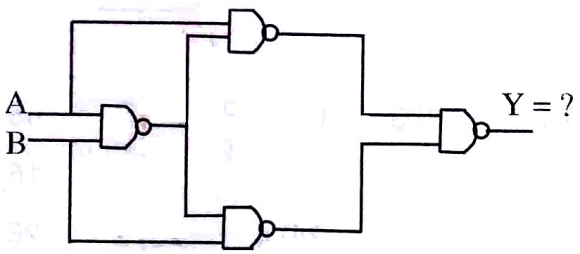
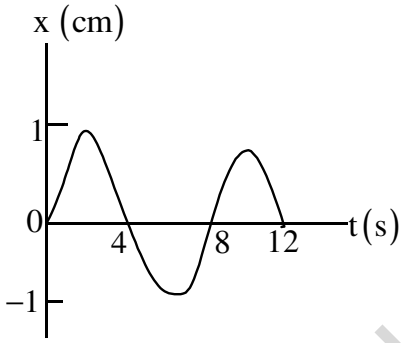
# JEE MAIN MODEL GRAND TEST (2017)




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

26. The x-t graph of a particle undergoing simple harmonic motion is shown below. The acceleration of the particle at t = 4/3 is




1) $\frac{\sqrt{3}}{32}\pi^2 cms^{-2}$ 2) $-\frac{\pi^2}{32}cms^{-2}$ 3) $\frac{\pi^2}{32}cms^{-2}$ 4) $-\frac{\sqrt{3}}{32}\pi^2 cms^{-2}$

27. A long straight wire of resistance R, radius 'a' and length 'L' carries a constant current "I". The pointing vector for the wire is

1) $\frac{IR}{2\pi al}$ 2) $\frac{IR^2}{al}$ 3) $\frac{I^2R}{al}$ 4) $\frac{I^2R}{2\pi al}$

28. An ideal gas is expanding such that $pT^2$ = constant. The coefficient of volume expansion of the gas is

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

29. In the experiment to determine the speed of sound using a resonance column.
1) prongs of the tuning fork are kept in a vertical plane
2) prongs of the tuning fork are kept in a horizontal plane
3) in one of the two resonances observed, the length of the resonating air column is close to the wavelength of sound in air
4) in one of the two resonances observed, the length of the resonating air column is close to half of the wavelength of sound in air.

30. The energy of a system as a function of time t is given as $E(t) = A^2 \exp(-\alpha t)$, where $\alpha = 0.2 s^{-1}$. The measurement of A has an error of 1.25%. If the error in the measurement of time is 1.50%, the percentage error in the value of E(t) at t = 5 s is

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

# MATHEMATICS

31. Locus of the image of the point (2, 3) in the line $(2x - 3y + 4) + k(x - 2y + 3) = 0$, $k \in R$, is a

1) Straight line parallel to x – axis 2) Straight line parallel to y – axis

3) Circle 4) Ellipse

32. Angle between tangents drawn to $x^2 + y^2 - 2x - 4y + 1 = 0$ at the points where it is cut by the line $y = 2x + c$ is $\frac{\pi}{2}$, then

1) $|c| = \sqrt{5}$ 2) $|c| = 2\sqrt{5}$ 3) $|c| = \sqrt{10}$ 4) $|c| = 2\sqrt{10}$

33. Mutually perpendicular tangents TA and TB are drawn to $y^2 = 4ax$ then the minimum length of AB is

1) a 2) 2a 3) 3a 4) 4a

34. Let P(6, 3) be a point on the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$. if the normal at the point P intersects the x – axis at (9, 0), then the eccentricity of the hyperbola is

1) $\sqrt{5/2}$ 2) $\sqrt{3/2}$ 3) $\sqrt{2}$ 4) $\sqrt{3}$

35. Let $f: R \to \left[0, \frac{\pi}{2}\right)$ defined by $f(x) = \tan^{-1}(x^2 + x + a)$, then the set of values of a for which $f$ is onto is

1) $[0, \infty)$ 2) [1, 2] 3) $\left[\frac{1}{4}, \infty\right)$ 4) $\left[\frac{3}{4}, \infty\right)$

36. $\lim\limits_{x \to \infty} \frac{x(\log x)^3}{1 + x + x^2}$ equals

1) 0 2) – 1 3) 1 4) Does not exist

37. The number of points of non – differentiability for $f(x) = \max \{|x| - 1|, 1/2\}$ is

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

38. The length of the largest continuous interval in which the function $f(x) = 4x - \tan 2x$ is monotonic is

1) $\pi/2$ 2) $\pi/4$ 3) $\pi/8$ 4) $\pi/16$

39. The value of $\int_{-1/2}^{1/2} \left[\left(\frac{x+1}{x-1}\right)^2 + \left(\frac{x-1}{x+1}\right)^2 - 2\right]^{1/2} dx$ is

1) 4 log (4/3) 2) 2 log (3/4) 3) 4 log (2/3) 4) log (4/3)

40. The curve satisfying the equation $\frac{dy}{dx} = \frac{y(x + y^3)}{x(y^3 - x)}$ and passing through the point (4, -2) is

1) $y^2 = -2x$ 2) $y = -2x$ 3) $y^3 = -2x$ 4) $y^2 = 2x$

41. Vector $\hat{a}$ in the plane of $\vec{b}=2\hat{i}+\hat{j}$ and $\vec{c}=\hat{i}-\hat{j}+\hat{k}$ is such that it is equally inclined to $\vec{b}$ and $\vec{d}$ where $\vec{d}=\hat{j}+2\hat{k}$. Then vector $\hat{a}$ is

1) $\frac{\hat{i}+\hat{j}+\hat{k}}{\sqrt{3}}$ 2) $\frac{\hat{i}-\hat{j}+\hat{k}}{\sqrt{3}}$ 3) $\frac{2\hat{i}+\hat{j}}{\sqrt{5}}$ 4) $\frac{2\hat{i}-\hat{j}}{\sqrt{5}}$

42. The equation of image of the line $\frac{x-1}{9}=\frac{y-2}{-1}=\frac{z+3}{-3}$ in the plane $3x-3y+10z-26=0$ is

1) $\frac{x-2}{9}=\frac{y-1}{-1}=\frac{z+3}{-3}$ 2) $\frac{x-5/2}{9}=\frac{y-1/2}{-1}=\frac{z-2}{-3}$

3) $\frac{x-1}{9}=\frac{y-2}{-1}=\frac{z+3}{-3}$ 4) $\frac{x-4}{9}=\frac{y+1}{-1}=\frac{z-7}{-3}$

43. The negation of the compound proposition $p\vee(\sim p)\vee q$ is

1) $(p\wedge\sim q)\wedge\sim p$ 2) $(p\wedge\sim p)\vee\sim q$ 3) $(p\wedge\sim q)\vee\sim p$ 4) $(p\wedge q)\vee p$

44. The value of 'a' for which the equation $4\,\text{cosec}^2(\pi(a+x))+a^2-4a=0$ has real solution is

1) a = 1 2) a = 2 3) a = 3 4) a = 4

45. A bird is sitting on the top of a vertical pole 20 m high and its elevation from a point O on the ground is $45^0$. It files off horizontally straight away from the point O. After one second, the elevation of the bird from O is reduced to $30^0$. Then the speed (in m/s) of the bird is

1) $40(\sqrt{2}-1)$ 2) $40(\sqrt{3}-\sqrt{2})$ 3) $40\sqrt{2}$ 4) $20(\sqrt{3}-1)$

46. If $ax+b\left(\sec\left(\tan^{-1}x\right)\right)=c$ and $ay+b\left(\sec\left(\tan^{-1}y\right)\right)=c$, then $\frac{x+y}{1-xy}=$

1) $\frac{ac}{a^2+c^2}$ 2) $\frac{2ac}{a-c}$ 3) $\frac{2ac}{a^2-c^2}$ 4) $\frac{a+c}{1-ac}$

