes through the point (2,1) and at that point the tangent to the graph is y=3x-5 , then the function is**

A) $(x+1)^3$ B) $(x-1)^3$ C) $(x+1)^2$ D) $(x-1)^2$

17. A straight line through the origin O meets the parallel lines 4x+2y=9 and 2x+y+6=0 and at points P and Q respectively. Then the point O divides the segment PQ in the ratio

A) 1:2 B) 3:4 C) 2:1 D) 4:3

18. The point P is the intersection of the straight line joining the points Q(2,3,5) and R (1,-1,4) with the plane 5x-4y-z=1. If S is foot of the perpendicular drawn from the point T(2,1,4) to QR, then the length of the line segment PS is

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

19. The equation of the chord of the hyperbola $25x^2-16y^2=400$ that is bisected at point (5,3) is

A) 135x-48y=481 B) 125x-48y=481 C) 125x-4y=48 D) none of these

20. If ab=2a+3b,a>0,b>0 then the minimum value of $\frac{a}{b}$ is

A) 1.5 B) 2.5 C) 1 D) 3

SECTION- II

(Numerical ValueAnswer Type)

Thissectioncontains5questions.TheanswertoeachquestionisaNumericalvaluescomprisingofpositive ornegativedecimalnumbers. Eachquestionhas4options(A),(B),(C) and(D)foritsanswer,outof which**ONLY ONE**optioncanbecorrect.

Markingscheme:+4forcorrectanswer,0inallothercases.

21. India plays 2 matches each with west Indies and Australia. In any match the probability of India getting points 0,1 and 2 are 0.45 , 0.05 and 0.50 respectively. Assuming that the outcomes are independent, the probability of India getting atleast 7 points is------

22. If $\sum_{k=0}^{100}\left(\frac{k}{k+1}\right)\left({}^{100}C_K\right)=\frac{a\left(2^{100}\right)+b}{c}(a,b,c\in N)$**, then least value of (a+b+c) is _____**

23. If the domain of function $f(x)=\sqrt{3\cos^{-1}(4x)-\pi}$ **is [a, b], then (4a+64b)=_____**

24. The area of the region bounded by the parabola $(y-2)^2$=x-1, the tangent to the parabola at the point (2,3) and the x-axis is

25. The area of the quadrilateral formed by the tangents at the end points of latus rectum to the ellipse $\frac{x^2}{9}+\frac{y^2}{5}=1, is$

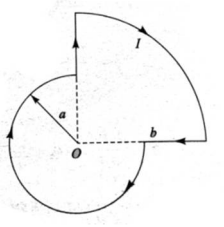
SECTION – I
(SINGLE CORRECT ANSWER TYPE)

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.

PHYSICS

26. The magnetic induction at the centre O (figure) is



A) $\left(\frac{\mu_o I}{2a}+\frac{\mu_o I}{2b}\right)\otimes$ B) $\left(\frac{3\mu_o I}{8a}+\frac{\mu_o I}{8b}\right)\otimes$ C) $\left(\frac{3\mu_o I}{8a}+\frac{\mu_o I}{8b}\right)\odot$ D) $\left(\frac{\mu_o I}{2a}+\frac{\mu_o I}{2b}\right)\odot$

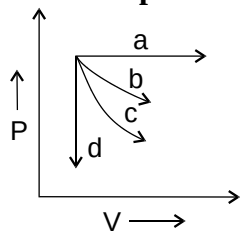
27. A steel wire of length 1 m, mass 0.1 kg and uniform area of cross section 10^{-6} m^2 is rigidly fixed at both the ends without any tension. Its temperature is lowered by 20 ^{0}C and transverse waves are set up by plucking the wire at the middle. The frequency of the fundamental mode is _____ Hz (Y = 200 GPa, $\alpha = 1.21\times10^{-5}\ {}^0C^{-1}$)

A) 21 B) 42 C) 11 D) 22

28. An electron (of mass m) and a photon have the same energy E in the range of few eV. The ratio of the de-Broglie wavelength associated with the electron and the wavelength of the photon is (C = speed of light in vaccum)

A) $\left(\frac{E}{2m}\right)^{1/2}$ B) $\frac{1}{C}\left(\frac{E}{2m}\right)^{1/2}$ C) $C(2mE)^{1/2}$ D) $\frac{1}{C}\left(\frac{2E}{m}\right)^{1/2}$

29. The given diagram shows four processes i.e., isochoric, isobaric, isothermal and adiabatic. The correct assignment of the processes, in the same order is given by



A) a d b c B) d a b c C) d a c b D) a d c b

30. Which of the following combinations should be selected for better tuning of an L-C-R circuit used for communication ?

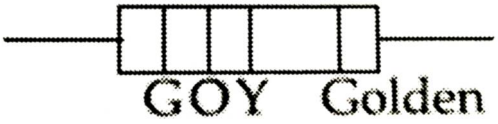
A) $R = 15\ \Omega,\ L = 3.5\,H,\ C = 30\,\mu F$ B) $R = 25\ \Omega,\ L = 1.5\,H,\ C = 45\,\mu F$

C) $R = 20\ \Omega,\ L = 3.5\,H,\ C = 35\,\mu F$ D) $R = 25\ \Omega,\ L = 1.5\,H,\ C = 45\,\mu F$

31. The value of acceleration due to gravity at Earth's surface is 9.8 ms^{-2}. The altitude above its surface at which the acceleration due to gravity decreases to 4.9 ms^{-2}, is close to: (Radius of earth = $6.4\times10^6\ m$**)**

A) $6.4\times10^6\ m$ B) $9.0\times10^6\ m$ C) $2.6\times10^6\ m$ D) $1.6\times10^6\ m$

32. A carbon resistance has a following colour code. What is the value of the resistance?

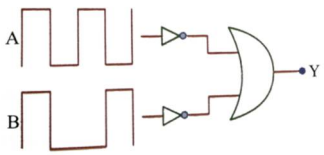


A) $5.3M\Omega\pm5\%$ B) $530K\Omega\pm5\%$ C) $64K\Omega\pm10\%$ D) $6.4M\Omega\pm5\%$

33. **If C the velocity of light, h planck's constant and G gravitational constant are taken as fundamental quantites, then the dimensional formula of mass is**

A) $h^{1/2}C^{1/2}G^{-1/2}$ B) $h^{-1/2}C^{1/2}G^{-1/2}$ C) $h^{-1/2}C^{-1/2}G^{-1/2}$ D) $h^{-1/2}C^{-1/2}G^{0}$