47. Let $\begin{vmatrix} x & 2x \\ x^2 & x & 6 \\ x & x & 6 \end{vmatrix}=Ax^4+Bx^3+Cx^2+Dx+E$. Then the value of $5A+4B+3C+2D+E$ is equal to

1) 0 2) – 16 3) 16 4) – 11

48. If $B.B^T=I$ where B is non – singular 3 X 3 symmetric matrix such that $|B|=1$, then det(B – I) is equal to

1) 1 2) 0 3) – 1 4) ±1

49. A man alternately tosses a coin and throws a die beginning with the coin. The probability that he gets a head in the coin before he gets a 5 or 6 in the dice is

1) 3/4 2) 1/2 3) 1/3 4) 1/4

50. The term independent of x in expansion of $\left(\frac{x+1}{x^{2/3}-x^{1/3}+1}-\frac{x-1}{x-x^{1/2}}\right)^{10}$ is:

1) 4 2) 120 3) 210 4) 310

51. Number of divisors of the number $N=2^3.3^5.5^7.7^9$ which are perfect square is

1) 24 2) 60 3) 119 4) 120

52. For x > 0, the sum of the series $\frac{1}{1+x}-\frac{(1-x)}{(1+x)^2}+\frac{(1-x)^2}{(1+x)^3}-.....\infty$ is equal to

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

53. If $|z_1|=|z_2|=|z_3|=1$ and $z_1+z_2+z_3=0$ then area of the triangle whose vertices are $z_1,z_2,z_3$ is

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

54. The greatest integral value of 'c' so that both the roots of the equation $(c-5)\ x^2-2cx+(c-4)=0$ are positive, one root is less than 2 and other root is lying between 2 and 3 is $(c\neq 5)$

1) 22 2) 23 3) 24 4) 25

55. Suppose $A_1,A_2.....A_{30}$ are thirty sets each having 5 elements and $B_1,B_2,....B_n$ are n sets each with 3 elements. Let $\bigcup_{i=1}^{30}A_i=\bigcup_{j=1}^{n}B_j=S$ and each element of S belongs to exactly 10 of the $A_i$'S and exactly 9 of the $B_j$'S. Then n is equal to

1) 15 2) 3 3) 45 4) 35

56. Let f be differentiable for all x. If f(l) = - 2 and $f^1(x)\geq 2$ for all $x\in[1,6]$, then the value of f(6)

1) $\geq 8$ 2) $\geq 4$ 3) $\geq 6$ 4) $\geq 2$

57. $\int\frac{dx}{x^2(1+x^5)^{4/5}}$ is equal to

1) $-\frac{(1+x^5)^{1/5}}{5x}+C$ 2) $\frac{(1+x^5)^{1/5}}{5x}+C$ 3) $-\frac{(1+x^5)^{1/5}}{x}+C$ 4) $\frac{(1+x^5)^{1/5}}{x}+C$

58. Let R be the relation on the set of all real numbers defined by aRb iff $|a-b|\leq 1$. Then R is

1) Reflexive and symmetric 2) Symmetric only

3) Transitive only 4) Anti – symmetric only

59. If $y=\frac{1}{x}$, then the value of $\frac{dy}{\sqrt{1+y^4}}+\frac{dx}{\sqrt{1+x^4}}+3$ is equal to

1) 0 2) 3 3) 4 4) –3

60. For a > b > c > 0, the distance between (1, 1) and the point of intersection of the lines ax+by+c=0 and bx+ay+c=0 is less than $2\sqrt{2}$. Then

1) a + b – c > 0 2) a – b + c < 0 3) a – b + c > 0 4) a + b – c < 0

# CHEMISTRY

61. A Hydrated salt $CaCl_2$ x $H_2O$ undergoes 49.32% loss in weight on heating and becomes anhydrous . The value of x will be.

1) 3 2) 6 3) 5 4) 2

62. Argon gas taken in a closed vessel was heated from $-23^0$C to $23^0$C. The percentage increase in pressure inside the bulb is

1) 10%` 2) 11% 3) 18.4% 4) 118.4%

63. At absolute temperature the average kinetic energy of any particle is $\frac{3}{2}$ KT. Which one of the following particle has highest de Broglie wave length

1) Visible photon 2) Thermal proton 3) Thermal electron 4) Thermal neutron

64. which one of the following combination is not allowed in the LCAO method for the formation of a molecular orbital (consider Z-axis as the molecular axis)

1) $S+P_z$ 2) $S+P_x$ 3) $P_z+p_z$ 4) $P_y+p_y$

65. An ideal solution contains two volatile liquids A ($(P^0=100\,\text{to rr})$ and B($P^0$=200 torr). If mixture contains 1 mole of A and 3 moles of B, then total vapour pressure of distillate is

1) 150 torr 2) 188.88 torr 3) 185.72 torr 4) 198.88 torr

66. At 300k 1 atm pressure $N_2O_4$ dissociates according to the equation $N_2O_{4(g)} \rightleftharpoons 2NO_{2(g)}$ if one mole of $N_2O_4$ gas is in a vessel and the degree of dissociation of $N_2O_4$ is 0.533,density of equilibrium mixture is

**1)** 3.11 g/l 2) 1.56 g/l 3) 2.43 g/l 4) 4.56 g/l

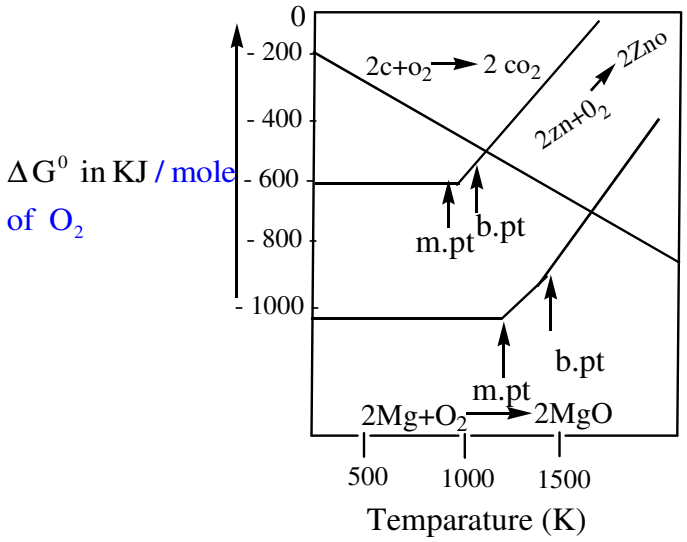
67. Equivalent conductance of saturated $BaSO_4$ is $400\,\Omega^{-1}\,cm^2\,equi^{-1}$ and specific conductance is $8x10^{-5}\,\Omega^{-1}\,cm^{-1}$. Hence Ksp of $BaSO_4$ is

1) $4x10^{-8}M^2$ 2) $1x10^{-8}M^2$ 3) $2x10^{-4}M^2$ 4) $1x10^{-4}M^2$

68. The substances X , Y and Z have coagulation values 3, 0.6, 0.08 for a metal sol respectively. Their Flocculating powers are in the ratio.