34. **In a given circuit as shown the two input wave forms A and B are applied simultaneously**

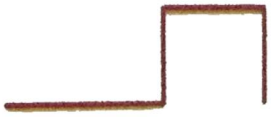


The resultant wave form at Y is

A) 

B) 

C) 

D) 

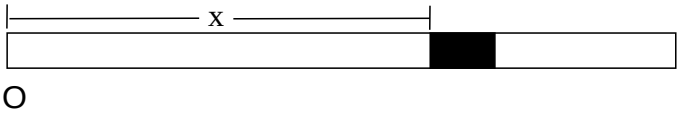
35. **When a monoatomic gas expands at constant pressure, then the percentage of heat supplied that increases temperature of the gas and in doing external work in expansion respectively are**

A) 100% , 0 B) 60% , 40% C) 40% , 60% D) 75% , 25%

36. **Using a nuclear counter the count rate of emitted particles from a radioactive source is measured. At t = 0 it was 1600 counts per second and t = 8 seconds it was 100 counts per second. The count rate observed, as counts per second, at t = 6 seconds is close to**

A) 150 B) 400 C) 360 D) 200

37. **The linear density of a rod of length L varies as $\rho = A + Bx$ where x is the distance from the left end. The distance of centre of mass from O is**



A) $\frac{3AL+2BL^2}{3(2A+BL)}$ B) $\frac{2AL+2BL^2}{3(2A+BL)}$ C) $\frac{2AL+2BL^2}{4(2A-BL)}$ D) $\frac{2AL+2BL^2}{4(2A-BL)}$

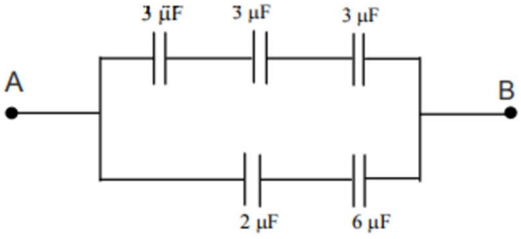
38. **In an electron microscope, the resolution that can be achieved is of the order of the wavelength of electrons used. To resolve a width of 7.5 x 10^{-12} m, the minimum electron energy required is close to _____ KeV**

A) 500 B) 25 C) 1 D) 100

39. **A copper block of mass 2.5 kg is heated in a furnace to a temperature of 500 ^{0}C and then placed on a large ice block. The maximum amount of ice (approx) that can melt ____ kg (Specific heat of copper = 0.39 J g^{-1} K^{-1} : heat of fusion of water = 335 J g^{-1})**

A) 2.5 B) 1 C) 1.5 D) 0.5

40. **In the given arrangement of the capacitors, one $3\mu F$ capacitor has got $600\mu J$ of energy. Then the potential difference across $2\mu F$ capacitor is**



A) 40 V B) 15 V C) 60 V D) 45 V

41. **Three bodies a ring, a solid disc and a solid sphere roll down the same inclined plane without slipping. The radii of the bodies are identical and they start from rest. If V_S, V_R and V_D are the speeds of the sphere, ring and disc respectively when they reach the bottom, then the correct option is**

A) $V_S > V_R > V_D$ B) $V_D > V_S > V_R$ C) $V_R > V_D > V_S$ D) $V_S > V_D > V_R$

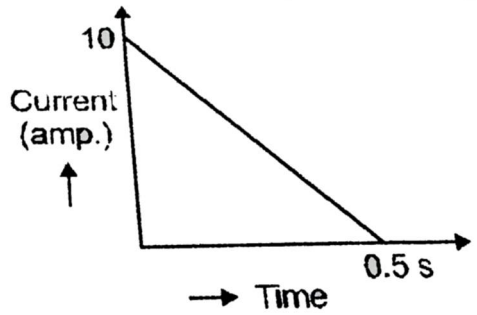
42. **A proton and a deutron are sent into an electric field. The ratio of the accelerations of proton and deutron is**

A) 2 : 1 B) 1 : 2 C) 1 : 1 D) 4 : 1

43. **Two moles of helium gas is mixed with three moles of hydrogen molecules (taken to be rigid). What is the molar specific heat of mixture at constant volume ? (R = 8.3 J mol^{-1} K^{-1})**

A) 17.4 **J mol^{-1} K^{-1}** B) 19.7 **J mol^{-1} K^{-1}** C) 21.6 **J mol^{-1} K^{-1}** D) 15.7 **J mol^{-1} K^{-1}**

44. **In a coil of resistance 100Ω, a current is induced by changing the magnetic flux through it as shown the figure. The magnitude of change in flux through the coil is**



A) 200 Wb B) 225 Wb C) 250 Wb D) 275 Wb

45. **A compound microscope has magnifying power 95 and the distance of the object from objective lens is 1/3.8 cm. If the focal length of is objective lens is ¼ cm, the magnification of eye-piece would be _____**

A) 10 B) 100 C) 5 D) 20

SECTION- II
(Numerical ValueAnswer Type)

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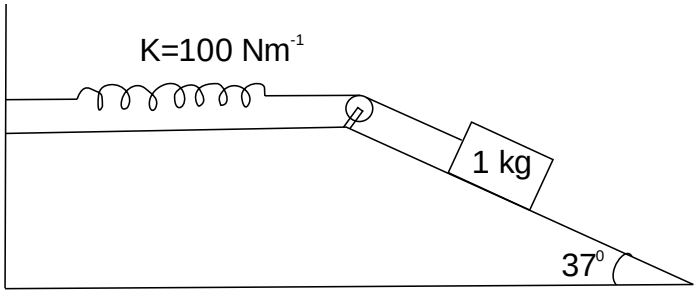
46. **The magnetic field in a travelling electromagnetic wave has a peak value of** 20 nT**. The peak value of electric field strength is _____ V/m**

47. **A 1kg block situated on a rough incline is connected to a spring of spring constant** $100 Nm^{-1}$ **as shown in figure. The block is released from rest with the spring in the unstretched position. The block moves 10cm down the incline before coming to rest. Assume that the spring has negligible mass and the pulley is frictionless. If the coefficient of friction between the block and the incline is μ. Then 80μ = _____ (take g = 10 ms^{-2})**



48. **In a meter bridge, the left and right gaps are closed by resistances 2 ohm and 3 ohm respectively. The value of shunt to be connected to 3 ohm resistor to shift the balancing point by 22.5 cm is_____ ohm**