1) 1,5,37.5 2) 0.08,0.6, 3 3) 1, 0.2, 0.0267 4) 0.0267, 5, 1

69. Consider the Ellingham diagram given below at $1100^0$c, which reaction is spontaneous.




1) $MgO + C \rightarrow Mg + CO$ 2) $ZnO + C \rightarrow Zn + CO$

3) $ZnO + Mg \rightarrow Zn + MgO$ 4) $MgO + Zn \rightarrow Mg + ZnO$

70. 25 ml of samples of distilled water, tap water and boiled water required respectively,1 ml, 13ml and 5 ml of soap solution to form a permanent lather. The ratio of permanent to temporary hardness in the tap water is

**1)** 2 : 1 2) 3 : 2 3) 2 : 3 4) 1 : 2

71. From the following statements choose the incorrect statement

1) Borax, $Na_2B_4O_7.10H_2O$ has eight water molecules are in water of crystallization

2) The possible number of isomers for the formula $B_3N_3H_3X_3$ (tri substituted borazine) is six

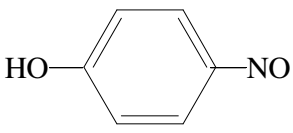
3) Diborane contains four (3c,2e) covalent bonds and two (2c, 2e) covalent bonds

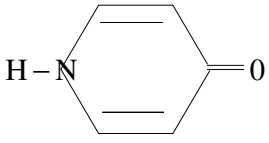
4) BN is isostrutural with graphite

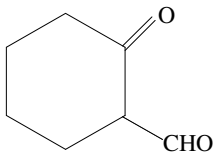
72. The products formed when iodine trichloride on hydrolysis with water

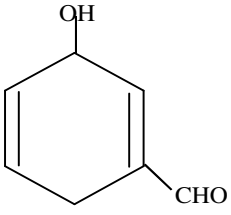
1) HOI, HCl 2) HOCl, HI 3) HI, $HClO_2$ 4) HCl, $HIO_2$

73. The compound which may exhibit tantomerism is

I. 

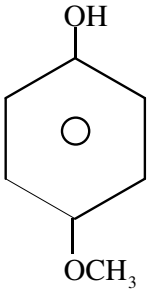

II. 


III. 

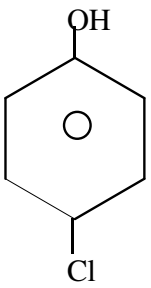

IV. 


1) I, II and III 2) I, II, III and IV 3) II, III and IV 4) I and III

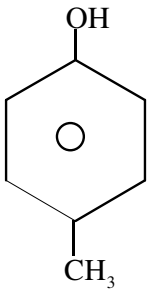
74. Arrange the following in the decreasing order of the faster rate of bromination



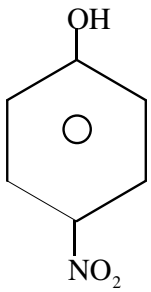
I.



II.



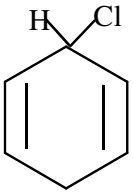
III.



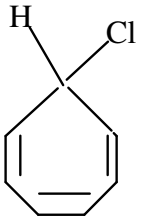
IV.

1) IV < III < II < I 2) I > III > II > IV 3) IV > II > III > I 4) I > IV > II > III

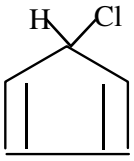
75. Which of the following will give precipitation on treatment with $AgNO_3$ solution readily?



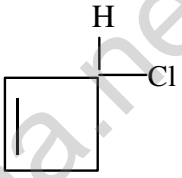
1)



2)



3)



4)

76. For the equilibrium $X_{(g)} \longrightarrow Y_{(g)}$, enthalpy change is – 80KJ/mole. If the ratio of the activation energies of the backward and forward reactions is $\frac{5}{4}$. Then

1) Ef = 80 KJ/mole ; Eb = 120 KJ/mole

2) Ef = 320 KJ/mole ; Eb = 400 KJ/mole

3) Ef = 60 KJ/mole ; Eb = 100 KJ/mole

4) Ef = 400 KJ/mole ; Eb = 320 KJ/mole

77. One mole of perfect gas expands isothermally to ten times of its Original volume, change in entropy is

1) 0.1R 2) 2.303R 3) 0.2303R 4) 10.0R

78. Assertion (A) : COD of water is determined by oxidizing organic matter with acidified (50% dil $H_2SO_4$) Potassium dichromate solution.

Reason (R) :- Greater COD value of water Greater is its pollution.

1) Both (A) and (R) are true and (R) is the correct explanation of (A)

2) Both (A) and (R) are true and (R) is not the correct explanation of (A)

3) (A) is true but (R) is false

4) (A) is false but (R) is true

79. which of the following combination is incorrect?

1) Silver 'UK' coins ———— Cu/Ni alloy

2) Mischmetall ———— Ln + Iron alloy

3) Dry battery ———— Zn and Pd/Cd alloy

4) Bronze ———— Cu/Sn alloy

80. which one of the following arrangements represent to the incorrect order of the property stated against it?

1) $V^{2+} < Cr^{2+} < Mn^{2+} < Fe^{2+}$ : paramagnetic behaviour

2) $Ni^{2+} < Co^{2+} < Fe^{2+} < Mn^{2+}$ : Ionic size

3) $Co^{3+} < Fe^{3+} < Cr^{3+} < Sc^{3+}$ : stability in aqueous solution

4) $Sc < Ti < Cr < Mn$ : Number of oxidation states

81. A sample of 1.79 mg of an alcoholic compound of molar mass 90. g/mole when treated with $CH_3MgI$ releases 1.34 ml of gas at STP. The number of active hydrogen atoms in the molecule is

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

82. $CH_3OC_2H_5$ and $(CH_3)_3COCH_3$ are treated with hydroiodic acid the fragments after reaction obtained are

1) $CH_3I + HOC_2H_5$ ; $CH_3I + (CH_3)_2CH-OH$

2) $CH_3OH + C_2H_5I$ ; $(CH_3)_3C-OH + CH_3I$

3) $CH_3I + HOC_2H_5$ ; $(CH_3)_3C-I + HOCH_3$

4) $CH_3OH + C_2H_5I$ ; $(CH_3)_3C-I + C_2H_5OH$

83. Which of the following can give iodoform test?

I. $CH_3CHO$

II. $C_6H_5-\overset{O}{\overset{\|}{C}}-CH_3$

III. $CH_3-\overset{O}{\overset{\|}{C}}-CH_2-\overset{O}{\overset{\|}{C}}-CH_3$

IV. $C_6H_5-CH_2-\overset{O}{\overset{\|}{C}}-CH_3$

1) I, II 2) II, IV 3) III, IV 4) All of these

84. 3 – methyl – but – 1 – ene on reaction with HBr a major product obtained is

1) $(CH_3)_2CHCH_2CH_2Br$

2) $(CH_3)_3CCH_2Br$

3) $(CH_3)_2CBrCH_2CH_3$

4) $(CH_3)_2CHCHBrCH_3$

85. The crystal field splitting energy $(\Delta_0)$ of

I. $[CoBr_6]^{3-}$ II. $[CoF_6]^{3-}$ III. $[Co(NCS)_6]^{3-}$ IV. $[Co(CN)_6]^{3-}$ is in the order of

1) II < IV < I < III 2) I < II < III < IV 3) III < I < IV < II 4) IV < III < II < I

86. which one of the following compounds will dissolve in an alkali solution after it has undergone reaction with Hinsberg reagent?

1) $C_6H_5NHC_6H_5$ 2) $CH_3-\underset{\underset{NH_2}{|}}{CH}-CH_3$ 3) $(C_2H_5)_2NH$ 4) $(CH_3)_3N$

87. Apatite is a mineral that is found in tooth enamel when fluoride toothpastes are used, this mineral is converted to fluoroapatite which is more resistant to tooth decay the formula of apatite is $Ca_5(PO_4)_xF$. What is the value of X if the compound contains 18.45% by weight of phosphorous (At.wts.of P = 31, Ca=40, F=19, O = 16)

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

88. Accumulation of L – lactic acid molecules in the muscles occurs as a result of

1) Over brushing 2) Excess eating 3) Over sleeping 4) Vigorous exercise

89. Arrange the following halides in the increasing order of their $P^H$ LiCl, $AlCl_3, MgCl_2, BeCl_2$

1) $AlCl_3 > MgCl_2 > BeCl_2 > LiCl$ 2) $LiCl > BeCl_2 > MgCl_2 > AlCl_3$

3) $AlCl_3 > BeCl_2 > MgCl_2 > LiCl$ 4) $LiCl > AlCl_3 > MgCl_2 > BeCl_2$

90. Match the polymers in column-A with their main uses in column–B choose the correct answer

| Column – A | Column – B |
|---|---|
| A. Urea formaldehyde regin | i. substitute for wool |
| B. BuNa – N | ii. Oil seals |
| C. Melamine – formaldehyde polymer | iii. Unbreakable crockery |
| D. Acrilan | iv. Lamination sheets |
| | v. Television cabinets |

1) A – iv, B – ii, C – i, D – iii 2) A – iv, B – v, C – iii, D – ii

3) A – v, B – ii, C – i, D – iii 4) A – ii, B – i, C – iii, D – v

# *JEE MAIN GRAND TEST*

## KEY SHEET

## PHYSICS

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1) 2 | 2) 3 | 3) 2 | 4) 3 | 5) 3 | 6) 1 | 7) 2 | 8) 2 | 9) 3 | 10) 3 |
| 11) 3 | 12) 1 | 13) 3 | 14) 2 | 15) 2 | 16) 4 | 17) 3 | 18) 1 | 19) 4 | 20) 2 |
| 21) 3 | 22) 2 | 23) 2 | 24) 1 | 25) 3 | 26) 4 | 27) 4 | 28) 3 | 29) 1 | 30) 4 |

## MATHEMATICS

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 31) 3 | 32) 3 | 33) 4 | 34) 2 | 35) 3 | 36) 1 | 37) 4 | 38) 2 | 39) 1 | 40) 3 |
| 41) 2 | 42) 4 | 43) 1 | 44) 2 | 45) 4 | 46) 3 | 47) 4 | 48) 2 | 49) 1 | 50) 3 |
| 51) 4 | 52) 2 | 53) 1 | 54) 2 | 55) 3 | 56) 1 | 57) 3 | 58) 1 | 59) 2 | 60) 1 |

## CHEMISTRY

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 61) 2 | 62) 3 | 63) 1 | 64) 2 | 65) 3 | 66) 3 | 67) 2 | 68) 1 | 69) 3 | 70) 4 |
| 71) 3 | 72) 4 | 73) 2 | 74) 2 | 75) 2 | 76) 2 | 77) 2 | 78) 2 | 79) 3 | 80) 1 |
| 81) 4 | 82) 3 | 83) 1 | 84) 3 | 85) 2 | 86) 2 | 87) 1 | 88) 4 | 89) 3 | 90) 1 |

# JEE MAIN GRAND TEST

## HINTS & SOLUTIONS

## PHYSICS

1. Kinetic energy + Potential energy = Total energy

   De-Broglie wavelength $\lambda = \frac{h}{\sqrt{2mK}}$

2. Conceptual

3. $C_1 = 4\pi\varepsilon_0\left(\frac{r_1 r_2}{r_2 - r_1}\right)$

   $C_2 = 4\pi\varepsilon_0\left(\frac{r_2^2}{r_2 - r_1}\right)$

   $\therefore \frac{C_1}{C_2} = \frac{r_1}{r_2} = \frac{r}{2r} = \frac{1}{2}$

4. Torque about contact point of sphere and inclined plane is zero.

   $\therefore mg\sin\frac{\pi}{3}(R) = T\left(\frac{3R}{2}\right)$

   $\frac{\sqrt{3}}{5}\times 10\times\frac{\sqrt{3}}{2} = \frac{3T}{2}$

   T = 2N

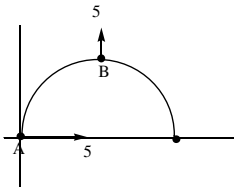
5. $\frac{1}{2}mv^2 = 0.0327\times 1.6\times 10^{-19} J$

   v = $2.5\times 10^3 ms^{-1}$

   $t = \frac{875\times 10^3}{v} = 350s$ = half life period

   $\therefore$ fraction is $\frac{1}{2} = \frac{5}{10}$

6. By constraint relation




$\overrightarrow{V_A} = 5\hat{i}\ m/s$

$$\frac{\left|\vec{V}_A - \vec{V}_B\right|}{\left|\vec{r}_A - \vec{r}_B\right|} = \frac{5\sqrt{2}}{\sqrt{2}} = 5\ rad/s$$

7. After hitting the block, the bullet gets embedded and hence the lower block starts moving in a vertical circle with speed (v) at the lower- most point

$$v = \frac{\sqrt{2gl}}{2}$$

$$T_{\max} = 2mg + 2m\frac{V^2}{1} = \mu\, mg = 3mg = \mu \times 2mg$$

$$\mu = 3/2$$

8. Answer (B)

$$\frac{hc}{\lambda} = E_{\max} \left| but\ \lambda_{\max} T = b \right. \Rightarrow E_{\max} = \frac{hct}{b}$$

9. Answer(C)

If $U \alpha v^2$

Then $T\ \alpha\ v^2$

$\Rightarrow PV\ \alpha\ V^2 \Rightarrow P\ \alpha\ V \quad \Rightarrow PV^{-1} = \text{constant}$

$\therefore$ Bulk modulus $-\frac{dP}{dV/V} = (-1)P$

$\therefore B\ \alpha\ P \Rightarrow B\ \alpha\ V$

10. Answer(C)

$mV_1(6R) = mV_2 4R$

$3V_1 = 2V_2$

$V_1$ is velocity at the farthest position, So it is minimum From conservation of energy

$$\frac{1}{2}mV_1^2 - \frac{GMm}{6R} = \frac{1}{2}mV_2^2 - \frac{GMm}{4R}$$

After simplification $V_2 = \sqrt{\frac{2GM}{15R}}$

11. The relation written by the boy $m = \frac{m_0}{(1 - v^2)^{1/2}}$

According to the principle of homogeneity of dimensions, the dimensions on either side of a relation must be same i.e., the powers of M, L, T on either side of a relation must be same.

Dimension of m is equal to the dimension of $m_0$, therefore the denominator $(1 - v^2)^{1/2}$ should b dimensionless. In denominator 1 is dimensionless but factor $v^2$ is not dimensionless. To make it dimensionless we have to divide it by the same physical quantity with same power, therefore it should be $v^2 / c^2$, to become dimensionless.

Hence, the correct relation should be $m = \frac{m_0}{\left(1 - \frac{v^2}{c^2}\right)^{1/2}}$.

12. 1) Incorrect, because a + b + c + d can be zero in many ways other than a, b, c and d must each be a null vector e.g., if the vectors are in different directions, then their resultant will be zero.

2) Correct, since a + b + c + d = 0, a + c = -(b + d)

3) Correct, since a + b + c + d = 0, a = -(b + c + d).

4) Correct, since a + b + c + d = 0, a + (b + c) + d = 0

13. $A_1 V_1 = A_2 V_2 \Rightarrow V_2 = 2 m/s$

14. We know that a positively charged particle is attracted towards the negatively charged plate and a negatively charged particle is attracted towards the positively charged plane.

Here, particle 1 and particle 2 are attracted towards positive plate that means particle 1 and particle 2 are negatively charged. Particle 3 is attracted towards negatively charged plate so it is positively charged. As the deflection in the path of a charged particle is directly proportional to the charge/mass ratio. $y \propto \frac{q}{m}$.

Here, the deflection in particle 3 is maximum, so the charge to mass ratio of particle 3 is maximum.

15. Given, radius of earth R = 6.37 x $10^6$ m

Negative surface charge density $\alpha = 10^{-9} C / m^2$

Potential difference V = 400 kV = 400 x $10^3$ V.

Current on the globe I = 1800 A.

Surface area of earth A = $4\pi R^2 = 4 \text{ x } 3.14 \text{ x } \left(6.37 \text{ x } 10^6\right)^2 = 509.64 \text{ x } 10^{12} \text{ m}^2$

Charge on earth surface Q = Area of earth surface x surface charge density.