49. **A particle which is experiencing a force, given by $\vec{F} = 3\hat{i} - 12\hat{j}$, undergoes a displacement of $\vec{d} = 4\hat{i}$. If the particle had a kinetic energy of 3 J at the beginning of the displacement, its kinetic energy at the end of the displacement_____ J**

50. **In Young's double slit experiment the wavelength of red light is** 7.5×10^{-5} cm **and that of blue light is** 5.0×10^{-5} cm**. The value of n for which** $(n+1)^{th}$ **blue bright band coincides with** n^{th} **red band is_____**

SECTION – I
(SINGLE CORRECT ANSWER TYPE)

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CHEMISTRY

51. **What is the wavelength of light emitted when the electron in a hydrogen atom undergoes transition from an energy level with $n = 4$ to energy level with $n = 2$?**

A) 880 nm B) 680 nm C) 486 nm D) 920 nm

52. **Both geometrical and optical isomerism are shown by**

A) $\left[Co(en)_2 Cl_2\right]^+$ B) $\left[Co(NH_3)_5 Cl\right]^{2+}$ C) $\left[Co(NH_3)_4 Cl_2\right]^+$ D) $\left[Cr(OX)_3\right]^{3-}$

53. **The x-x bond length is 1.00 A^0 and $C-C$ bond length is** $1.54A^0$**. If electronegativity's of 'X' and 'C' are 3.0 and 2.0 respectively the $C-X$ bond length is likely to be**

A) 1.27 A^0 B) $1.18A^0$ C) $1.08A^0$ D) $1.28A^0$

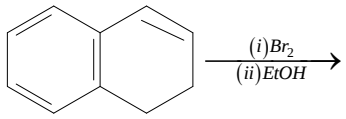
54. **How many σ and π - bonds are there in salicylic acid**

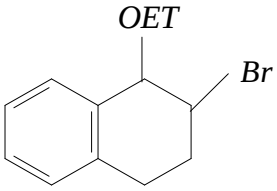
A) $10\sigma, 4\pi$ B) $16\sigma, 4\pi$ C) $18\sigma, 2\pi$ D) $16\sigma, 2\pi$

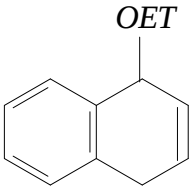
55. **Sulphur reacts with chlorine in 1:2 ratio and forms X. Hydrolysis of X gives a sulphur compound Y. What is the hybridization state of central atom in the compound?**

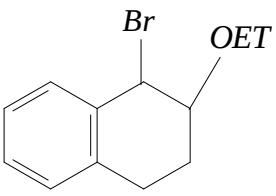
A) SP^2 B) SP^3 C) SP D) dSP^2

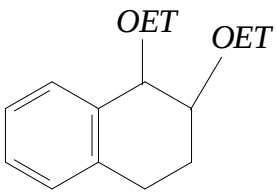
56. **The major product of the following reaction is**



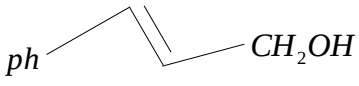
A) 

B) 

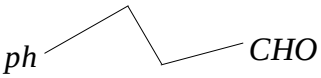
C) 

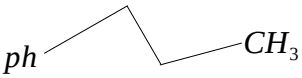
D) 

57. 

A) 

B) 

C) 

D) 

58. $CH_3Cl + KCN \rightarrow X \xrightarrow{hydrolysis} Y \xrightarrow{P_4O_{10}} Z$ **In the above series of reaction 'Z' is**

A) CH_3CN B) CH_3COOH C) $(CH_3CO)_2O$ D) $CH_3 - CH_2OH$

59. **The polymer obtained by the monomers glycine and amino caproic acid is**

A) Nylon-6 B) Nylon-6,6 C) Nylon-2-Nylon-6 D) Nylon-6,10

60. **Which of the following does not produce any gaseous product when reacts with water ?**

A) Ca_3N_2 B) CaC_2 C) CaO D) Ca_3P_2

61. $2RCl + Si \xrightarrow[570K]{Cu\,power} R_2SiCl_2 \xrightarrow{H_20} R_2Si(OH)_2 \rightarrow (X)$ **is**

A) Cyclic silicone B) Cross-linked silicone

C) Linear silicone D) None of these

62. **The neurotransmitter of the following are**

A) iproniazid B) histamine C) noradrenaline D) bithional

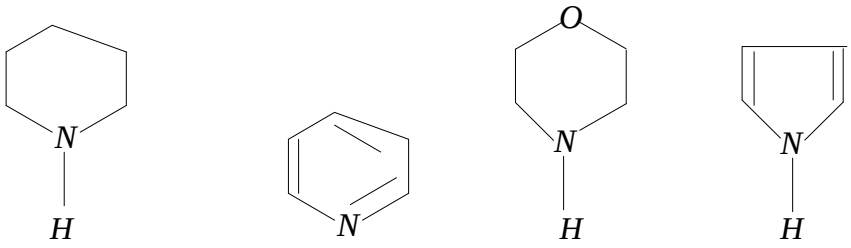
63. **Which of the following ores is best concentrated by forth floatation method**

A) Magnetic B) Siderite C) Galena D) Malachite

64. **Pressure exerted by 1 mole of methane in a 0.25 litre container at 300K using vanderwaal's equation** $\left(a = 2.253\,atm\,L^2mol^{-2}, b = 0.0428\,Lmol^{-1}\right)$ **is**

A) 82.82 atm B) 152.21 atm C) 19.52 atm D) 70.52 atm

65. **The order of basicity of the compounds**



(I) **(II)** **(III)** **(IV)**

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

66. **The volume of** CH_4 **at NTP is formed when 20.5 g** CH_3COONa **is treated with sodalime**

A) 4.4 lit B) 2.2 lit C) 3.2 lit D) 5.6 lit

67. **Estimate the approximate** P^{Ka} **of 0.5 M** CH_3COOH **degree of dissociation is 0.15**

A) 2.0 B) 1.5 C) 1.88 D) 0.15

68. **Heat of neutralization of HF is**

A) 57.32 KJ B) >57.32 KJ C) <57.32 KJ D) All

69. **What is Z in the following reactions** $BCl_3 + H_2 \xrightarrow[450^0C]{Cu-Al} X + HCl$

$X \xrightarrow{methylation} Z$

A) $(CH_3)BH_2$ B) $(CH_3)_4B_2H_2$ C) $(CH_3)_3B_2H_3$ D) $(CH_3)_6B_2$

70. **The concentration of dissolved oxygen** (DO) **in cold water can go up to**

A) 8 PPm B) 16 PPm C) 14 PPm D) 10 PPm

SECTION- II

(Numerical ValueAnswer Type)

Thissectioncontains5questions.TheanswertoeachquestionisaNumericalvaluescomprisingofpositive ornegativedecimalnumbers. Eachquestionhas4options(A),(B),(C) and(D)foritsanswer,outof which**ONLY ONE**optioncanbecorrect.
Markingscheme:+4forcorrectanswer,0inallothercases.

71. 12g a nonvolatile solute dissolved in 108g of water produces the relative lowering of vapour pressure is 0.1. The molecular mass at the solute is------

72. The percentage of P-character in the orbital forming P-P bonds in P_4 is-----

73. What is the P^H of 10^{-4} MOH solution at 330k , if Kw at 330 k is $10^{-13.6}$?

74. 2.84 g of methyl iodide was completely converted into methyl magnesium iodide was decomposed by express of ethanol excess, the volume(in lit) of the gaseous hydrocarbon produced at NTP will be ----

75. A litre of sea water (which weight 1030g) contain $6x10^{-3}$g of dissolved oxygen. The concentration of dissolved oxygen ppm is--

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MELUHA INTERNATIONAL SCHOOL

HYDERABAD

SR MPC | **JEE MAINS TOTAL GT** | **Date: 16-05-2020**

Time: 3 Hours | **Max. Marks: 300**

KEY SHEET

MATHEMATICS

1) **C**	2) **A**	3) **A**	4) **C**	5) **B**	6) **B**	7) **A**	8) **D**	9) **C**	10) **B**
11) **D**	12) **A**	13) **B**	14) **B**	15) **C**	16) **B**	17) **B**	18) **A**	19) **B**	20) **A**
21) **0.0875**	22) **201**	23) **7**	24) **9**	25) **27**					

PHYSICS

26) **B**	27) **C**	28) **B**	29) **B**	30) **A**	31) **C**	32) **B**	33) **A**	34) **A**	35) **B**
36) **D**	37) **A**	38) **B**	39) **C**	40) **D**	41) **D**	42) **A**	43) **A**	44) **C**	45) **C**
46) **6**	47) **10**	48) **2**	49) **15**	50) **2**					

CHEMISTRY

51) **C**	52) **A**	53) **B**	54) **B**	55) **B**	56) **A**	57) **B**	58) **C**	59) **C**	60) **C**
61) **C**	62) **A**	63) **C**	64) **A**	65) **A**	66) **D**	67) **C**	68) **C**	69) **B**	70) **D**
71) **20**	72) **75**	73) **9.6**	74) **0.448**	75) **5.8**					

HINTS& SOLUTIONS
MATHS

1. $\sigma^2 = \left(\frac{\sum x_i^2}{n}\right) - \left(\frac{\sum x_i}{n}\right)^2 = \frac{1530}{10} - 12^2 = 9$

   Now CV= $\frac{\sigma}{\bar{x}} \times 100 = \frac{3}{12} \times 100 = 25$

2. $\sim(\sim p \wedge q) \wedge (p \vee q) \equiv (p \vee \sim q) \wedge (p \vee q)$

   $\equiv p \vee (\sim q \wedge q)$

   $\equiv p \vee F \equiv p$

3. Given *f(f(1))=0, f(f(2))=0,*

   =>equation f(x)=0 has roots f(1),f(2)

   =>f(1)+f(2)= -α and f(1) f(2)=β

   =>5+3α+2β=-α and (1+α+β)(4+2α+β)=β

   $\Rightarrow 2\alpha + \beta = \frac{-5}{2}$ *and* $\left(1 - \frac{5}{4} - \frac{\beta}{2} + \beta\right)\left(4 - \frac{5}{2}\right) = \beta$

   $\Rightarrow \beta = \frac{-3}{2}$

   Now f(0)= $\beta = \frac{-3}{2}$

4. b_1 is first term and r is common ratio

   $\frac{b_4}{b_6} = \frac{1}{4} \Rightarrow \frac{b_1 r^3}{b_1 r^5} = \frac{1}{4} \Rightarrow r = \pm 2$

   Also $b_2+b_5=216 \Rightarrow b_1(r+r^4)=216$

   $\Rightarrow b_1\left(2 + 2^4\right) = 216 \Rightarrow b_1 = 12$

5. P_1=x-4y+7z-g=0

   P_2=3y-5z-h=0

   P_3=-2x+5y-9z-k=0

   Since system is consistent , $2P_1+P_2+P_3=0$

   So 2g+h+k=0

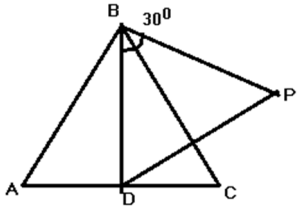
6. Data => a=5,b=6,c=7

   Median BD= $\frac{1}{2}\sqrt{2c^2 + 2a^2 - b^2} = 2\sqrt{7}$

   DP=lamp post of height 'h'

   $\Delta DBP \Rightarrow \tan 30^0 = \frac{DP}{BD}$

   $\frac{1}{\sqrt{3}} = \frac{h}{2\sqrt{7}} \Rightarrow h = \frac{2\sqrt{7}}{\sqrt{3}} \Rightarrow h = \frac{2\sqrt{21}}{3}$



7. Roots α,β,γ satisfy $|\alpha| = |\beta| = |\gamma| = 1$,

   Now α+ β+ γ= - a $\Rightarrow |-a| = |\alpha + \beta + \gamma|$

   $\Rightarrow |a| \le |\alpha| + |\beta| + |\gamma|$

   $\Rightarrow |a| \le 1+1+1 \Rightarrow |a| \le 3$

   Similarly $\Rightarrow |b| \le 3, |c| = 1$

8. $P_n = {}^{n-2}C_3, Q_n = {}^{n}C_3 - (n + n(n-4))$

   Now $P_n - Q_n = 6 \Rightarrow n = 10$

9. Given equation converts to

   $(\sin x+1)(4\cos^2 x+2\cos x-2)=0$

   =>sinx=-1,cosx= $\frac{1}{2}, -1$

   $x = \frac{-\pi}{2}, \pm\frac{-\pi}{3}, \pm\pi$

   Sum of solutions $\frac{-\pi}{2} = \frac{-\pi}{k} \Rightarrow k = 2$

10. $(\bar{a}.\bar{c}).\bar{b} - (\bar{a}.\bar{b}).\bar{c} = (\bar{a}.\bar{c}).\bar{b} - (\bar{b}.\bar{c}).\bar{a}$