$Q = A\sigma = 509.64 \text{ x } 10^{12} \text{ m}^2 = 509.64 \text{ x } 10^3 \text{ C}$

We know that Q = IT.

$\therefore$ Time required to neutralize earth's surface.

$$t = \frac{Q}{I} = \frac{509.64 \text{ x } 10^3}{1800}$$

t = 283.1 s or t = 4 min 43 s

Thus, the time required to neutralize the earth's surface is 283.1 s.

16. Resistance of galvanometer $G = 10\Omega$.

Deflection for current $I_G = 1\text{mA} = 10^{-3} \text{ A}$

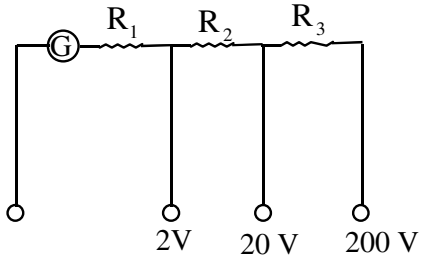
For 2 V range, $I_G\left(G + R_1\right) = 2$

$$G + R_1 = \frac{2}{I_G} = \frac{2}{10^{-3}} = 2000.$$

Resistance $R_1 = 2000 - 10 = 1990\Omega$

For 20 V range, $I_G\left(G + R_1 + R_2\right) = 20$. $G + R_1 + R_2 = \frac{20}{I_G} = \frac{20}{10^{-3}} = 20000$

For 200 V range $I_G\left(G + R_1 + R_2 + R_3\right) = 200$, $G + R_1 + R_2 + R_3 = \frac{200}{I_G} = \frac{200}{10^{-3}} = 200000$




17. Magnetic moment of $C_1 \Rightarrow m_1 = n_1 I A_1$

Magnetic moment of $C_2 \Rightarrow m_2 = n_2 I A_2$

$$m_1 = \frac{L.I.\pi R^2}{2\pi R}, m_2 = \frac{L}{4a}.I.a^2$$

$$m_1 = \frac{LIR}{2} ----(1), m_2 = \frac{LIa}{4} ---(2)$$

Moment of inertia of $C_1 \Rightarrow I_1 = \frac{MR^2}{2}$ ---- (3)

Moment of inertia of $C_2 \Rightarrow I_2 = \frac{Ma^2}{12}$ ----- (4)

Frequency of $C_1 \Rightarrow f_1 = 2\pi\sqrt{\frac{I_1}{m_1 B}}$; Frequency of $C_2 \Rightarrow f_2 = 2\pi\sqrt{\frac{I_2}{m_2 B}}$

According to question, $f_1 = f_2$.

$$2\pi\sqrt{\frac{I_1}{m_1 B}} = 2\pi\sqrt{\frac{I_2}{m_2 B}}$$

$$\frac{I_1}{m_1} = \frac{I_2}{m_2} \text{ or } \frac{m_2}{m_1} = \frac{I_2}{I_1}$$

Plugging the values by eqs. (1), (2), (3), (4) $\frac{LIa.2}{4 \text{ x } LIR} = \frac{Ma^2.2}{12.MR^2} = 3R = a$

18. The motional electric field along CD = v x B = vB sin 90° = vB.

Electromagnetic force along PQ = (length PQ) x (field along PQ).

$$e = \frac{d}{\cos\theta} \text{ x } vB\cos\theta = vBd$$

So, current in the write $I = \frac{e}{R} = \frac{dvB}{R}$, it is independent of q.

19. $$\mu = \frac{\sin\frac{A+\delta}{2}}{\sin\frac{A}{2}}$$

Given $A = \delta$

$$\mu = \frac{\sin A}{\sin\frac{A}{2}} = \frac{2\sin\frac{A}{2}\cos\frac{A}{2}}{\sin\frac{A}{2}}$$

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

$$\frac{A}{2} = 30° \qquad \therefore A = 60°$$

20. $$\frac{a\,min}{a\,max} = \frac{a_1 - a_r}{a_1 + a_r} = \frac{1}{n}$$

$$\frac{a_i}{a_r} = \frac{(n+1)}{(n-1)}$$

Since $\alpha\ A^2 \Rightarrow$ fraction of energy reflected = $\left(\frac{n-1}{n+1}\right)^2$

21. $$l_1 + e = \frac{\lambda}{4}$$

$$l_2 + e = \frac{3\lambda}{4}$$

$2 - 1 \Rightarrow l_2 - l_1 = \frac{\lambda}{2}$

Substitute in $l_1 + e = \frac{(l_2 - l_1)}{2}$

$$2l_1 + 2e = l_2 - l_1$$

$e = \frac{l_2 - 3l_1}{2}$

22. $r = f\tan\theta$ or $r \propto f \quad \therefore \pi r^2 \propto f^2$

23. Conceptual

24. Conceptual

25. $$Y = \overline{\left(\overline{A.\overline{A.B}}\right).\left(\overline{B.\overline{A.B}}\right)} = \overline{\left(A.\overline{A.B}\right)} + \overline{\left(B.\overline{A.B}\right)}$$

$= A.\overline{A.B} + B.\left(\overline{A.B}\right) = A.\left(\overline{A} + \overline{B}\right) + B\left(\overline{A} + \overline{B}\right)$

$= A\overline{A} + A\overline{B} = B\overline{A} + B\overline{B} = 0 + A\overline{B} + B\overline{A} + 0$

Input Output $Y = A\overline{B} + B\overline{A}$

(1, 0) $Y_1 = 1.1 + 0.0 = 1 + 0 = 1$

(1, 1) $Y_2 = 1.0 + 1.0 = 0 + 0 = 0$

(0, 0) $Y_3 = 0.1 + 0.1 = 0 + 0 = 0$

26. T = 8s, $\omega = \frac{2\pi}{T} = \left(\frac{\pi}{4}\right) \text{rad s}^{-1}$; $x = A\sin\omega t$

$\therefore a = -\omega^2 x = -\left(\frac{\pi^2}{16}\right)\sin\left(\frac{\pi}{4}t\right)$

Substituting $t = \frac{4}{3}s$, we get $a = -\left(\frac{\sqrt{3}}{32}\pi^2\right) \text{cms}^{-2}$

27. Poynting vector = $\overline{E}$ X $\overline{H}$

Here $B = \frac{\mu oi}{2\pi a}$ and $E = \frac{V}{L} = \frac{iR}{L}$

Pointing vector $= \frac{iR}{L} x \frac{\mu oi}{2\pi a}$

$= \frac{i^2 R}{2\pi aL}$

28. $PT^2 = \text{cons tan t}$

PV = RT $P = \frac{RT}{V}$

$\left(\frac{RT}{V}\right)T^2 = \text{constant} \Rightarrow T^3 V^{-1} = \text{constant}$

$\frac{3T^2}{V}dT\frac{T^3 dv}{V^2} = 0$

$\frac{3T^2}{V}dT = \frac{T^3 dv}{V^2}$

$\frac{dv}{V\,dT} = \frac{3}{T}$

$\alpha = \frac{3}{T}$

29. Theory

30. $\in_{(t)} = A^2 e^{-\alpha t}$

Log E = 2log A - $\alpha t$

$$\frac{\Delta \in}{\in} = \frac{2\Delta A}{A} - \alpha\, dt$$

= 2(1.25)+ (1.5) = 2.5 + 1.5 = 4%

# MATHEMATICS

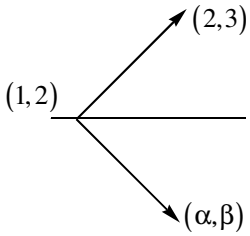
31. Line passing through (1, 2) for all $K \in R$

$(\alpha-1)^2 + (\beta-2)^2 = (2-1)^2 + (3-2)^2$ where image is $(\alpha,\beta)$

$\alpha^2 + \beta^2 - 2\alpha - 4\beta + 3 = 0$

Locus of $(\alpha,\beta)$ is $x^2 + y^2 - 2x - 4y + 3 = 0$

$\therefore \text{radius} = \sqrt{1+4-3} = \sqrt{2}$



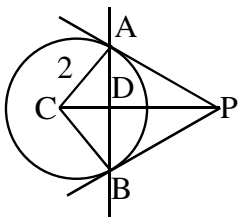

32. $x^2 + y^2 - 2x - 4y + 1 = 0$ is a circle with C(1,2); r = 2

$\angle APB = \frac{\pi}{2} \Rightarrow \angle ACB = \frac{\pi}{2}$

$\Rightarrow \angle ACD = \frac{\pi}{4} \quad \therefore \ CD = 2\cos\frac{\pi}{4} = \sqrt{2}$

$\therefore \Rightarrow \sqrt{2} = \text{distance from } (1,2) \text{ to } 2x - y + c = 0$

$\therefore \Rightarrow |c| = \sqrt{10}$



33. Min length of AB = length of latusrectum

34. $\frac{x^2}{a^2}-\frac{y^2}{b^2}=1\Rightarrow\left(\frac{dy}{dx}\right)_{(6,3)}=\frac{6b^2}{3a^2}=\frac{2b^2}{a^2}$

$\therefore$ slope of normal = $\frac{-a^2}{2b^2}$

Eq of normal is (y – 3) = $\frac{-a^2}{2b^2}(x-6)$

(9, 0) Lies on it, so $\frac{a^2}{2b^2}=1\Rightarrow e=\sqrt{\frac{3}{2}}$

35. Since co – domain = $\left[0,\pi/2\right)$

$\therefore$ f to be onto, range = $\left[0,\pi/2\right)$

This is possible when $x^2+x+a\geq 0$

$\therefore 1-4a\leq 0\Rightarrow a\geq\frac{1}{4}$

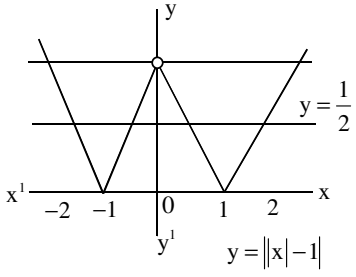
36. $\lim_{x\to\infty}\left(\frac{(\log x)^3+3x(\log x)^2\frac{1}{x}}{1+2x}\right)$ (By L' Hospital Rule)

= $\lim_{x\to\infty}\frac{1}{2}\left(\frac{3(\log x)^2}{x}+\frac{6\log x}{x}\right)$ (By L' Hospital Rule)

= $\lim_{x\to\infty}\left(\frac{6(\log x)+6}{2x}\right)$ (By L' Hospital Rule) = $\lim_{x\to\infty}\left(\frac{6\left(\frac{1}{x}\right)}{2}\right)$ (By L' Hospital Rule)

= 3 (0)= 0

37. From the graph, f(x) is nm – differentiable at five points x = -2, -1, 0, 1, 2.



$f^1(x) = 4 - 2\sec^2 2x = 2(1 - \tan^2 2x)$

38. $f^1(x) \geq 0$ in $\left[\frac{-\pi}{8}, \frac{\pi}{8}\right]$ and $f^1(x) < 0$ in $\left(\frac{-\pi}{4}, \frac{-\pi}{8}\right) \cup \left(\frac{\pi}{8}, \frac{\pi}{4}\right]$

$\left[\therefore \text{ continuous in } \left(\frac{-\pi}{4}, \frac{\pi}{4}\right)\right]$

$\therefore$ Required largest continuous interval is $\left[\frac{-\pi}{8}, \frac{\pi}{8}\right]$

$\therefore$ length is $= \frac{\pi}{4}$

39. $I = \int_{-1/2}^{1/2} \left[\left(\frac{x+1}{x-1} - \frac{x-1}{x+1}\right)^2\right]^{1/2} dx \quad \int_{-1/2}^{1/2} \left[\left|\frac{x+1}{x-1} - \frac{x-1}{x+1}\right|\right] dx = \int_{-1/2}^{1/2} \left|\frac{4x}{x^2-1}\right| dx = 2\int_0^{1/2} \left|\frac{4x}{x^2-1}\right| dx$

$= 2\int_0^{1/2} \left(\frac{4x}{1-x^2}\right) dx \quad \left[\because \left|\frac{4x}{x^2-1}\right| = \frac{-4x}{x^2-1} \text{ fx } 0 \leq x \leq 1/2\right] = -4\left[\log\left(1-x^2\right)\right]_0^{1/2} = 4\log\left(\frac{4}{3}\right)$

40. $\left(xy^3 - x^2\right)dy - \left(xy + y^4\right)dx = 0$

$\Rightarrow y^3\left(xdy - ydx\right) - x\left(xdy + ydx\right) = 0$

$\Rightarrow x^2y^3\left(\frac{xdy - ydx}{x^2}\right) - x\ d(xy) = 0$

$\Rightarrow x^2y^3\, d\left(\frac{y}{x}\right) - x\ d\left(xy\right) = 0$

$\Rightarrow \left(\frac{y}{x}\right) d\left(\frac{y}{x}\right) - \frac{d\left(xy\right)}{x^2y^2} = 0 \Rightarrow$ Integrating $\frac{1}{2}\left(\frac{y}{x}\right)^2 + \frac{1}{xy} = C$

It passes through (4, -2) $\Rightarrow C = 0$

$\therefore y^3 = -2x$

41. Let $\vec{a} = \lambda\vec{b} + \mu\vec{c}$, $\vec{a}$ is equally inclined to $\vec{b}$ and $\vec{d}$

Where $\vec{d} = \hat{j} + 2\hat{k}$ $\therefore \frac{\vec{a}\cdot\vec{b}}{ab} = \frac{\vec{a}\cdot\vec{d}}{ad} \Rightarrow \lambda(5) + \mu = \lambda + \mu \Rightarrow \lambda = 0 \therefore \hat{a} = \frac{\hat{i} - \hat{j} + \hat{k}}{\sqrt{3}}$

42. D.R'S of line are 9, -1, -3

D.R'S of normal of plane are 3, -3, 10

Here 9(3) + (-1) (-3) + (-3) (10) = 0

Hence line is parallel to the plane and Pt(1,2,-3) does not lie in the plane.

$\therefore$ Image of (1,2, -3) in the plane is $\left(\frac{5}{2},\frac{1}{2},2\right)$

SO image of line in the plane is $\frac{x-5/2}{9}=\frac{y-1/2}{-1}=\frac{-2}{-3}$

43. If $\sim[P\vee(\sim p\vee q]=\sim p\wedge\sim(\sim p\vee q)$

$=\sim p\wedge(\sim(\sim p)\wedge\sim q)=\sim p\wedge(p\wedge\sim q)$

44. $4\cos ec^2(\pi(a+x))+a^2-4a=0$

$\Rightarrow\cos ec^2(\pi(a+x))=\frac{4a-a^2}{4}\geq 1$

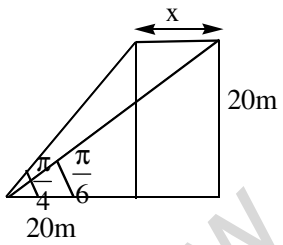
$\Rightarrow 4a-a^2\geq 4\Rightarrow a^2-4a+4\leq 0$