    $\bar{a} = \frac{(\bar{a}.\bar{b})}{(\bar{b}.\bar{c})}\bar{c} \Rightarrow \bar{a} = \lambda\bar{c}$

    $\Rightarrow \bar{a}, \bar{c}$ are collinear

11. $\int(\sin 2x - \cos 2x)dx = \frac{1}{\sqrt{2}}\sin(2x-a) + b$

    $\Rightarrow -\frac{1}{2}(\sin 2x + \cos 2x) = \frac{1}{\sqrt{2}}\sin(2x-a) + b$

    $\Rightarrow -\left[\frac{1}{\sqrt{2}}\sin 2x + \frac{1}{\sqrt{2}}\cos 2x\right] = \sin(2x-a) + \sqrt{2}b$

    $\Rightarrow \sin\left(2x + \frac{5\pi}{4}\right) = \sin(2x-a) + b$

    $\Rightarrow$ b is any constant and a = $\frac{-5\pi}{4}$

12. $\lim_{x\to\infty} \frac{x^2 \sin\frac{1}{x} - x}{1-|x|}$

    $= \lim_{x\to\infty} \frac{x^2\left(\frac{1}{x} - \frac{1}{3!}\frac{1}{x^3} + ---\right) - x}{1-|x|}$

    $, \left[as\ x \to \infty, \frac{1}{x} \to 0\right]$

    $\lim_{x\to\infty} \frac{\left(x - \frac{1}{6x} + ----x\right)}{1-|x|}$

    $\lim_{x\to\infty} \frac{\frac{1}{6x} - \text{terms containing powers of } \frac{1}{x}}{1-|x|} = 0$

13. $y = \cos^{-1}\left(\frac{1-x^2}{1+x^2}\right) = \begin{cases} 2\tan^{-1}x, 0 \le x < \infty \\ -2\tan^{-1}x, if\ -\infty < x < 0 \end{cases}$

$$f^1(x)=\frac{d}{dx}\cos^{-1}\left(\frac{1-x^2}{1+x^2}\right)=\frac{2x}{|x|\left(1+x^2\right)}$$

$f^1(x)<0$ *if* $x<0$

$x\in(-\infty,0)$

14. $f(x)=\dfrac{|x|}{8\cos^2 2x+1}$

Then

$$f(-x)=\frac{|x|}{8\cos^2 2(-x)+1}=\frac{|x|}{8\cos^2 2x+1}=f(x)$$

$\therefore f(x)$ is even function

$$\therefore I_1=\int_{\frac{-\pi}{2}}^{\frac{\pi}{2}}\frac{|x|dx}{8\cos^2 2x+1}=2\int_0^{\frac{\pi}{2}}\frac{|x|dx}{8\cos^2 2x+1}$$

$$=\frac{\pi}{2}\int_0^{\frac{\pi}{2}}\frac{dx}{8\cos^2 2x+1}-I_1$$

$$2I_1=\frac{\pi}{2}.2\int_0^{\frac{\pi}{4}}\frac{dx}{8\cos^2 2x+1}$$

$$2I_1=\pi\int_0^{\frac{\pi}{4}}\frac{\sec^2 2xdx}{9+\tan^2 2x}$$

Put tan2x=t => $2\sec^2 2xdx=dt$

$$2I_1=\frac{\pi}{2}\int_0^{\infty}\frac{dt}{9+t^2}=\frac{\pi}{2}.\frac{1}{3}.\frac{\pi}{2}$$

$$\therefore I_1=\frac{\pi^2}{24}\Rightarrow I=2I_1=\frac{\pi^2}{12}$$

15. $f(x)=\dfrac{\sqrt{a^2-ax+x^2}-\sqrt{a^2+ax+x^2}}{\sqrt{a+x}-\sqrt{a-x}}$

f(x) is continuous for all x so it is continuous at x=0

f(0) = $\lim\limits_{x\to 0} f(x)$

$$\lim_{x\to 0}\frac{\sqrt{a^2-ax+x^2}-\sqrt{a^2+ax+x^2}}{\sqrt{a+x}-\sqrt{a-x}}$$

$$\lim_{x\to 0}\frac{-2ax}{2x}\lim_{x\to 0}\frac{\sqrt{a+x}+\sqrt{a-x}}{\sqrt{a^2-ax+x^2}+\sqrt{a^2+ax+x^2}}$$

$$=\frac{-a\times 2\sqrt{a}}{2a}=-\sqrt{a}$$

16. given $f''(x)=6(x-1)$

$f'(x)=3(x-1)^2+c_1$

But at point (2,1) the line y=3x-5 is tangent to the graph y=f(x)

Hence $\left.\dfrac{dy}{dx}\right|_{x=2}=3$ *or* $f'(2)=3$

Then from (i) $f'(2)=3(2-1)^2+C_1$

3=3+C_1 => C_1=0,I,e $f^1(x)=3(x-1)^2$

$\therefore f(x)=(x-1)^3+C_2$

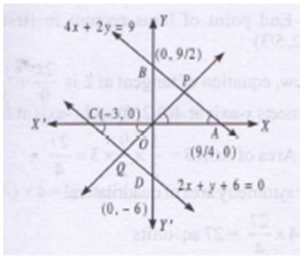
Given f(2)=1

$\therefore f(2)=1+C_2$

1=1+C_2 => C_2 =0. Hence $f(x)=(x-1)^3$

17. In particular , PQ can be taken perpendicular to the two parallel lines then required ratio = ratio of perpendicular distance of lines from origin

$$=OP.OQ=\left|\frac{9}{\sqrt{20}}\right|:\left|\frac{-6}{\sqrt{5}}\right|=3:4$$



18. Direction ratios QR are 1,4,1

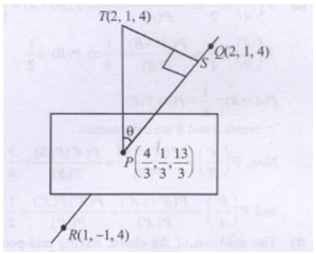
Equation of line QR is

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

Let P= (2+λ,3+4λ,5+λ) = 10+5λ-12-16λ-5-λ=1 [from 5x-4y-z=1]