$\Rightarrow (a-2)^2\leq 0\ \ \therefore a=2$

45. $\tan 30^0=\frac{20}{20+x}$

20+x = $20\sqrt{3}\Rightarrow x=20(\sqrt{3}-1)$

$\Rightarrow$ Speed is $20(\sqrt{3}-1)\ m/sec$




46. Put $Tan^{-1}x=\alpha,\ Tan^{-1}y=\beta\ Tan\alpha=x\ ;\ Tan\beta=y$

So given system of equations is

$a\tan\alpha+b\sec\alpha=C\ ;\ a\tan\beta+b\sec\beta=C$

$\therefore\ \alpha,\beta$ are the roots of $a\tan\theta+b\sec\theta=C$

$\therefore Tan\alpha+Tan\beta=\frac{2ac}{a^2-b^2}\ ;\ \tan\alpha\tan\beta=\frac{c^2-b^2}{a^2-b^2}\ \Rightarrow\frac{x+y}{1-xy}=\frac{2ac}{a^2-c^2}$

47. $\Delta(x)=\begin{vmatrix} x & 2 & x \\ x^2 & x & 6 \\ x & x & 6 \end{vmatrix}$ Then 5A+4B+3C+2D+E = $\Delta(1)+\Delta^1(1)$

Where $\Delta^1(x)=\begin{vmatrix} 1 & 0 & 1 \\ x^2 & x & 6 \\ x & x & 6 \end{vmatrix}+\begin{vmatrix} x & 2 & x \\ 2x & 1 & 0 \\ x & x & 6 \end{vmatrix}+\begin{vmatrix} x & 2 & x \\ x^2 & x & 6 \\ 1 & 1 & 0 \end{vmatrix}$

48. det (B-I)= det(B-BB$^T$) = det (B) det (I – B$^T$)

= det (B) det (I-B)=(-1) det (B-I)

$\therefore$ det (B-I) = 0

49. p = probability of getting a head in a single toss of a coin = $\frac{1}{2}$

q = probability of getting 5 or 6 in a single throw of die = $\frac{2}{6}=\frac{1}{3}$

Req. probability = p + (1-p)(1-q) p+(1-p)$^2$ (1-q)$^2$ p+.....

$$\frac{p}{1-(1-p)(1-q)}=\frac{1/2}{1-\left(\frac{1}{2}\right)\left(2/3\right)}=3/4$$

50. $\left[\frac{x+1}{x^{2/3}-x^{1/3}+1}-\frac{x-1}{x-x^{1/2}}\right]^{10}=\left[\left(x^{1/3}+1\right)-\left(1+x^{-1/2}\right)\right]^{10}$

$=\left(x^{1/3}-x^{-1/2}\right)^{10}$

$\therefore T_{r+1}=10_{C_r}\frac{10-r}{3}\left(-x^{-1/2}\right)^r=10_{C_r}\,x^{(-1)^r}\left(\frac{20-5r}{6}\right)$

$\Rightarrow 20-5r=0 \quad \therefore r=4$

$\therefore T_5=10_{c_4}=210$

51. 2 can take in 2 ways $\left(2^0 \text{ or } 2^2\right)$

3 can take in 3 ways $\left(3^0 \text{ or } 3^2 \text{ or } 3^4\right)$

5 can take in 4 ways $\left(5^0 \text{ or } 5^2 \text{ or } 5^4 \text{ or } 5^6\right)$

7 can take in 5 ways $\left(7^0 \text{ (or) } 7^2 \text{ (or) } 7^4 \text{ (or) } 7^6 \text{ (or) } 7^8\right)$

$\therefore$ Total divisors which are perfect squares = 2x3x4x5=120

52. $S=\frac{1}{1+x}-\frac{1-x}{(1+x)^2}+\frac{(1-x)^2}{(1+x)^3}-.....\infty$

$=\frac{\left(\frac{1}{1+x}\right)}{1+\left(\frac{1-x}{1+x}\right)}=1/2\ [\because \text{Infinite G.P}]$

53. $|z_1|=|z_2|=|z_3|=1\Rightarrow$ Circum centre of triangle is origin

Also orthocenter which coincide with circum centre $[\because z_1+z_2+z_3=0]$

$\therefore \Delta^{le}$ in equilateral

Since length of side is $a=\sqrt{3}$ ; Area $=\frac{\sqrt{3}}{4}a^2=\frac{3\sqrt{3}}{4}$

54. we have $x^2-\left(\frac{2c}{c-5}\right)x+\left(\frac{c-4}{c-5}\right)=0$ Let f(x) $=x^2-\left(\frac{2c}{c-5}\right)x+\left(\frac{c-4}{c-5}\right)$

So f(o) > 0, f(2) <0, f(3) >0

$\therefore f(0)>0\Rightarrow\frac{c-4}{c-5}>0\rightarrow I$

$f(2)<0\Rightarrow\frac{c-24}{c-5}<0\rightarrow II$

$f(3)>0\Rightarrow\frac{4c-24}{c-5}>0\rightarrow III$

From I, II, III $\Rightarrow c\leftarrow\left(\frac{49}{4},24\right)$

55. If element are not repeated then number of elements in $\bigcup_{i=1}^{30}Ai$ is 30x5

But each element is used 10 times so $S=\frac{30x5}{10}=15$

If elements in $B_1$, $B_2$ .....$B_n$ are not repeated

Then $S=\frac{3N}{9}$ $\therefore \frac{3n}{9}=15$

$\therefore n=45$

56. By L M V T there exist $C\leftarrow(1,6)$ such that

$f^1(C)=\frac{f(6)-f(1)}{6-1}\Rightarrow\frac{f(6)+2}{5}\geq 2$

$\Rightarrow f(6)\geq 8$

57. $\int\frac{dx}{x^2\left(1+x^5\right)^{4/5}}=\int\frac{dx}{x^6\left(\frac{1}{x^5}+1\right)^{4/5}}$ put $1+\frac{1}{x^5}=t$

58. $|a-a|=0<1\ \therefore a\,R\,a\ \forall a\in R$

$\therefore$ R is reflexive

a R b $\Rightarrow|a-b|\leq 1$ and $|b-a|\leq 1\Rightarrow bRa$

$\therefore$ R is symmetric But $1R2,\ 2R3\Rightarrow 1\ R\ 3\ \left[\because |1-3|=2>1\right]$

$\therefore$ R is not transitive

59. $y=\frac{1}{x}\Rightarrow\frac{dy}{dx}=-1/x^2\Rightarrow x^2dy+dx=0\ \Rightarrow\frac{x^2}{\sqrt{1+x^4}}dy+\frac{dx}{\sqrt{1+x^4}}=0$

$\Rightarrow\frac{x^2}{\sqrt{\frac{1}{x^4}+1}}+\frac{dx}{\sqrt{1+x^4}}=0\Rightarrow\frac{dy}{\sqrt{1+y^4}}+\frac{dx}{\sqrt{1+x^4}}=0$

Hence $\frac{dy}{\sqrt{1+y^4}}+\frac{dx}{\sqrt{1+x^4}}+3=3$

60. Solving given lines then P.I is $\left(\frac{-c}{a+b},\frac{-c}{a+b}\right)$ its distance from (1,1) is

$\sqrt{\left(1+\frac{c}{a+b}\right)^2+\left(1+\frac{c}{a+b}\right)^2}<2\sqrt{2}$

i.e $(a+b+c)^2<4(a+b)^2\Rightarrow(a+b+c)^2-4(a+b)^2<0\Rightarrow(c-a-b)(c+3a+3b)<0$

$\therefore c-a-b<0$ (or) $a+b-c>0\ [\because a>b>c>0]$

# CHEMISTRY

61. % Loss in weight of compound $=\frac{18x}{111+18x}x100=49.32$ on solving x = 6 ; Formula of Hydrated salt is $CaCl_2.6H_2O$

62. $\frac{P_1}{T_1}=\frac{P_2}{T_2};\frac{P_1}{250}=\frac{P_2}{296};1.184P=P_2\ \therefore\%\,\text{increase}\ =\frac{1.184P-P}{P}x100=\frac{0.184P}{P}x100$ = 18.4%