-7-12λ=1 $\Rightarrow\dfrac{-2}{3}$

Then $p\equiv\left(\dfrac{4}{3},\dfrac{1}{3},\dfrac{13}{3}\right)$



Let S=(2+μ, 3+4μ,5+μ)

$\vec{TS}=(\mu)\hat{i}+(4\mu+2)\hat{j}+(\mu+1)\hat{k}$

$\vec{TS}\left(\hat{i}+4\hat{j}+\hat{k}\right)=0\Rightarrow\mu+16\mu+8+\mu+1=0$

$$\mu=-\frac{1}{2}\Rightarrow S=\left(\frac{3}{2},1,\frac{9}{2}\right)$$

PS=

$$\sqrt{\left(\frac{4}{3}-\frac{3}{2}\right)^2+\left(\frac{1}{3}-1\right)^2+\left(\frac{13}{3}-\frac{9}{2}\right)^2}=\sqrt{\frac{1}{36}+\frac{4}{9}+\frac{1}{36}}=$$

$$\sqrt{\frac{1}{18}+\frac{4}{9}}=\sqrt{\frac{9}{18}}=\frac{1}{\sqrt{2}}$$

19. The equation of the chord, having mid-point as (x_1,y_1) of the hyperbola $\frac{x^2}{a^2}-\frac{y^2}{b^2}=1$ is given by $T=S_1$ ---(1)

Where , $T=\frac{xx_1}{a^2}-\frac{yy_1}{b2}-1$ and

$S_1=\frac{x_1^2}{a^2}-\frac{y_1^2}{b^2}-1$

According to the question,

$(x_1,y_1)=(5,3)\,and\;a^2=16,b^2=25$

As $25x^2-16y^2=400$

$\Rightarrow \frac{x^2}{16}-\frac{y^2}{25}=1$

$\Rightarrow \frac{5x}{16}-\frac{3y}{25}=\frac{25}{16}-\frac{9}{25}\Rightarrow 125x-48y=625-144$

$\Rightarrow 125x-48y=481$

20. ab=2a+3b => (a-3)b=2a=> $b=\frac{2a}{a-3}$

Now $z=ab=\frac{2a^2}{a-3}$

$\Rightarrow \frac{dz}{da}=\frac{2\left[(a-3)2a-a^2\right]}{(a-3)^3}=\frac{2\left[a^2-6a\right]}{(a-3)^3}$

$\Rightarrow \frac{dz}{da}=0\;\therefore a^2-6a=0\Rightarrow a=0,6$

Now put a=6, $\frac{d^2z}{da^2}=+ve$

When a=6,b=4 $\therefore\left(\frac{a}{b}\right)=\frac{6}{4}=1.5$

21. Number of matches 2+2=4matches
(7 points or 8 points in 4 matches)
= (1,2,2,2)+(2,2,2,2)

$=\left(\frac{4!}{3!}\right)(0.05)(0.50)^3+\frac{4!}{4!}(0.50)^4$

$=0.0875$

22. Data =>

$\sum_{k=0}^{100}\left(1-\frac{1}{k+1}\right)\left({}^{100}C_K\right)=\frac{a\left(2^{100}\right)+b}{c}$

$\sum_{k=0}^{100}{}^{100}C_K-\sum_{k=0}^{100}\frac{{}^{100}C_K}{k+1}=\frac{a\left(2^{100}\right)+b}{c}$

$2^{100}-\frac{2^{101}-1}{101}=\frac{a(2^{100})+b}{c}\left(\because\sum_{r=0}^{n}\frac{{}^nC_r}{r+1}=\frac{2^{n+1}-1}{n+1}\right)$

$\Rightarrow \frac{99\left(2^{100}\right)+1}{101}=\frac{a(2^{100})+b}{c}$

$\therefore a+b+c=99+1+101\Rightarrow a+b+c=201$

23. f(x)exists if $3\cos^{-1}(4x)-\pi\geq 0$

$\Rightarrow \cos^{-1}(4x)\geq\frac{\pi}{3}\Rightarrow\frac{\pi}{3}\leq\cos^{-1}4x\leq\pi$

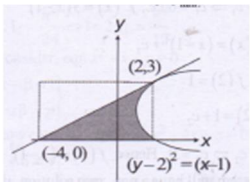
$\Rightarrow -1\leq 4x\leq\frac{1}{2}$

$\Rightarrow -\frac{1}{4}\leq x\leq\frac{1}{8}$

$\Rightarrow x\in\left[-\frac{1}{4},\frac{1}{8}\right]$ domain

Thus $a=-\frac{1}{4},b=\frac{1}{8}\Rightarrow$ 4a+64b=7

24.



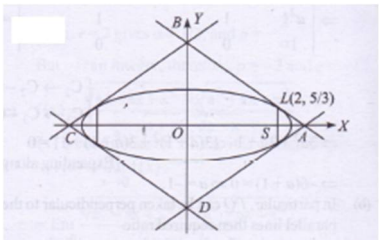
The equation of tangent at (2,3) to the given parabola is x=2y-4 , it cuts x-axis at (-4,0)

Required area = $\int_0^3\left\{(y-2)^2+1-2y+4\right\}dy$

=

$\left[\frac{(y-2)^3}{3}-y^2+5y\right]_0^3=\frac{1}{3}-9+15+\frac{8}{3}=9sq.units$

25. The given ellipse is $\frac{x^2}{9}+\frac{y^2}{5}=1$



Here , $a^2=9$, $b^2=5$ => $\Rightarrow e=\sqrt{1-\frac{b^2}{a^2}}=\sqrt{1-\frac{5}{9}}=\frac{2}{3}$

$\therefore$ End point of latus rectum in first quadrant is L(2,5/3)

Now, equation of tangent at L is $\frac{2x}{9}+\frac{y}{3}=1$

Its meet x-axis at A(9/2,0) and y-axis at B(0,3)

$\therefore$ area of $\Delta OAB=\frac{1}{2}\times\frac{9}{2}\times 3=\frac{27}{4}$

By symmetry area of quadrilateral =

$4\times\left(area\,of\;\Delta OAB\right)=4\times\frac{27}{4}=27sq.units$

PHYSICS

26. $B = B_a \otimes + B_b \otimes$

$B = \frac{3}{4}\left(\frac{\mu_o I}{2a}\right)\otimes + \frac{1}{4}\left(\frac{\mu_o I}{2b}\right)\otimes$