63. Conceptual $\left(\lambda=\frac{h}{mv};\lambda\alpha\frac{1}{m}\right)$

64. S and $P_x$ orbitals do most have proper orientation to overlap and hence MO is not formed

65. P total = $P_A^0X_A+P_B^0X_B$ $= 100X\frac{1}{4}+200X\frac{3}{4}$

= 25+150=175

P distillate = $100X\frac{25}{175}+200X\frac{150}{175}$

= 185.72 torr

66. $N_2O_4 \rightleftharpoons 2NO_2$ given $\alpha=0.533$

t = 0 1 0

t = equi $1-\alpha$ $2\alpha$

$\therefore$ molecular weight of mixture = $\frac{(1-\alpha)M_{N_2O_4}+(2\alpha)M_{NO_2}}{1+\alpha}$

$=\frac{(1-0.533)92+(1.066)46}{1.533}$ = 60

According to ideal gas equation

PV = nRT ; $PM_{mix}=dRT$

$\therefore d=\frac{PM_{mix}}{RT}=\frac{1x60}{0.0821x300}=\frac{60}{24.63}=2.436\,g/L$

67. $\lambda_{(BaSo_4)}=\frac{1000xSP.conduc\,tan\,ce}{concentration\,(normality)}$

(or) Normality = $\frac{1000x8x10^{-5}}{400}$

$\therefore Molarity=\frac{Normality}{2}=10^{-4}M$

$\therefore ksp=Ba^{2+}+SO_4^{2-}$

S S

= $s^2=(10^{-4}M)^2=10^{-8}M^2$

68. Flocculation power $\alpha \frac{1}{\text{Coagulation}}$ Value

$\therefore$ For x, flocculation power $= 1/3$

$\therefore$ For Y, flocculation power $= \frac{1}{0.6}$

$\therefore$ For Z, flocculation power $= \frac{1}{0.08}$

$\therefore X: Y: Z = 1, 5, 37.5$

69. At $1100^0$c, the $\Delta G^0$ for $ZnO + Mg \rightarrow Zn + MgO$ is more negative than other three reactions

70. Volume of soap solution used effectively in tap water = 13-1 = 12ml

$\therefore$ Temporary + permanent hand ness = 12ml

Volume of soap solution used effectively in boiled water = 5-1 = 4ml

$\therefore$ Temporary + Permanent handness = 12ml

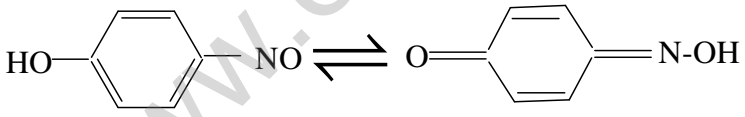
Temporary handness = 12-4=8ml

Permanent handness = 4ml

$\therefore \frac{\text{permanent handness}}{\text{Temaporaryhandness}} = \frac{4}{8} = \frac{1}{2} = 1:2$

71. Conceptual

72. $ICl_3 + 2H_2O \rightarrow HIO_2 + 3HCl$ smaller halogen form halide ion, larger halogen form Oxoanion derivative

73. 

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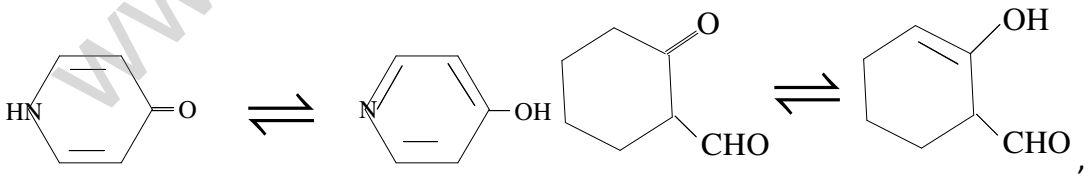

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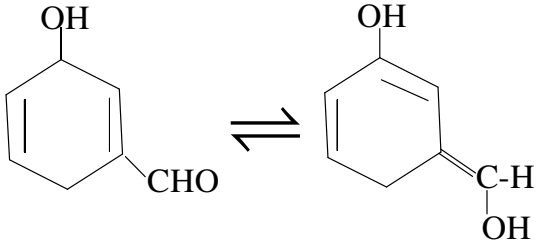
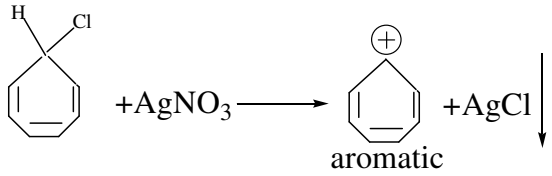


74. Ring activating groups increase the rate of bromination

75. 

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In other cases the compounded formed is either anti aromatic or non aromatic

76. Ef = 320 kj/mole , Eb = 400 kj/mole

Given $X \rightleftharpoons Y\ \Delta H = -80\text{kj/mole}; \frac{Eb}{Ef} = \frac{5}{4};$

We know that Ef –Eb = $\Delta H$ , Ef – Eb = - 80,

$$Ef - \frac{5}{4}Ef = -80 \left(\because Eb = \frac{5}{4}Ef\right)$$

$$Ef\left(1 - \frac{5}{4} : \frac{4-5}{4} = \frac{1}{4}\right) = 80; \therefore Ef = 320$$

$\therefore$ Ef = 320kJ/mole ; Eb = 400 kJ/mole

77. $\Delta S = 2.303nR \log \frac{V_2}{V_1}$ given , n=1 $\Delta S = 2.303R \log \frac{10}{1}$ = 2.303R

78. Conceptual

79. Conceptual

80. Conceptual

81. Let the reaction be $R(OH)_n + nCH_3MgI \rightarrow n\,CH_4 + R(OMgI)_n$

Amount of gas produced = $\frac{1.34\,\text{ml}}{22400\,\text{ml}} \approx 6x10^{-5}\,\text{mole}$

Amount of compounded used = $\frac{1}{n}\left(6x10^{-5}\right)$

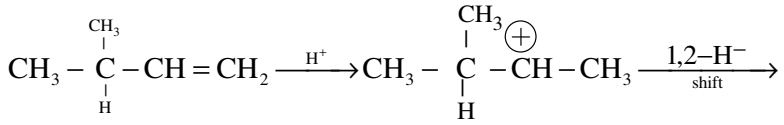
This is equal to $\left(1.79x10^{-3}\,g/90\,g/\text{mole}\right) \simeq 2x10^{-5}\,\text{mole}$

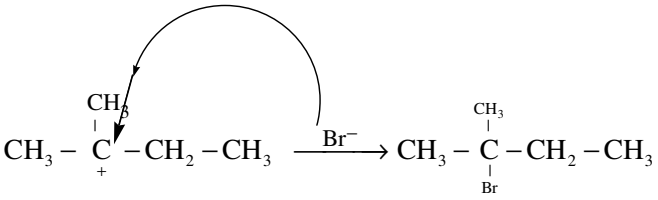
Hence n = $\frac{6x10^{-5}\,\text{mole}}{2x10^{-5}\,\text{mole}} = 3$

82. Conceptual

83. In III and IV the hydrogen atom of – $CH_3$ group is not attacked by the base rather more acidic H- atom about two carbonyl groups in III and methylene H – atom about phenyl group in IV

84.





85. Crystal field splitting energy depends on strength of ligand Strong ligands have more value of C F S E $(\Delta_0)$

Hence $B\bar{r} < F^- < NC\bar{S} < CN^-$

86. Primary amine reacts with Hinsberg reagent and the product formed is dissolved in NaOH

87. $\% \, P = \dfrac{(X)\,x\,(31)}{5x40 + (31x) + (64x) + 19} X100 = 18.45$

$\therefore x = 3$

88. Lactic acid is formed in muscles during vigorous exercise due to anaerobic respiration

(Glucose $\rightarrow$ Lactic acid + Energy)

89. According to Fajans rules higher the charge (+Ve or – Ve) more is the covalent more is the acidic character and less is its $P^H$

90. Conceptual



***Question paper with solutions were prepared by***

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