$= \left(\frac{3\mu_o I}{8a} + \frac{\mu_o I}{8b}\right)\otimes$

27) $V = \frac{1}{2l}\sqrt{\frac{YA\alpha(\Delta t)}{\mu}} = \frac{1}{2}\sqrt{\frac{YA\alpha(\Delta t)l}{m}}$

$V = \frac{1}{2}\sqrt{\frac{200\times10^{9}\times10^{-6}\times1.21\times10^{-5}\times20\times1}{1\times10^{-1}}} = 11Hz$

28)

$\lambda_{photon} = \frac{hc}{E}, \lambda_{electron} = \frac{h}{\sqrt{2mE}}$

$\frac{\lambda_{electron}}{\lambda_{photon}} = \frac{1}{C}\left(\frac{E}{2m}\right)^{1/2}$

29) Conceptual

30) The LCR circuit used for communicaton should possess high quality factor (Q factor) or resonance, which is given by

$Q = \frac{1}{R}\sqrt{\frac{L}{C}}$

To make Q high , R should be low, L should be high and C should be low. Therefore, Choice (1) is the best suited.

31) From $\frac{g_1}{g_2} = \frac{(R+h_2)^2}{(R+h_1)^2}$

$\frac{9.8}{4.9} = \left(\frac{R+h_2}{R+0}\right)^2$

$h_2 = \left(\sqrt{2}-1\right)R = 2.6\times10^{6}m$

32)

1st digit green = 5

2nd digit orange = 3

3rd digit yellow = 4

$Tolerance\,is\,gold = \pm5\%$

$\therefore R = 53\times10^{4}\pm5\% = 530K\Omega\pm5\%$

33) $M = (C)^x (h)^y (G)^z$

$M = \left(LT^{-1}\right)^x \left(ML^2T^{-1}\right)^y \left(M^{-1}L^3T^{-2}\right)^z$

By solving $x = \frac{1}{2}, y = \frac{1}{2}, z = -\frac{1}{2}$

34)

Logic of A is 1011

Logic of B is 1001

Logic of Y is 0111

35) $\frac{dU}{dQ}\times100\% = \frac{1}{\gamma}\times100\% = 60\%$

$\frac{dW}{dQ}\times100\% = 100\% - 60\% = 40\%$

36) $A = A_o\left(\frac{1}{2}\right)^{\frac{t}{t_{1/2}}}$

$100 = 1600\left(\frac{1}{2}\right)^{\frac{8}{t_{1/2}}} \Rightarrow t_{1/2} = 2$

$A_6 = 1600\left(\frac{1}{2}\right)^{\frac{6}{2}} = 200C/s$

37) $x_{cm} = \frac{\int_0^L x\,dm}{\int_0^L dm}$

$x_{cm} = \frac{\int_0^L x(A+Bx)dx}{\int_0^L (A+Bx)dx}$

$x_{cm} = \frac{3AL+2BL^2}{3(2A+BL)}$

38)

$\lambda = \sqrt{\frac{150}{V}} \Rightarrow 7.5\times10^{-2} = \sqrt{\frac{150}{V}}$

$V = \frac{80}{3} \approx 25$

39) $(ms\Delta\theta)_{copper} = (mL)_{ice}$

$2.5\times0.39\times500 = m\times335$

$m \approx 1.5$

40)

$600\times10^{-6} = \frac{1}{2}\left(3\times10^{-6}\right)V_0^2$

$\Rightarrow V_o = 20V \Rightarrow V_{AB} = 3V_o = 60V$

$V_{2\mu F} = \left(\frac{3}{3+1}\right)60 = 45V$

41) From $V \propto \sqrt{\frac{1}{1+\frac{K^2}{R^2}}}$

As

$\left(\frac{K^2}{R^2}=1\right)_{ring} > \left(\frac{K^2}{R^2}=\frac{1}{2}\right)_{disc} > \left(\frac{K^2}{R^2}=\frac{2}{5}\right)_{solid\,sphere}$

$V_S > V_D > V_R$

42) $a = \frac{qE}{m} \Rightarrow a \propto \frac{1}{m}$

43) $f_{mix} = \dfrac{n_1 f_1 + n_2 f_2}{n_1 + n_2} = \dfrac{2\times 3 + 3\times 5}{5} = \dfrac{21}{5}$

$C_v = f\dfrac{R}{2} = \dfrac{21}{5}\times\dfrac{R}{2} = 17.4$

44) $d\phi = (i\,R)dt = (i\,dt)R$ = (area under i-t graph) R

$d\phi = \left(\dfrac{1}{2}\times\dfrac{1}{2}\times 10\right)100 = 250Wb$

45)

$\dfrac{1}{v_o} = \dfrac{1}{f_o} + \dfrac{1}{u_o} = 4 - 3.8 = 0.2$

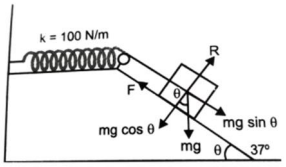
$v_o = 5cm$

$m = m_o m_e = \left(\dfrac{v_o}{u_o}\right)m_e \Rightarrow 95 = (5\times 3.8)\,m_e$

$m_e = 5cm$

46) $E_o = B_o C = 20\times 10^{-9}\times 3\times 10^8 = 6V/m$

47)



$W_{net} = 0$

$W_g + W_f + W_S = 0$

$(mg\,\mathrm{Sin}\,\theta)(x)\,\mathrm{Cos}\,0^0 + (\mu mg\,\mathrm{Cos}\,\theta)(x)$

$\mathrm{Cos}\,180^0 - \dfrac{1}{2}Kx^2 = 0$

$1\times 10(\mathrm{Sin}\,37^0 - \mu\,\mathrm{Cos}\,37^0) = \dfrac{1}{2}\times 100\times 0.1$

$\mu = \dfrac{1}{8}$

48)

$\dfrac{2}{3} = \dfrac{l}{100-l} \Rightarrow l = 40cm$

$\dfrac{\dfrac{2}{3r}}{3+r} = \dfrac{62.5}{100-62.5} \Rightarrow r = 2\Omega$

49) $K_f - K_i = \vec{F}.\vec{S}$

$K_f - 12 = (3i - 12j).(4j)$

$K_f = 15J$

50)

$n_1\lambda_1 = n_2\lambda_2$

$(n+1)\times 5\times 10^{-5} = n\times 7.5\times 10^{-5}$

$n = 2$

CHEMISTRY

51. $\dfrac{1}{\lambda} = R\left[\dfrac{1}{n_1^2 - n_2^2}\right]$

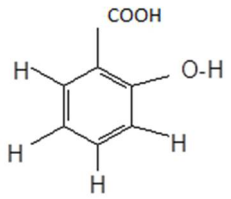
$n_1 = 2$, $n_2 = 4$, $R = 109677$

52. $\left[Co(en)_2 Cl_2\right]^+$ exhibit the cis and trans forms. cis compound is optical active

53. $d_{c-x} = (r_c + r_x) - 0.09\times EN$ difference

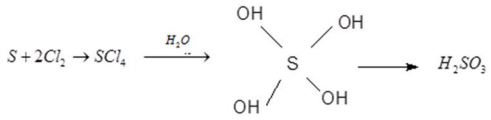
$\left(\dfrac{1.54}{2} + \dfrac{1.00}{2}\right) - (0.09\times 1) = 1.18A^0$

54.

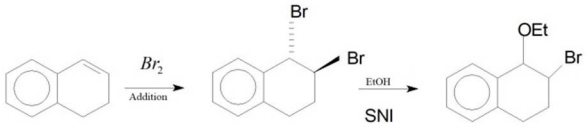


σ bond =16
πboud =4

55.



56.



57. $NaBH_4$ reduces C=C phenyl group is present at β position.

58.

$CH_3Cl \xrightarrow{Kcal} CH_3CN \xrightarrow{hytrolysis} CH_3COOH$

$\xrightarrow{P_4O_{10}} (CH_3COO)_2 O + H_2o$

59.

$NH_2 - CH_2 - COOH + NH_2 - (CH_2)_5 - COOH \rightarrow$

$\left(-CO - CH_2 - NH - CO - (CH_2)_5 - NH -\right)_n$

(Glycine) (Amino caproic acid)
(Nylon-2-Nylon-6)

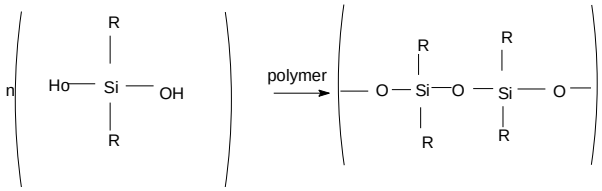
60. $Ca_3N_2 \xrightarrow{H_2O} Ca(OH)_2 + NH_3\uparrow$

$CaC_2 \xrightarrow{H_2O} Ca(OH)_2 + C_2H_2\uparrow$

$CaO \xrightarrow{H_2O} Ca(OH)_2$

$Ca_3P_2 \xrightarrow{H_2O} Ca(OH)_2 + PH_3\uparrow$

61.



62. Iproniazid is neurotransmitter.

63. Galena is sulphide ore is best concentrated by forth floatation method

64. $\left[P+\frac{n^2a}{v^2}\right](v-nb)=nRT$

$\left(P+\frac{2.253\times1^2}{(0.25)^2}\right)(0.25-1\times0.0428)$

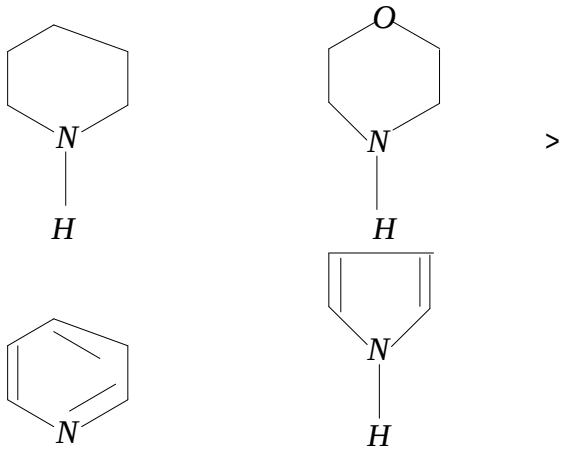
$=1\times0.0821\times300$

$P=82.82\,atm$

65. Aliphatic amines are more basic than aromatic amines.

If E.N groups decrease the basic nature in aliphatic amines.

Lone pair in pyridine is out of plane, so basic nature is more than pyrole.



66. $CH_3COONa+NaOH\xrightarrow[\Delta]{Cao}CH_4+Na_2CO_3$

$\frac{20.5}{82}=0.25$ >

1 stoichiometric coefficient of

$Na_2CO_3\rightarrow0.25\,moles$

1 stoichiometric coefficient of

$CH_4\rightarrow0.25\,moles$

$1\,mole\,Cl_2\,librates\rightarrow22.4\,liters$

$0.25\,moles\,Cl_2\,librates\rightarrow5.6\,liters$

67. $K_a=C\alpha^2/1-\alpha\;\;K_a=\frac{0.5(0.15)^2}{1-0.15}$

$K_a=\frac{1.25\times10^{-2}}{0.85}\;P^{K_a}=-\log K_a$

$=-\log\left[1.32\times10^{-2}\right]=2-\log1.32$

$=2-0.122=1.88$

68. HF is a weak acid hence heat of neutralization is less than 57.32 KJ

69 $2BCl_3+6H_2\xrightarrow[450^0C]{Cu-Al}B_2H_6+6HCl$

$B_2H_6\xrightarrow{methylation}(CH_3)_4B_2H_2$

70. D.O in cold water can go upto 10ppm.

71. $\frac{p_A^0-p_A}{p_A^0}=0.1\qquad\frac{p_A^0-p_A}{p_A^0}=\frac{w_B}{M_B}\times\frac{M_A}{w_A}$

$\Rightarrow0.1=(12/m)\times15/108\;=m=20$

72. In

$P_4\,molecule\,P\,undergoes\,SP^3\,hybridization$

$\%of\;P=75$

$\%of\;S=25$

73.

$\left[OH^-\right]=10^{-4}$

$\left[H^+\right]=\frac{Kw}{\left[OH^-\right]}=\frac{10^{-13.6}}{10^{-4}}=10^{-9.6}$

$P^H=9.6$

74. $CH_3MgI+C_2H_5OH(mole)\rightarrow\rightarrow$

$CH_4+C_2H_5OMgI$

75. $PPM=\frac{no.of\;\;parts}{total\;\;no.of\;\;parts}\times10^6$

$PPM=\frac{6\times10^{-3}}{1030}\times10^6=\frac{6000}{1030}=5.825\,ppm$

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